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PHYSICAL CONSTANTS OF HYDROCARBONS

Volume I

PARAFFINS, OLEFINS, ACETYLENES,
and
OTHER ALIPHATIC HYDROCARBONS

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CHICAGO, ILLINOIS



American Chemical Society
Monograph Series

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Dedicated to
JOSEPH G. ALTHER

GENERAL INTRODUCTION

American Chemical Society Series of Scientific and Technologic Monographs

By arrangement with the Interallied Conference of Pure and Applied Chemistry, which met in London and Brussels in July, 1919, the American Chemical Society was to undertake the production and publication of Scientific and Technologic Monographs on chemical subjects. At the same time it was agreed that the National Research Council, in coöperation with the American Chemical Society and American Physical Society, should undertake the production and publication of Critical Tables of Chemical and Physical Constants. The American Chemical Society and the National Research Council mutually agreed to care for these two fields of chemical development. The American Chemical Society named as Trustees, to make the necessary arrangements for the publication of the monographs, Charles L. Parsons, secretary of the society, Washington, D. C.; the late John E. Teeple, then treasurer of the society, New York; and Professor Gellert Alleman of Swarthmore College. The Trustees arranged for the publication of the A. C. S. series of (a) Scientific and (b) Technologic Monographs by the Chemical Catalog Company, Inc. (Reinhold Publishing Corporation, successors) of New York.

The Council, acting through the Committee on National Policy of the American Chemical Society, appointed editors (the present list of whom appears at the close of this introduction) to have charge of securing authors, and of considering critically the manuscripts submitted. The editors endeavor to select topics of current interest, and authors recognized as authorities in their respective fields.

The development of knowledge in all branches of science, especially in chemistry, has been so rapid during the last fifty years, and the fields covered by this development so varied that it is difficult for any individual to keep in touch with progress in branches of science outside his own specialty. In spite of the facilities for the examination of the literature given by Chemical Abstracts and by such compendia as Beilstein's *Handbuch der Organischen Chemie*, Richter's *Lexikon*, Ostwald's *Lehrbuch der Allgemeinen Chemie*, Abegg's and Gmelin-Kraut's *Handbuch der Anorganischen Chemie*, Moissan's *Traité de Chimie Minérale Générale*, Friend's and Mellor's *Textbooks of Inorganic Chemistry* and Heilbron's *Dictionary of Organic Compounds*, it often takes a great deal of time to coördinate the knowledge on a given topic. Consequently when men who have spent years in the study of important subjects are willing to coördinate their knowledge and present it in concise, readable form, they perform a service of the highest value. It was with a clear recognition of the usefulness of such work that the American Chemical Society undertook to sponsor the publication of the two series of monographs.

Two distinct purposes are served by these monographs: the first, whose fulfillment probably renders to chemists in general the most important

service, is to present the knowledge available upon the chosen topic in a form intelligible to those whose activities may be along a wholly different line. Many chemists fail to realize how closely their investigations may be connected with other work which on the surface appears far afield from their own. These monographs enable such men to form closer contact with work in other lines of research. The second purpose is to promote research in the branch of science covered by the monograph, by furnishing a well-digested survey of the progress already made, and by pointing out directions in which investigation needs to be extended. To facilitate the attainment of this purpose, extended references to the literature enable anyone interested to follow up the subject in more detail. If the literature is so voluminous that a complete bibliography is impracticable, a critical selection is made of those papers which are most important.

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Preface

The collating and critical evaluation of physical constants of hydrocarbons is of recognized importance to all workers in hydrocarbon chemistry. With the tremendous increase in this field of research during the past fifteen years the customary sources of physical constant data have become inadequate due to more precise developments in synthesis, purification, and methods of determining physical constants. The experimental data of recent years lend themselves to more significant analyses. Hence, a greater reliability can be attributed to relationships between the different homologous series of hydrocarbons which show the dependence of physical properties upon their structure. In the present work, the critical study of the hydrocarbon constants and their interrelationships to derive useful and sound generalizations has been the desired goal.

The melting point, boiling point, specific gravity, and refractive index of all classes of pure hydrocarbons will appear in three volumes and their interrelationships in a fourth volume.

Volume one covers the paraffins, olefins, acetylenes, and other aliphatic hydrocarbons.

Volume two includes the cycloparaffins, cycloolefins, cycloacetylenes, bi- and dicycloparaffins and cycloolefins, olefin and acetylene substituted cycloparaffins and cycloolefins.

Volume three presents the aromatic series and more complex condensed ring systems of which the carcinogenic hydrocarbons are representative.

Volume four systematizes and correlates the physical properties with the structures of the hydrocarbons of homologous series, thus disclosing possible errors in experimental values. Interrelationships between other homologous series are also shown, permitting the prediction of physical properties of hydrocarbons yet unknown.

In the first volume the physical constants of hydrocarbons have been critically reviewed and the most reliable values derived therefrom. An attempt has been made to collect all the existing data to November, 1938. This has been accomplished by the use of (1) original articles, (2) Beilstein's *Handbuch der Organischen Chemie*, (3) R. Stelzner's *Literatur Register der Organischen Chemie*, (4) *Chemical Abstracts*, (5) *Chemisches Zentralblatt*, (6) *British Chemical Abstracts*, (7) *International Critical Tables*, (8) *Landolt-Börnstein Tabellen*, (9) various minor or unusual sources of information, and (10) unpublished research of our own and other experimenters.

This study of physical constants was started about sixteen years ago with Emma E. Crandal and carried on in a systematic manner for a period of time. Thanks are due Miss Crandal for her continued interest and help.

The research was renewed with A. V. Grosse, and Bulletins 217 and 219 were issued by Universal Oil Products Company on paraffin and mononuclear aromatic physical constants. Due to stress of other duties he had to relinquish further work on the project. Grateful acknowledgement is hereby given for his assistance.

The author wishes to express also his deep appreciation to Jack Sherman, Prudence M. Van Arsdell, Mildred Venger, and George Hulla for their constructive and critical assistance in gathering and evaluating the physical constants of hydrocarbons presented in the first volume.

Thanks are due to G. Calingaert for data on paraffins, and C. E. Boord on olefins, derived from their laboratories and for their critical review of these hydrocarbons. Appreciation is also expressed to C. L. Thomas, H. Pines, C. B. Linn, and H. S. Bloch for their co-operation.

The ideal underlying this four-volume study of the physical constants of the hydrocarbons has been to contribute to our fundamental knowledge of hydrocarbons from the scientific as well as the pragmatic points of view.

It is believed that this study will be of service to workers in all fields of hydrocarbons. The scope is such that it may be utilized in pure and applied science and in industries such as the petroleum, natural and manufactured gas, chemical, rubber, plastic, resin, and pharmaceutical.

February 15, 1939

GUSTAV EGLOFF

Physical Constants of Hydrocarbons

Paraffins, Olefins, Acetylenes, and Other Aliphatic Hydrocarbons

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I. Introduction

1. Foreword

Under the impetus of a constantly increasing demand for hydrocarbon products, the amount of research performed in this field of science has been particularly great during the past fifteen years. An urgent need has been felt for a critical digest of all data pertaining to physical constants of hydrocarbons.

This work will present in the first three volumes the most reliable values to use of the melting points, boiling points, specific gravities, and indices of refraction of hydrocarbons, together with all the data from which these values are derived. The hydrocarbons are grouped as paraffins, olefins, acetylenes, cycloparaffins, cycloolefins, and aromatics, and the mixed types which may belong to two or more groups. The first volume contains the paraffins, olefins, acetylenes, and other aliphatic hydrocarbons. The second volume contains the cycloparaffins, cycloolefins, bi- and dicycloparaffins, and bi- and dicycloolefins, together with compounds which may belong to two or more of these classes, such as alkenyl-substituted cycloparaffins and alkynyl-substituted cycloparaffins. The terpenes have not been classified in a separate section due to the fact that they belong in a number of the groups already mentioned. The aromatic hydrocarbons are covered in the third volume. The fourth volume will cover the correlation of physical properties with structure, allowing detection of errors in existing data, prediction of the constants of unknown hydrocarbons with confidence, and derivation of relationships giving a deeper insight into the structure of hydrocarbon molecules.

Although recent efforts have been made to correlate the physical properties of restricted groups of hydrocarbons with structure, no comprehensive attempt has been made to do this systematically *for all classes of hydrocarbons*. This is not surprising in view of the fact that the physical constants of all hydrocarbons have not been collated or critically evaluated heretofore.

The present study is restricted to the four physical constants already mentioned chiefly because they are frequently employed in the identification of hydrocarbons and in industrial engineering. Other constants are also of great importance for present day science and technology. Hence there is an increasing need to collect and study them. These studies are under way and will be reported upon by us at a later date. A few of the constants may be mentioned: the critical pressure, temperature, and volume; viscosity, surface tension, specific heats; heats of formation, vaporization, and fusion; free energies, entropies, parachor values, and octane numbers.

Probably the outstanding fact in collating hydrocarbon constants has been the inordinate number of experiments carried out on certain compounds in contrast to almost none on others. This fact has given a false impression to investigators who believe that the data on physical constants of hydrocarbons are quite complete. In this work the effort has been toward collecting all the studies which have been made.

No doubt some physical constants have been overlooked, and the author would appreciate receiving the references so that the data may be included in future editions. Will any experimenters who have unpublished data that can be released communicate with the author?

Many gaps appear in the physical constant data where the possible isomers are relatively few in number. Of course, where the possible isomers increase rapidly as is the case with pentadecane (4,347 isomers) and eicosane (366,319 isomers) there is no probability of synthesizing all of these isomers.

2. Description of the Tables

The aliphatic hydrocarbons tabulated in Volume I are grouped into ten sections:

1. Alkanes or Paraffins
2. Alkenes or Olefins
3. Alkadienes or Diolefins
4. Alkatrienes or Triolefins
5. Alkatetraenes or Tetraolefins
6. Alkapentaenes or Pentaolefins
7. Alkahexaenes or Hexaolefins
8. Alkynes or Acetylenes
9. Alkadiynes or Diacetylenes
10. Mixed Alkene-Alkynes of the Aliphatic Series

In each section the compounds are listed in order of increasing number of carbon atoms. For molecules containing a given number of carbon atoms, the isomers of the paraffin, olefin, and acetylene series are listed in order of increased branching as illustrated in the following:

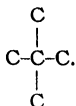
Alkanes	Alkenes	Alkynes
<i>n</i> -heptane	heptene-1 heptene-2 heptene-3	heptyne-1 heptyne-2 heptyne-3
2-methylhexane	2-methylhexene-1	
3-methylhexane	3-methylhexene-1 4-methylhexene-1 5-methylhexene-1	3-methylhexyne-1 4-methylhexyne-1 5-methylhexyne-1
	2-methylhexene-2 3-methylhexene-2 4-methylhexene-2 5-methylhexene-2	
	2-methylhexene-3 3-methylhexene-3	4-methylhexyne-2 5-methylhexyne-2
3-ethylpentane	2-ethylpentene-1 3-ethylpentene-1 3-ethylpentene-2	3-ethylpentyne-1
2,2-dimethylpentane		
2,3-dimethylpentane	2,3-dimethylpentene-1	

Alkanes	Alkenes	Alkynes
2,4-dimethylpentane	2,4-dimethylpentene-1	
3,3-dimethylpentane	3,3-dimethylpentene-1	3,3-dimethylpentyn-1
	3,4-dimethylpentene-1	3,4-dimethylpentyn-1
	4,4-dimethylpentene-1	4,4-dimethylpentyn-1
	2,3-dimethylpentene-2	
	2,4-dimethylpentene-2	
	3,4-dimethylpentene-2	
	4,4-dimethylpentene-2	4,4-dimethylpentyn-2
2,2,3-trimethylbutane	3-methyl-2-ethylbutene-1	
	2,3,3-trimethylbutene-1	

3. *The Geneva System of Nomenclature for Aliphatic Hydrocarbons*

The nomenclature of hydrocarbons used by many experimenters varies according to individuals of the same and different countries and the period in which they worked. Much has been written about the use of a uniform system of naming compounds; some countries use the Greek alphabet in designating the position of groups in the molecule, while other countries use numbers or a combination of Greek letters, numbers, and primed numbers. In this study of aliphatic hydrocarbons, the Geneva system has been used due to its simplicity and consistency.

Many hydrocarbons were named before their structure had been determined. The names by which these compounds are known naturally give no indication of their structure. When the structure of a compound is later determined, the common name may be so well established by usage that it persists even though it would be more logical and informative to adopt the scientific name. A well known compound is often reported by several names—e.g. neopentane, tetramethylmethane, 2,2-dimethylpropane, all refer to the molecule whose carbon skeleton is



Since users of the present work may not be completely familiar with the Geneva system, the hydrocarbon rules taken from the Definitive Report of the Commission on the Reform of the Nomenclature of Organic Chemistry (translated by A. M. Patterson and appearing in the *Journal of the American Chemical Society*, 55, 3905-25 (1933) with his comments) are given below for reference.

"4. The ending *ane* is adopted for saturated hydrocarbons. Open-chain hydrocarbons will have the generic name *alkanes*."

Comments.—"The name "alkane" is better and shorter than "paraffin," especially since the latter term is now so commonly applied to a solid mixture." (This statement is no longer accurate (Dec. 15, 1938) as applied to the Petroleum Industry where the gaseous, liquid, and solid hydrocarbons of the $\text{C}_n\text{H}_{2n+2}$ group are called paraffins.)

"5. The present names of the first four normal saturated hydrocarbons (methane, ethane, propane, butane) are retained. Names derived from the Greek or Latin numerals will be used for those having more than four atoms of carbon."

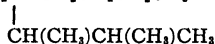
Comment—"The words "or Latin" have been added to the Geneva rule (No. 4) because *nomane* is almost universally used for C_8H_{18} instead of the Greek derivative *enneane* (as also is *noma-* instead of *ennea-* in combination, as in *nomadecane*); and because *undecane* appears oftener than *hendecane*, although the latter has a respectable standing. For most of the alkanes, however, names of Greek derivation are customary."

"6. Branched-chain hydrocarbons are regarded as derivatives of the normal hydrocarbons; their names will be referred to the longest normal chain present in the formula by adding to it the designations of the side chains. In case of ambiguity, or if a simpler name would result, that chain which admits of the maximum of substitutions will be selected as the fundamental chain."

Comment—"This rule may require further interpretation. The version published by the Journal of the Chemical Society is quite different. It reads: "Branched-chain hydrocarbons are regarded as derivatives of normal hydrocarbons; their names will be determined by the longest chain containing the maximum number of double or triple linkings (preference being given to the double linking where ambiguity arises), or, in the case of saturated hydrocarbons, by the longest chain in the formula. In cases where there might be doubt as to the choice of the longest chain, that one will be selected which admits of the maximum of substitution." It was the impression of the writer that this version, which he considers preferable, was adopted at Liege, but he has followed the French version of the "Comptes rendus" of the meeting.

"If the French version is accepted, then it seems best to interpret it as referring to *saturated* hydrocarbons only, unsaturated hydrocarbons being treated in rules 8-10. The phrase "or if a simpler name would result" ("ou si cela donne un nom plus simple" in the French version) is of doubtful value as there may be differences of opinion as to which name is "simpler". In saturated branched-chain hydrocarbons, in the writer's opinion the longest chain present should be chosen as the fundamental one, and if there are two or more choices for the longest chain, then that one should be chosen in which there is the greatest number of substitutions (the reason being that the substituting radicals, while more numerous, will be of simpler structure).

Example: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$



By the principle of the "longest chain" the name would be 5-(1,2-dimethylpropyl)-nonane; but according to the rule the name 4-butyl-2,3-dimethyloctane (which avoids a branched side chain) is the one to be chosen if it seems simpler."

"7. In case there are several side chains, the order in which such chains are named will correspond to the order of their complexity. The chain having the greatest number of secondary and tertiary atoms will be considered the most complex. The alphabetic order may also be followed in such cases."

Comment—"The Committee members were divided in their preferences between an order of radical names based on structure (for example, one based on increasing weight, as methyl, ethyl, butyl) and an alphabetic order as used, for example, in *Chemical Abstracts*. The two possibilities were hence left side by side, not only in this rule but also more generally in rule 63.

"The advocates of the structural basis for such an order did not formulate any complete rule, and the wording of rule 7 is not very clear. In the writer's opinion it means that the name of the hydrocarbon radical of lowest weight is to be announced first, then that of the next highest weight, and so on, and that as between isomers the normal radical comes first, then the ones of branched structure, e.g., methyl, ethyl, propyl, isopropyl, butyl, isobutyl. The rule does not decide completely between branched isomers, and neither this rule nor rule 63 prescribes any structural order for the host of substituting groups which are not hydrocarbon radicals (such orders have been constructed, however.)

"The beauty of the alphabetic order is that it furnishes a means of arranging in order, almost instantly, substituents of any kind. Its only difficulty is that a few radical names differ substantially in spelling in certain languages (e.g. ethyl, athyl). In such cases a transposition would

be necessary in the translation. Fortunately, the exact order of prefixes in an organic name is not of great importance except in indexes. Example of the alphabetic order: butyl, ethyl, isobutyl, isopropyl, methyl, propyl. (Or, if *iso-* is italicized, butyl, *iso*-butyl, ethyl, methyl, propyl, *iso*-propyl.) For further illustrations the indexes to *Chemical Abstracts* may be consulted."

"8. In the names of open-chain unsaturated hydrocarbons having one double bond the ending *ane* of the corresponding saturated hydrocarbon will be replaced by the ending *ene*; if there are two double bonds, the ending will be *diene*, etc. These hydrocarbons will bear the generic names *alkenes*, *alkadienes*, *alkatrienes*, etc. Examples: propene, hexene, etc."

Comments—"This rule follows the Geneva system and in addition introduces the generic names *alkene*, etc., corresponding to *alkane*. Strictly interpreted, it calls for the replacement of *ethylene* by *ethene*. The writer doubts if this change will ever become general but the higher names, as propene, butene, etc., seem to be slowly supplanting the older propylene, butylene, etc.

Examples: $\overset{1}{\text{CH}}_2 = \overset{2}{\text{CH}}\overset{3}{\text{CH}}_3$, propene; $\overset{1}{\text{CH}}_2 = \overset{2}{\text{CH}}\overset{3}{\text{CH}}_2\overset{4}{\text{CH}}_3$, 1-butene; $\overset{1}{\text{CH}}_3\overset{2}{\text{CH}} = \overset{3}{\text{CH}}\overset{4}{\text{CH}} = \overset{5}{\text{CH}}\overset{6}{\text{CH}}_3$, 2,4-hexadiene. The double bond receives its number from the lowest-numbered carbon atom to which it is attached. The principle of "lowest numbers" (see rule 64) is always applied; for instance, 1-butene might also be called 3-butene, but the lower number is selected.

"For the naming of branched unsaturated hydrocarbons see the comments on rule 10."

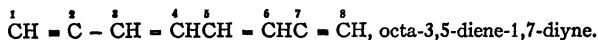
"9. The names of triple-bond hydrocarbons will end in *yne*, *diyne*, etc. They will bear the generic name *alkynes*. Examples: propyne, heptyne, etc."

Comment—"The Geneva ending *-ine* for these hydrocarbons has been replaced by *-yne* because *-ine* is reserved for names of organic bases (see rule 33). The English pronunciation of *-yne* is like that of *-ine* in "wine." It seems unlikely that the time-honored "acetylene" will be replaced by "ethyne" but the names for the higher members, such as propyne,

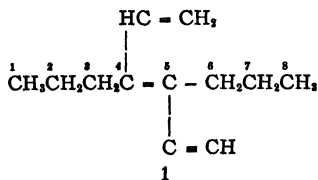
$\overset{1}{\text{CH}} = \overset{2}{\text{C}} - \overset{3}{\text{CH}}_3$, 1-butyne $\overset{1}{\text{CH}} = \overset{2}{\text{C}} - \overset{3}{\text{CH}}_2\overset{4}{\text{CH}}_3$ and 2,4-hexadiyne $\overset{1}{\text{CH}}_3\overset{2}{\text{C}} = \overset{3}{\text{C}} - \overset{4}{\text{C}} = \overset{5}{\text{C}}\overset{6}{\text{CH}}_3$ will probably be increasingly used."

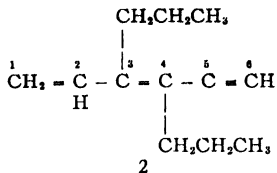
"10. If there are both double and triple bonds in the fundamental chain the endings *enynes*, *dienynes*, etc., will be used. The generic names of these hydrocarbons will be *alkenynes*, *alkadienynes*, etc."

Comment—"The endings *-enynes* and *-dienynes* given in the rule indicate that the double bonds are always to be expressed first, then the triple bonds. E.g.,



"If we interpret rule 6 as applying to saturated hydrocarbons only (see the comments on rule 6), then the Committee has made no rule for the naming of *branched unsaturated* hydrocarbons. Two alternatives seem to be open: (1) to follow the Geneva system and choose the longest chain in the molecule as the fundamental one, even if it does not contain the double or triple bonds. (2) To consider the unsaturated linkages as functions (they are so listed in rule 52) and, guided by rule 18, to select as the fundamental chain that one which contains the maximum of double and triple bonds (even if it is not the longest present in the molecule). Example:





By method (1): 4-ethenyl-5-ethynyl-4-octene. By method (2): 3,4-dipropyl-hexa-1,3-dien-5-yne. (As to beginning the numbering with the double instead of the triple bond, see rule 64.) For general use the writer favors method (2) as being in accordance with the treatment of other functions, and also as better expressing the nature of the hydrocarbons in the ending of the name."

"54. Univalent radicals derived from saturated aliphatic hydrocarbons by removal of one atom of hydrogen will be named by replacing the ending *ane* of the hydrocarbon by the ending *yl*."

Comment—"Examples: methyl, ethyl, pentyl (or amyl), etc. Since isopropylidene is recognized (rule 56) it was no doubt the intention of the Committee to recognize isopropyl similarly."

"55. The names of univalent radicals derived from unsaturated aliphatic hydrocarbons will have the endings *enyl*, *ynyl*, *dienyl*, etc., the positions of the double or triple bonds being indicated by numerals or letters where necessary."

Comment—"Examples: $\text{CH}_2 = \text{CH}-$, ethenyl (or vinyl); $\text{CH} \equiv \text{C}-$, ethynyl; $\text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_2-$, 2-butenyl; $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH} -$, 1,3-butadienyl."

"56. Bivalent or trivalent radicals derived from saturated hydrocarbons by removal of 2 or 3 hydrogen atoms from the same carbon atom will be named by replacing the ending *ane* of the hydrocarbon by the endings *ylidene* or *ylidyne*. For radicals derived from unsaturated hydrocarbons, these endings will be added to the name of the hydrocarbons. The names isopropylidene and methylene are retained."

Comment—"Examples: $\text{CH}_2 <$, methylene; $\text{CH}_2\text{CH} <$, ethylidene; $\text{CH}_2\text{CH}_2\text{CH} <$, propylidene; $(\text{CH}_3)_2\text{C} <$, (1-methylethylidene) or isopropylidene; $\text{CH}_3\text{C} \equiv$, ethylidyne; $\text{CH}_2 = \text{CH} - \text{CH}_2\text{CH} <$, 3-butenylidene. In the last example the number must be changed from 1 (in the name of the hydrocarbon, 1-butene) to 3 in order to indicate the position of the double bond correctly. The new ending *ylidyne*, formed by analogy with "ylidene," should prove useful."

"57. The names of bivalent radicals derived from aliphatic hydrocarbons by removal of a hydrogen atom from each of the two terminal carbon atoms of the chain will be ethylene, trimethylene, tetramethylene, etc."

Comment—"Only saturated radicals are provided for: $-\text{CH}_2\text{CH}_2-$, ethylene; $-\text{CH}_2\text{CH}_2\text{CH}_2-$, trimethylene, etc. (In an earlier draft the ending *ylene* was employed, thus; $-\text{CH}_2\text{CH}_2-\text{CH}_2\text{CH}_2-$, butylene; $-\text{CH}_2\text{CH} - \text{CHCH}_2-$, 2-butenylene.)"

"63. The order in which prefixes or radicals are stated (alphabetic order or conventional order) remains optional."

Comment—"See the comments on rule 7. There is no generally accepted "conventional order" for all prefixes."

"64. In Aliphatic compounds the carbon atoms of the fundamental chain will be numbered from one end to the other with the use of Arabic numerals. In case of ambiguity the lowest numbers will be given (1) to the principal function, (2) to double bonds, (3) to triple bonds, (4) to atoms or radicals designated by

prefixes. The expression "lowest numbers" signifies those that include the lowest individual number or numbers. Thus, 1,3,5 is lower than 2,4,6; 1,5,5 lower than 2,6,6; 1,2,5 lower than 1,4,5; 1,1,3,4 lower than 1,2,2,4."

Comment—"Examples: $\text{CH}_2 = \text{CHCH}_2\text{CH}_3$, 1-butene (not 3-butene); $\text{CH}_2 = \text{CHC} \equiv \text{CH}$, 1-propen-3-yne (not 3-propen-1-yne); $\text{CH}_2 = \text{CH} - \text{CH}_2\text{OH}$, 3-propen-1-ol (not 1-propen-3-ol; the name allyl alcohol may also be used) $\text{CHCl}_2\text{CH}_2\text{CH} = \text{CH}_2$, 4,4-dichloro-1-butene.

"The last example illustrates a difficulty of interpretation which might arise; it might be thought that, the numbers 1,1,3 being lower than 1,4,4, the compound should be named 1,1-dichloro-3-butene. This, however, was apparently not the intention of the Committee, for 1-butene is the parent compound. The British version makes this interpretation clearer by translating the French "En cas d'ambiguïté" rather freely as "To avoid ambiguity."

"The principle of "low numbers" also applies to cyclic compounds, with due regard to their different structure (e.g., bridges and hetero atoms are usually given preferred positions). Examples: 1,3-cyclohexadiene; 3-cyclohexen-1-one or simply 3-cyclohexenone; 4,4-dichlorocyclohexene.

"*Position of Numbers*.—Where shall position numbers be placed, before or after the parts of the name to which they refer? Usage varies; some chemists place them before, some place them after, some use a combination. The Committee has left full latitude on this point. The examples in the French version usually show the numbers placed after; the examples in these comments follow the practice of *Chemical Abstracts* in being placed before. Each method has certain advantages. In Beilstein numbers placed after are in parentheses, those placed before are not, e.g., "2-methyl-butanol-(4)."

4. Geometrical Isomerism

Until recently chemists have considered the structure of ethylene and its derivatives as being composed of two tetrahedra sharing an edge in common. We now know that the two carbon and four hydrogen atoms in ethylene are coplanar, the carbon-hydrogen single bonds and carbon-carbon double bond forming 120° angles.

Due to the fact that rotation about the double bond is not a permissible degree of freedom, geometrical isomers exist for compounds containing double bonds which have no analogy in the paraffin series. Geometrical olefinic isomers are theoretically derivable from each other by a 180° rotation of the two parts of the molecule about the double bond.

If the four groups or three of the four attached to the two carbon atoms forming the double bond are the same, no geometrical isomers are possible, since a 180° rotation of one part of the molecule about the double bond is equivalent to a 180° rotation of the the molecule as a whole. If two of the four groups are the same, geometrical isomerism occurs only when the two groups are attached to each of the two carbon atoms forming the double bond. The isomers are *cis* or *trans* depending upon which side of the double bond the groups lie.

In the diolefins, geometrical isomerism does not occur when the double bonds are adjacent, as in allene. This is due to the fact that the four groups attached to the allenic carbons do not lie in the same plane, as is evidenced by the occurrence of optical activity in allenic derivatives. In the polyolefins, geometrical isomerism may occur, a maximum of 2^x isomers in a compound containing x double bonds being possible when all the groups are different.

In acetylene derivatives, no geometrical isomerism occurs, even though rotation about the triple bond is inhibited. This is because the two groups attached to the two carbon atoms forming the triple bond are collinear with the triple bond.

In the physical constants reported for the olefins, some authors have apparently overlooked the possibility of geometrical or *cis*, *trans* isomerism. These compounds have been indicated in the tables by writing "mixtures of geometrical isomers" or "mixtures of *cis*, *trans* isomers" above the carbon skeleton. No evaluations are given since the variations in the data of different authors may indicate varying amounts of these geometrical isomers.

5. Critical Evaluation of the Data and Calculation of the Most Probable Values

A. Introduction

A considerable number of experiments carried out on different hydrocarbons show inconsistencies in the data of a given compound when determined by one or several investigators. This is more generally true of the olefins and acetylenes than of the paraffins, due to the greater instability and difficulty of preparation.

In recent years very accurate data on physical constants of hydrocarbons have been obtained as a result of carefully designed experiments on the purest compounds with boiling points reliable to within 0.01° , specific gravities and indices of refraction to within one or two parts in 100,000.

If every investigator had given the probable errors of his constants, the task of evaluating the data would be relatively simple. The probable error is seldom given, and consequently it has been necessary in the present work to estimate the reliability of the different workers and their data in order to determine by correlation the most probable values of the constants. Unfortunately there is no one way in which to calculate the probable errors. Wherever possible, recourse has been made to the original article in contrast to the use of abstract sources. Where sufficient detail in the mode of synthesis, purification, and measurement is given, all the pertinent facts are utilized in forming an estimate of the probable error in the value of a constant.

More reliable values of physical constants of hydrocarbons can be obtained by the close co-operation of organic and physical chemists, than by either group alone. The organic chemist in preparing compounds is not primarily interested in determining the physical constants but does so in order to establish the identity of his product. On the other hand, the physical chemist is generally better able to make physical measurements of high accuracy but does not prepare compounds of high purity.

An important development is under way to synthesize several hundred hydrocarbons of different homologous series and to determine their physical constants. This program is sponsored by the American Petroleum Institute as a four-year plan. The hydrocarbons will be synthesized and purified under the direction of Prof. C. E. Boord of Ohio State University. This part of the project is financed through twenty-four oil companies¹.

A number of other laboratories with specialists in their requisite fields will carry out experimental work on the antiknock and other physical properties without cost to the project. The resultant of this co-operative effort should be a set of physical constants of a high order of accuracy and completeness.

1. *Committee on Hydrocarbon Research*
American Petroleum Institute

D. P. BARNARD	Standard Oil Co. (Indiana) Whiting, Ind.
E. G. BORDON	Power Patents Co., 60 Wall St., New York
T. A. BOYD	General Motors Corp., 485 W. Milwaukee Ave., Detroit
R. E. BURK	Standard Oil Co. of Ohio, Midland Bldg., Cleveland
G. H. BURRUSS	Anderson-Prichard Oil Corp., Oklahoma City
GEORGE CALINGAERT	Ethyl Gasoline Corp., 723 E. Milwaukee Ave., Detroit
B. P. CRITTENDEN	Rodessa Oil & Refining Co., 324 First National Bank Bldg., Shreveport, La.
D. E. DAY	Richfield Oil Co., 555 S. Flower St., Los Angeles
GUSTAV EGLOFF	Universal Oil Products Co., 310 S. Michigan Ave., Chicago
S. W. FERRIS	The Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia
J. M. GARDINER	Republic Oil Refining Co., 223 Fourth Ave., Pittsburgh
F. W. HALL	The Texas Co., 135 E. 42nd St., New York
R. A. HALLORAN	Standard Oil Co. of Calif., 225 Bush St., San Francisco
J. BENNETT HILL	Sun Oil Co., 1608 Walnut St., Philadelphia
B. H. LINCOLN	Continental Oil Co., Ponca City, Okla.
J. B. MACAULEY	Chrysler Corp., 12200 E. Jefferson Ave., Detroit
L. G. METCALF	Union Oil Co. of Calif., Union Oil Bldg., Los Angeles
A. E. MILLER	Sinclair Refining Co., 630 Fifth Ave., New York
C. W. MONTGOMERY	Gulf Research & Development Co., Box 2038, Pittsburgh
W. E. MOODY	Deep Rock Oil Corp., Cushing, Okla.
E. V. MURPHREE	Standard Oil Development Co., 26 Broadway, New York
J. B. RATHER	Socony-Vacuum Oil Co., Inc., 26 Broadway, New York
H. V. SMITH	The Barber Co., 1600 Arch St., Philadelphia
S. TIJMSMA	Shell Development Co., Emeryville, Calif.
C. R. WAGNER	The Pure Oil Co., 35 E. Wacker Drive, Chicago

B. Limitations of the Data

Specific gravity is used to illustrate the order of magnitude of the errors in the data. The specific gravity of a compound is a function of temperature, pressure, and purity. Considering the effect of temperature, the value of dD/dt at 20° for normal heptane is - 0.0008563 per degree, and consequently the change in temperature which would cause a change in the specific gravity of one unit in the fifth decimal place is calculated to be 0.012°.

The dependence of the specific gravity on pressure is small but it is not entirely negligible when the value is given to five significant figures, as shown by the data of Smith, Beattie, and Kay¹ on the compressibility of normal heptane. They give the following results for the specific volume at 30°:

Specific volume, Cm. ³ /g.	Pressure, atm.
1.4793	7.12
1.4756	19.08
1.4723	31.04
1.4700	43.00
1.4133	351.25

From the above data, the change in pressure which would cause a change in the specific gravity of one unit in the fifth decimal place is found to be 55 mm.

1. L. B. Smith, J. A. Beattie, and W. C. Kay, *J. Am. Chem. Soc.*, **59**, 1587, 1937

An error in the specific gravity of normal heptane due to an impurity may be calculated as follows. Assume that a sample is contaminated by 2-methylhexane. Knowing the specific gravities in each case, we can calculate how much of the latter would cause the specific gravity of the former to be in error by one unit in the fifth decimal place. The specific gravities at 20° for *n*-heptane and 2-methylhexane are 0.68375 and 0.67873 respectively. Assuming a perfect solution, and resulting additivity of volumes, the amount of 2-methylhexane, Δ , can be calculated from the equation

$$\frac{1 - \Delta}{0.68375} + \frac{\Delta}{0.67873} = \frac{1}{0.68374}$$

Solving this equation, $\Delta = 0.0019$ or 0.19 percent. The sample of *n*-heptane must therefore be of 99.8 percent purity in order that the specific gravity be accurate to within one unit in the fifth decimal place.

The presence of high molecular-weight paraffin impurities causes a more pronounced effect due to the greater difference in specific gravities. Since the specific gravity of *n*-decane at 20° is 0.7304, its presence in *n*-heptane to the extent 0.024 percent would cause an error of one unit in the fifth decimal place of the specific gravity of *n*-heptane.

C. Melting Points

There is a greater paucity of data for the melting points of aliphatic hydrocarbons than the other physical constants studied. For melting points the values show greater variations for each compound than for any other physical constants reported. These inaccuracies and general lack of data may be due to the difficulties involved in the precise measurements compared to other constants and the tendency of many hydrocarbons to supercool forming amorphous rather than crystalline solids. The equilibrium between liquid and solid during a melting point determination may not have been reached; therefore the value reported is in error.

Where several melting point determinations are available on a given compound, the weighted average was selected as the most probable value. The general rule followed is that impurities lower the melting point of a pure compound. The weightings assigned to the individual values were taken as inversely proportional to the squares of the probable errors, in accordance with the theory of errors.

The melting point of those hydrocarbons which have been determined are shown in the tables. The bold face number given is the best melting point value as of today.

D. Boiling Points

The boiling point of a compound can be determined with a high order of accuracy, except in the case of hydrocarbons which undergo cracking, dehydrogenation, or other changes such as isomerization and polymerization during the determination.

The boiling point of a liquid is a sensitive function of the pressure, the dependence being given by the Clausius-Clapeyron equation. For compounds where several boiling points are given under various pressures, the normal boiling point at 760 mm may be calculated reliably by fitting all the data to the integrated form

of the Clausius-Clapeyron equation. Due to the lack of sufficient data in most cases, this procedure is not justified, and the normal boiling point for many hydrocarbons is derived by taking the *weighted* mean of all the values at 760 mm.

For each compound the boiling point data are listed in order of decreasing pressure. The pressure in millimeters corresponding to each boiling point is given unless this pressure is 760 mm in which case it is omitted. The value given in bold-face type for each hydrocarbon is the most accurate boiling point to use.

E. Specific Gravity

The number of specific gravity values for the aliphatic hydrocarbons is greater than for the other constants. The specific gravity values may be determined to a higher percentage accuracy than either the melting or boiling point.

In general, we assume that the variation of specific gravity with temperature may be expressed by the equation

$$D_4^t = D_4^{t_0} + a(t - t_0) + b(t - t_0)^2. \quad (1)$$

Here D_4^t is the specific gravity of the substance at the temperature t (the density relative to water at 4°); $D_4^{t_0}$ is the specific gravity at some constant temperature t_0 , and a and b are constants to be evaluated; t_0 is usually 20°. For compounds of low boiling points, 0° or the melting point or the boiling point is used.

The constants $D_4^{t_0}$, a , and b are determined by the method of least squares¹ in every case where there is a sufficient number of specific-gravity values available. (If several values are available for the same temperature, the method of least squares is degenerate, and is equivalent to taking the weighted average of those values.)

From equation (1) the derivative of D with respect to t is

$$\frac{dD}{dt} = a + 2b(t - t_0) \quad (2)$$

$$= a \left[1 + \frac{2b}{a}(t - t_0) \right] \quad (3)$$

Instead of giving equation (1) explicitly, the value of $D_4^{t_0}$ ($t_0 = 20^\circ$ wherever the data permit) is given in the specific gravity column, and equation (3) is given in the additional-data column.

In many cases values of $D_{t_1}^{t_0}$ are reported, t_1 being different from 4°. In these cases, the values of $D_4^{t_1}$ are calculated by the formula

$$D_4^{t_1} (\text{hydrocarbon}) = D_{t_1}^{t_0} (\text{hydrocarbon}) \times D_4^{t_1} (\text{water})$$

The values of $D_4^{t_0}$ of water are taken from the International Critical Tables. $D_{t_1}^{t_1}$ is numerically equal to the density of t_2 in c.g.s. units when t_1 refers to the

1. The method of least squares is described in J. B. Scarborough, "Numerical Mathematical Analysis", Johns Hopkins Press, Baltimore, 1930.

density of water at 4° which is 1.00000 g/cc. In general a straight line is found to be sufficient to represent the hydrocarbon specific gravities over a temperature range of 30° to 40° ($b = 0$) but that a parabola is usually justified over a larger temperature interval.

From the values of dD/dt , the coefficient of expansion of the liquid at any temperature may be calculated by the formula

$$\alpha = -\frac{1}{D} \cdot \frac{dD}{dt}$$

This equation follows from the definition of α :

$$\alpha = \frac{1}{v} \cdot \frac{dv}{dt}$$

where v , the specific volume, is defined as the reciprocal of D , the density.

As an example of the application of the method of least squares to the evaluation of specific gravity data, the following table for *n*-nonane is given.

TABLE I—SPECIFIC GRAVITY OF *N*-NONANE

Weighting	t° C.	D_4^t (Exper.)	D_4^t (Calc.)	$\Delta \cdot 10^4$
1	150	0.6096	0.6101	-5
1	130	0.6272	0.6273	-1
1	110	0.6445	0.6442	3
1	90	0.6619	0.6610	9
1	70	0.6776	0.6775	1
1	50	0.6945	0.6938	7
1	30	0.7105	0.7099	6
25	25	0.71398	0.71392	0.6
25	20	0.71808	0.71790	1.8
25	20	0.71780	0.71790	-1.0
2	20	0.7176	0.7179	-3
25	20	0.71770	0.71790	-2.0
1	15	0.7213	0.7219	-6
1	10	0.7260	0.7258	2
1	-10	0.7417	0.7415	2
1	-30	0.7573	0.7570	3
1	-50	0.7726	0.7723	3

In column 1 the weightings assigned to the specific gravity values are taken to be inversely proportional to the squares of the probable errors, in accordance with theory. Wherever possible, an estimate of the accuracy of the work was determined by reference to the original articles containing experimental details of synthesis, and the methods used in determining the physical constants.

In column 2 the temperatures are given in degrees Centigrade.

In column 3 the experimental values of the specific gravities are given.

From the first three columns the constants in equation (1) were determined by the method of least squares. The equation is

$$D_4^t = 0.71790 - 0.0007952(t - 20) - 0.0000002622(t - 20)^2.$$

In column 4 the values of D_4^t calculated from this equation are given.

In column 5 the differences between the observed and calculated values multiplied by 10^4 are given.

The above equation reproduces the data to within about three units in the fourth decimal place, or about one part in 2200; this accuracy appears to be typical for the paraffins.

It should be pointed out that for any given compound the values calculated for D_4^{20} and dD/dt by the method of least squares depend upon all the data of that compound at all temperatures. Once the weightings are assigned to the individual values, the calculation is straightforward and has the advantage over graphical methods in that it eliminates the "personal equation".

Where the values for a given compound are reported over a small temperature interval (10 degrees or less) the equation for dD/dt is not usually determined.

The specific gravity value given at 20° in bold face type for each hydrocarbon is the most accurate one to use. In many cases the last figure is given in small print, e.g. 0.7666₃. This signifies that it is not to be retained but is inserted in order to eliminate errors in calculating specific gravities at temperatures other than 20°.

The specific gravity values for each compound are listed in order of decreasing temperature. When the specific gravity was determined at 20°, this temperature was omitted in the list of values since the heading is given as D_4^{20} . If the specific gravity is referred to water at any temperature other than 4°, this is indicated by $D_{t_1}^{t_2}$, following the specific gravity value (t_1 and t_2 being expressed numerically).

F. Index of Refraction

The physical measurement of the index of refraction is the simplest and most accurate compared to the other constants studied. The value is referred to the sodium D line unless otherwise indicated. The changes with temperature are of the same order of magnitude as those of specific gravity. The most reliable values of the index at 20° and dn/dt were evaluated by the same method as used for specific gravity.

The index of refraction is tabulated in a manner similar to that for specific gravities. The bold face type number for each hydrocarbon is the best value at 20° derivable from all the data.

6. Tabulated Data—Examples Illustrating Their Use.

From the values of D_4^{20} and dD/dt , the specific gravity may be calculated for any temperature over which the equation for dD/dt is valid. If dD/dt is given as a constant over a specified range, the calculation is simple, as illustrated by the following. Calculating the specific gravity of 2-methylpentene at 0°, from the tables we find

$$D_4^{20} = 0.61996$$

$$dD/dt = -0.0009679/^\circ\text{C. (from } 0^\circ \text{ to } 20^\circ).$$

D_4^0 is then given by the equation

$$\begin{aligned} D_4^0 &= D_4^{20} - 0.0009679 (0^\circ - 20^\circ) \\ &= 0.61996 + 0.0009679 \times 20^\circ \\ &= 0.61996 + 0.01935 \\ &= 0.63931. \end{aligned}$$

When dD/dt is given as a linear function of the temperature, the calculation of the specific gravity at some temperature different from 20° is somewhat more extensive than the previous case. Let us consider normal nonane. From the tables we find

$$D_4^{20} = 0.71790$$

$$\frac{dD}{dt} = -0.0007847 (1 + 0.0006684 t)/^\circ\text{C}. \quad (4)$$

(from -50° to 150°)

In calculating the specific gravity at 0° , the above equation shows that the value of dD/dt continuously changes. Over a small temperature range, the change dD/dt is small and a constant value may be used—namely, the average over that range. The average value of dD/dt from 0° to 20° is found by substituting in the above equation for dD/dt the temperature midway between 0° and 20° . dD/dt is then found to be $-0.0007847 \times 1.006684 = -0.0007899/^\circ\text{C}$. Proceeding as in the previous example, the specific gravity at 0° is calculated to be

$$\begin{aligned} D_4^0 &= 0.71790 + 0.0007899 \times 20 \\ &= 0.7337. \end{aligned}$$

To calculate the specific gravity of normal nonane at some temperature further removed from 20° , e.g. 100° , it is no longer permissible to assume a constant value of dD/dt over the entire range from 20° to 100° , and it is therefore necessary to use equation (4), which may be rewritten as

$$dD = -0.0007847 (1 + 0.0006684 t) dt.$$

Integrating dD between the limits D_4^{20} and D_4^{100} and dt between the limits 20° and 100° , we have

$$\int_{D_4^{20}}^{D_4^{100}} dD = - \int_{20}^{100} 0.0007847 (1 + 0.0006684 t) dt$$

$$\begin{aligned} \text{or, } D_4^{100} - 0.71790 &= - [0.0007847 t(1 + 0.0003342 t)]_{20}^{100} \\ &= -0.0007847 (103.342 - 20.134) \\ &= -0.0007847 \times 83.208 \\ &= -0.06529. \end{aligned}$$

$$\begin{aligned} \text{Hence, } D_4^{100} &= 0.71790 - 0.06529 \\ &= 0.6526. \end{aligned}$$

It should be noticed in the two foregoing examples that the calculations are carried out to one more significant figure than is retained in the final answer. This is the customary procedure in order to avoid errors due to the rounding off of numbers in the calculations.

Although the equations for dD/dt are not valid beyond the temperature limits given in each case, the invalidity does not take place abruptly at these temperatures, but rather the equation becomes less significant at temperatures deviating from the stated limits. Extrapolating a few degrees beyond the temperatures given is therefore permissible, but it is not possible to state *a priori* the magnitude of the error involved in any given case.

The index of refraction at some temperature other than 20° may be calculated from n^{20} and dn/dt in precisely the same manner as the specific gravity, illustrated by the previous examples.

There are a number of common names which do not give an indication of the structures of the hydrocarbons in this volume which is otherwise self-indexing. The common names which do not cover structures of the hydrocarbons will be indexed in the fourth volume which will also contain the common name index for the other two volumes.

II PHYSICAL CONSTANTS OF ALKANES OR PARAFFINS

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Methane	-182.6	-161.58	0.4240₃ @ -161.58°		[log ₁₀ p (atm)] = - $\frac{595.546}{T}$
C	-182.6 ⁶	-182.5 ¹⁰	0.4417 ⁷		+8.09938
	-182.9 ¹⁶	@ 83 to 85mm	@ -173.1°		-4.04175 × 10 ⁻² T
	-182.5 ¹⁷	-178.1 ⁷	0.4335 ⁷		+1.68655 × 10 ⁻⁴
	-184.0 ²²	@ 151mm	@ -168.1°		T ² - 2.51715 × 10 ⁻⁷ T ³
		-173.1 ⁷	@ 262mm	0.4263 ⁷	
		-168.1 ⁷	@ @ 429mm	@ -163.1°	
		-163.1 ⁷	0.4241 ⁷		
		@ 670mm	@ -161.58°		
	-163 ¹⁸	@ 751mm	0.4190 ⁷		
	-161.58 ⁷	@	@ -158.1°		
	-161.37 ⁶	-160 ²²	0.4117 ⁷		
	-160 ²²	-158.1 ⁷	@ -153.1°		
		@	1.319 atm	0.4043 ⁷	
		-153.1 ⁷	@ @	@ -148.1°	
		@	1.905 atm	0.3967 ⁷	
		-148.1 ⁷	@ @	@ -143.1°	
		@	2.670 atm	0.3888 ⁷	
		-143.1 ⁷	@ @	@ -138.1°	
		@	3.641 atm	0.3804 ⁷	
		-138.1 ⁷	@ @	@ -133.1°	
		@	4.853 atm	0.3712 ⁷	
		-133.1 ⁷	@ @	@ -128.1°	
		@	6.338 atm	0.3612 ⁷	
		-128.1 ⁷	@ @	@ -123.1°	
		@	8.132 atm	0.3505 ⁷	
		-123.1 ⁷	@ @	@ -118.1°	
		@	10.27 atm	0.3391 ⁷	
			@ -113.1°		

$$\frac{dD}{dt} = -0.005310 \cdot (1 + 0.004832t)/^{\circ}\text{C.}$$

(-90° to -170°)

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Methane—(Continued)					
		—118.1 °	0.3279 °		
		@	@		
		12.79 atm	—108.1 °		
		—113.1 °	0.3137 °		
		@	@		
		15.74 atm	—103.1 °		
		—108.1 °	0.2988 °		
		@	@		
		19.14 atm	—98.1 °		
		—103.1 °	0.2812 °		
		@	@		
		23.05 atm	—93.1 °		
		—98.1 °	0.2573 °		
		@	@		
		27.49 atm	—88.1 °		
		—93.1 °	0.1613 °		
		@	@		
		32.51 atm	—82.1 °		
		—88.1 °	crit.		
		@	temp.		
		38.15 atm			
		—82.1 °			
		@			
		45.79 atm			
		crit. pres.			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Ethane	-172.0	-88.5	0.5462, @ -88.5°		$\frac{dD}{dt} = -0.001298/^\circ\text{C.}$ (-70° to -105°)
C-C	-172.0 ¹ -172.1 ²²	-110 ¹⁰ @ 200 to 215mm -100.8 ¹ @ 364.5mm -95.5 ¹ @ 504.0mm -90.6 ¹ @ 664.5mm -88.0 ¹² @ 743mm -88.4 ¹ @ 753.0mm -88.63 ³ -84.1 ²² -88.3 ^{1,12} -79.7 ¹ @ 1177.0mm -74.1 ¹ @ 1547.0mm -72.7 ¹ @ 1654.5mm	0.5272 ¹ @ -74.0° 0.5338 ¹ @ -78.8° 0.5392 ¹ @ -83.1° 0.5458 ¹ @ -88.1° 0.5459 ¹ @ -88.6° 0.5469 ¹⁵ @ -88.3° 0.5472 ¹ @ -89.05° 0.5549 ¹ @ -95.3° 0.5589 ¹ @ -98.2° 0.5608 ¹ @ -99.7° 0.5685 ¹ @ -105.8° 0.5719 ¹ @ -108.2°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Propane	-187.1	-42.2	0.5824, @ -42.2°	1.3397, @ -42.2°	$\frac{dD}{dt} = -0.001151/^\circ\text{C.}$ (-25° to 80°)
C-C-C	-189.9 ¹	-78.5 ¹⁰	0.5829 ¹	1.3395 ⁴	$\frac{dn}{dt} = -.0006753/^\circ\text{C.}$ (-45° to -65°)
	-187.8 ⁸	@ 100 to 110mm	@	@	
	-187.1 ²		-42.2°	-42.2°	
	187.8 ²²	-44.5 ¹	0.5957 ¹	1.3448 ⁴	
		-42.6 to	@	@	
		-43.6 ⁹	-53.3°	-50.0°	
		-42.2 ¹¹	0.6238 ¹	1.3587 ⁴	
		-42.17 ²	@	@	
		-44.1 ²²	-78.2°	-70.0°	

- (1) O. Maass and C. H. Wright, J. Am. Chem. Soc. **43**, 1098, 1921.
- (2) M. M. Hicks-Bruun and J. H. Bruun, J. Am. Chem. Soc. **58**, 810, 1936.
- (3) A. G. Loomis and J. E. Walters, J. Am. Chem. Soc. **48**, 2051, 1926.
- (4) A. v. Grosse, Unpublished data.
- (5) A. Eucken and E. Karwat, Z. physik. Chem. **112**, 467, 1924.
- (6) F. Henning and A. Stock, Z. Physik. **4**, 226, 1921.
- (7) F. G. Keyes, R. S. Taylor, and L. B. Smith, J. Math. Phys., Mass. Inst. Tech. **1**, 211-242, 1922.
- (8) J. Timmermans, Bull. soc. chim. Belg. **30**, 62, 1921.
- (9) K. W. F. Kohlrausch and F. Köppl, Z. physik. Chem. **26B**, 209, 1934.
- (10) W. Fischer and W. Klemm, Z. physik. Chem. **147A**, 275, 1930.
- (11) L. I. Dana, A. C. Jenkins, J. N. Burdick, and R. C. Timm, Refrigeration Engineering **12**, 387, 1926.
- (12) W. A. McMillan, J. Am. Chem. Soc. **58**, 1345, 1936.
- (13) W. B. Kay, Ind. Eng. Chem. **30**, 459, 1938.
- (14) R. K. Witt and J. D. Kemp, J. Am. Chem. Soc. **59**, 273, 1937.
- (15) F. R. Morehouse and O. Maass, Can. J. Research **11**, 637, 1934.
- (16) R. Wiebe and M. J. Brevoort, J. Am. Chem. Soc. **52**, 622, 1930.
- (17) K. Clusius, Z. physik. Chem. **B3**, 41, 1929.
- (18) A. Ladenburg and C. Krügel, Ber. **33**, 637, 1900.
- (19) C. C. Coffin and O. Maass, J. Am. Chem. Soc. **50**, 1427, 1928.
- (20) O. Maass and D. McIntosh, J. Am. Chem. Soc. **36**, 737, 1914.
- (21) J. D. Kemp and C. J. Egan, J. Am. Chem. Soc. **60**, 1521, 1938.
- (22) R. P. Anderson, Ind. Eng. Chem. **12**, 547, 1920.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
n-Butane	-135.0	-0.5	0.5788,	1.3562 @ -15.0°	$\frac{dn}{dt} = -0.00059/^\circ\text{C}.$ (-15° to -25°)
C-C-C-C	-135.0 ³ -135.0 ⁹	-13 ⁵ @ 490 to 460mm -1.5 to 0 ⁷ -0.6 ⁶ -0.5 ¹ -0.3 ⁸ +0.3 ⁹ +0.5 ⁴	0.5791 ¹ 0.6017 ¹ @ -0.5°	1.3562 ² @ -15.0° 1.3621 ² @ -25.0°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylpropane		-12.2	0.5592_s		$\frac{dn}{dt} = -0.00062/^\circ\text{C}.$ (-25° to -45°)
Isobutane	-145.0 ³	-10.2 ¹	0.5530 ¹	1.3514 ²	
		-9.5 to	@ 25.3°	@ -25.0°	
		-11.5 ⁷	0.5591 ¹	1.3638 ²	
		-12.2 ⁶	@ 20.2°	@ -45.0°	
		-13.0 ⁴	0.5682 ¹		
			@ 12.5°		
			0.5691 ¹		
			@ 11.7°		
			0.5729 ¹		
			@ 8.5°		
			0.5787 ¹		
			@ 4.3°		
			0.5821 ¹		
			@ 0.7°		
			0.5845 ¹		
			@ -1.3°		
			0.5857 ¹		
			@ -2.7°		
			0.5893 ¹		
			@ -5.5°		
			0.5899 ¹		
			@ -6.2°		
			0.5924 ¹		
			@ -8.5°		
			0.5927 ¹		
			@ -11.2°		
			0.5980 ¹		
			@ -13.6°		
			0.6005 ¹		
			@ -15.8°		
			0.6055 ¹		
			@ -20.7°		
			0.6131 ¹		
			@ -27.8°		

- (1) C. C. Coffin and O. Maass, J. Am. Chem. Soc. **50**, 1427, **1928**.
- (2) A. v. Grosse, J. Am. Chem. Soc. **59**, 2739, **1937**.
- (3) J. Timmermans, Bull. soc. chim. Belg. **25**, 300, **1911**.
- (4) K. W. F. Kohlrausch and F. Köppl, Z. physik. Chem. **26B**, 209, **1934**.
- (5) W. Fischer and W. Klemm, Z. physik. Chem. **147A**, 275, **1930**.
- (6) L. I. Dana, A. C. Jenkins, J. N. Burdick, and R. C. Timm, Refrigeration Engineering **12**, 387, **1926**.
- (7) W. Hückel, Agnes Kraemer, and F. Thiele, J. prakt. Chem. **142**, 207, **1935**.
- (8) G. A. Burrell and I. W. Robertson, J. Am. Chem. Soc. **37**, 2188, **1915**.
- (9) R. P. Anderson, Ind. Eng. Chem. **12**, 547, **1920**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_{15}^{20}	n_D^{20}	Additional Data
n-Pentane	-129.7	36.08	0.62638 @ 20° 0.64529 @ 0°	1.35768	$\frac{dD}{dt} = -0.0009293 \cdot$ (1+0.000867t)/°C. (10° to -90°)
C-C-C-C-C	-129.93 ²	36.00 ⁴	0.6163 ¹⁶	1.35470 ³	$\frac{dD}{dt} = -0.0009686/°C.$ (10° to 30°)
	-129.73 ¹	36.06 ³	@ 30°	@ 25°	
	-129.7 ⁴	36.0 ²⁶	0.62783 ⁸	1.35495 ⁴	$\frac{dn}{dt} = -0.0005473/°C.$ (-25° to 25°)
	-129.1 ²	36.10 ²	0.627 ²⁶	@ 25°	
		36.2 ⁸	0.62624 ⁴	1.35828 ⁸	
		36.25 ¹⁷	0.62606 ³⁵	1.35769 ⁴	
		36.3 ^{19,23}	0.6309 ¹⁷	1.35801 ¹⁶	
		36.65 ²²	$D_{15.5}^{20}$	1.3589 ²²	
		36.75 ¹⁸	0.625 ²²	@ 18°	
		36.8 ²⁷	@ 18°	1.3570 ²⁹	
		37 ²⁸	0.6270 ²⁹	@ 18°	
		38 ²⁹	@ 17°	1.3818 ²²	
		36.077 ³⁷	0.63114 ²	@ -25°	
			@ 15°		
			0.6340 ¹⁷		
			$D_{15.5}^{14}$		
			0.6309 ¹⁸		
			$D_{15.5}^{15.5}$		
			0.6359 ¹⁶		
			@ 10°		
			0.6454 ¹⁰		
			@ 0°		
			0.6545 ¹⁶		
			@ -10°		
			0.6728 ¹⁶		
			@ -30°		
			0.6908 ¹⁶		
			@ -50°		
			0.7083 ¹⁶		
			@ -70°		
			0.7257 ¹⁶		
			@ -90°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylbutane	-159.6	27.95	0.61996	1.35796 @ 15°	$\frac{dD}{dt} = -0.0009679/^\circ\text{C.}$ (0° to 20°)
isopentane	-159.6 ³⁰	29.7 ²⁷	0.61972 ⁴	1.35796 ¹⁴	
	-159.6 ¹⁴	@ 763mm	0.6197 ¹³	@ 15°	
<chem>CC(C)CC</chem>	-159.65	27.95 ¹⁰	0.6198 ³⁰	1.3598 ^{11,12}	
		27.95 ⁹	0.621 ⁷	1.35485 ^{3,3}	
	-160.0 ⁶	27.95 ¹⁴	@ 19.1°		
	-160.5 ²⁴	27.8 ²¹	0.6214 ¹⁷		
	-160.6 ²¹	28 ^{19,23,30}	@ 20°		
		28.0 ^{7,24}	0.6234 ¹⁷		
		28.05 ¹⁸	@ 17°		
		30.55 ¹⁷	0.62470 ¹⁴		
		27 ²⁰	@ 15°		
		@ 725mm	0.6243 ¹⁸		
			@ 15°		
			0.6250 ²⁷		
			@ 14.7°		
			0.6393 ¹⁰		
			@ 0°		
			0.6394 ²³		
			@ 0°		
			0.63942 ⁹		
			@ 0°		
			0.63945 ¹⁴		
			@ 0°		
2,2-Dimethylpropane	-16.63	9.45	0.613 @ 0°	1.3513 @ 0°	$\frac{dn}{dt} = -0.00062/^\circ\text{C.}$ (0° to 6°)
neopentane	-19.5 ^{5,30}	8.9 to 9.1 ²⁵	0.613 ⁵	1.3513 ³⁰	
	-16.63 ³⁴	9.4 ⁵	@ 0°	1.3513 ⁵	
<chem>CC(C)(C)C</chem>		9.6 ³⁰	0.613 ³⁰	@ 0°	
		9.45 ³⁴	@ 20°	1.3476 ⁵	
				@ 6°	

- (1) J. Timmermans, *Bull. soc. chim. Belg.* **43**, 626, 1934.
- (2) J. Timmermans and Mme. Hennaut-Roland, *J. chim. phys.* **32**, 501, 589, 1935.
- (3) B. J. Mair, *J. Research Nat. Bur. Standards* **9**, No. 4, 457, 1936.
- (4) A. F. Shepard, A. L. Henne, and T. Midgley, Jr., *J. Am. Chem. Soc.* **53**, 1948, 1931.
- (5) F. C. Whitmore and G. H. Fleming, *J. Am. Chem. Soc.* **55**, 3803, 1933.
- (6) J. Timmermans, *Comm. Phys. Lab. Univ. Leiden, Suppl. No.* **64**, 3, 1929.
- (8) A. Karvonen, *Suomen Kem.* **3**, 101, 1930.
- (9) J. Timmermans, *Proc. K. Akad. Wetenschappen* **13**, 507, 1910.
- (10) S. Young and G. L. Thomas, *J. Chem. Soc.* **71**, 440, 1897.
- (11) K. v. Auwers and F. Eisenlohr, *Z. physik. Chem.* **83**, 429, 1913.
- (12) J. F. Eykman, *Verhandelingen Haarlem* (3) **8**, 441, 1919.
- (13) J. F. Eykman, *Rec. trav. chim.* **12**, 160, 1907.
- (14) J. Timmermans and F. Martin, *J. chim. phys.* **23**, 747-87, 1926.
- (15) W. Seitz, H. Alterthum, and G. Lechner, *Ann. phys.* (4) **49**, 85, 1916.
- (16) R. W. Dornte and C. P. Smyth, *J. Am. Chem. Soc.* **52**, 3546, 1930.
- (17) G. G. Brown and A. R. Carr, *Ind. Eng. Chem.* **18**, 718, 1926.
- (18) R. P. Anderson and A. M. Erskine, *Ind. Eng. Chem.* **16**, 263, 1924.
- (19) G. Chavanne and L. J. Simon, *Compt. rend.* **168**, 1324, 1919.
- (20) W. Wöllmer, *Ber.* **58**, 672, 1925.
- (21) P. Sabatier and G. Gaudion, *Compt. rend.* **165**, 224, 1917.
- (22) A. Kirrmann, *Bull. soc. chim.* (4) **39**, 988, 1926.
- (23) G. Chavanne and L. J. Simon, *Ann. chim. anal. chim. appl.* (2) **2**, 76, 1920.
- (24) G. S. Parks, H. M. Huffmann, and S. B. Thomas, *J. Am. Chem. Soc.* **52**, 1032, 1930.
- (25) K. W. F. Kohlrausch and F. Köppl, *Z. physik. Chem.* **26B**, 209, 1934.
- (26) G. W. Stewart, *Phys. Rev.* **32**, 153, 1928.
- (27) W. Fischer and W. Klemm, *Z. physik. Chem.* **147A**, 275, 1930.
- (28) J. v. Braun and W. Sobecki, *Ber.* **44**, 1918, 1911.
- (29) C. Engler and B. Halmai, *Ber.* **43**, 397, 1910.
- (30) H. Hoog, J. Smittenberg, and G. H. Visser, R-51-S2 11^o Congres (H. Hoog and J. Smittenberg, priv. com.) Mondial du Petrol, Paris, June 1937.
- (31) J. Smittenberg, H. Hoog, and R. A. Henkes, Preprint Petroleum Division, Rochester Meeting, Am. Chem. Soc. Sept. 1938.
- (32) H. R. Henze and C. M. Blair, *J. Am. Chem. Soc.* **53**, 3084, 1931.
- (33) N. A. Rosanov, *Chem. Zentr.* **1923** I 1490.
- (34) J. G. Aston and G. H. Messerly, *J. Am. Chem. Soc.* **58**, 2354, 1936.
- (35) B. J. Mair, Private Communication.
- (36) J. Timmermans, H. v. d. Horst, and H. Kammerlingh-Onnes, *Chem. Zentr.* **1923**, IV 377.
- (37) M. Wojciechowski, *J. Research Nat. Bur. Standards* **17**, 453, 1936.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Hexane	-94.0	68.8	0.65942	1.37506	$\frac{dD}{dt} = -0.0008790 \cdot$ (1 + 0.000764t)/°C. (-90° to 50°)
C-C-C-C-C-C	-94.03 ¹⁴	68.3 ²⁴	0.6318 ¹⁶	1.37224 ⁴	
	-94.5 ²⁸	68.6 to 68.7 ²⁸	@ 50°	@ 25°	$\frac{dn}{dt} = 0.0005598/°C.$ (15° to 25°)
	-94.6 ²	68.70 ⁴	0.65055 ⁸	1.37230 ⁵	
	-95.0 ³²	68.71 ⁵	@ 30°	@ 25°	
	-95.1 ⁸	68.74 to	0.6507 ¹⁵	1.3840 ²⁰	
	-95.34 ⁴	68.78 ¹	@ 30°	@ 25°	
	-95.39 ⁸	68.80 ⁸	0.65502 ⁵	1.3840 ¹⁷	
	-95.4 ³³	68.8 ^{8,17}	@ 25°	@ 25°	
		68.95 ^{8,20}	0.6583 ³	1.37490 ¹⁶	
		69 ³³	0.6590 ²⁸	1.37499 ⁴³	
		69.2 ²³	0.6592 ²⁴	1.37506 ⁶	
		70.5 ²⁹	0.65928 ³⁶	1.37508 ⁹	
		50.0 ⁹	0.65945 ⁵	1.3751 ⁴³	
		@ 568.0mm	0.6595 ⁷	1.37515 ²⁴	
		57.7 ¹⁷	0.660 ²⁷	1.37518 ³	
		@ 525.8mm	0.6600 ⁹	1.3752 ¹	
		40.0 ⁹	0.6610 ^{17,20}	1.3851 ^{17,20}	
		@ 400.6mm	0.6630 ²⁹	1.37787 ⁸	
		46.7 ¹⁷	@ 17°	@ 15°	
		@ 355.1mm	0.6692 ¹⁶		
		30.0 ⁹	@ 10°		
		@ 275.7mm	0.67713 ¹³		
		35.7 ¹⁷	@ 0°		
		@ 233.53mm	0.67704 ⁸		
		20.0 ⁹	@ 0°		
		@ 186.1mm	0.6869 ¹⁶		
		24.8 ¹⁷	@ -10°		
		@ 149.19mm	0.7037 ¹⁵		
		14.0 ¹⁷	@ -30°		
		@ 92.30mm	0.7206 ¹⁶		
			@ -50°		
			0.7370 ¹⁶		
			@ -70°		
			0.7533 ¹⁶		
			@ -90°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-153.7 -143 ³³ -153.71 ³⁶ -154.0 ³⁴	60.20 60.15 to 60.20 ¹⁰ 60.19 ³⁴ 60.2 ^{6,18} 60.20 ¹² 60.22 to 60.26 ¹ 60.27 ⁴⁸ 60.3 ^{33,44} 61.15 ²⁰ 61.5 to 62 ⁴² 62.05 ^{21,22}	0.6562₃ 0.6519 ³ 0.6525 ³³ 0.6527 ³⁴ 0.65316 ⁴³ 0.6532 ¹ 0.6542 ⁸ 0.6594 ²⁰ 0.6614 ¹⁸ @ 17° 0.6583 ¹⁸ @ 15° 0.6580 ¹⁰ @ 15° 0.6576 ⁴² @ 15° 0.6711 ¹⁸ @ 0° 0.6712 ¹⁰ @ 0°	1.37149 1.3684 ³⁴ @ 25° 1.3711 ³⁴ 1.3714 or 6 ^{33,44} 1.37170 ³ 1.3717 ⁷ 1.3718 ¹ 1.372 ³⁸ 1.374 ³⁵ 1.37445 ⁷ @ 15° 1.3740 ³¹ @ 15°	$\frac{dD}{dt} = -0.0008985/^{\circ}\text{C.}$ (0° to 20°) $\frac{dn}{dt} = -0.0008099/^{\circ}\text{C.}$ (15° to 25°)
3-Methylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-118^{33,35}	63.2 62.7 ³ 63.16 to 63.21 ¹ 63.2 ^{10,12,14,33,34} 63.3 ³⁸	0.66409 0.6614 ³ 0.6638 ³³ 0.6640 ³⁴ 0.6642 ¹ 0.6643 ¹⁰ 0.6647 ⁶ 0.665 ³⁵ 0.6690 ³⁴ @ 15° 0.6690 ¹⁸ @ 15° 0.6687 ¹⁰ @ 15° 0.6820 ¹⁰ @ 0° 0.6819 ¹⁸ @ 0°	1.3765 1.3738 ³⁴ @ 25° 1.376 ³⁵ 1.37639 ³ 1.3764 ³⁴ 1.3775 ¹ 1.37929 ⁷ @ 15° 1.3790 ³⁴ @ 15°	$\frac{dD}{dt} = -0.0008995/^{\circ}\text{C.}$ (0° to 20°) $\frac{dn}{dt} = -0.0005433/^{\circ}\text{C.}$ (15° to 25°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D_4^{20}	n_D^{20}	Additional Data	
2,2-Dimethylbutane	-98.2	49.7	0.6494.	1.36887	$\frac{dD}{dt} = -0.0009150/^{\circ}\text{C.}$ (0° to 20°)	
	-98.2 ^{11,19}	49.7 to	0.6482 ³³	1.3675 ¹⁶	$\frac{dn}{dt} = -0.0005414/^{\circ}\text{C.}$ (15° to 20°)	
		49.75 ¹¹	0.6491 ¹¹	1.3688 ³³		
		49.7 ^{6,18,19,33}	0.6493 ¹	1.36887 ³⁶		
		49.5 to 50.5 ¹⁶	0.6498 ⁶	1.3692 ¹		
		49.80 to	0.6512 ¹⁸	1.37054 ³		
		49.82 ¹	0.6518 ³	1.37158 ⁷		
		52.5 ³	0.6538 ¹¹	@ 15°		
			@ 15°			
			0.6541 ¹⁸			
			@ 15°			
			0.6678 ¹¹			
			@ 0°			
			0.6677 ¹⁸			
			@ 0°			
2,3-Dimethylbutane	-128.8	58.0	0.6620.	1.37499	$\frac{dD}{dt} = -0.0008692/^{\circ}\text{C.}$ (0° to 20°)	
	C-C-C-C C C	-128.6 ⁴³	57.82 to	0.6591 ³	1.3722 ³⁴	$\frac{dn}{dt} = -0.0005400/^{\circ}\text{C.}$ (15° to 25°)
		-129.0 ³	58.02 ¹	0.6612 ¹	@ 25°	
		-132.7 ³⁶	57.93 ³⁴	0.6615 ³⁴	1.37471 ⁴	
		-134.9 ¹	58.0 ³⁵	0.66166 ⁴³	1.37501 ^{1,33,34}	
		-135 ³⁶	58.02 ³⁶	0.6617 ³³	1.37509 ³⁵	
		-135.1 ¹⁰	58.05 to	0.6618 ⁶	1.3783 ³⁶	
			58.08 ¹⁰	0.668 ³⁵	1.3776 ³⁴	
			58.06 ¹²	0.6659 ¹⁰	@ 15°	
			58.1 ^{6,18,43}	@ 15°	1.38092 ⁷	
			58.2 ³	0.6665 ³⁴	@ 15°	
			@ 15°			
			0.6662 ¹⁸			
			@ 15°			
			0.6794 ¹⁸			
			@ 0°			
			0.6795 ¹⁰			
			@ 0°			

- (1) P. L. Craemer and M. J. Mulligan, *J. Am. Chem. Soc.* **58**, 373, 1936.
- (2) J. Timmermans, *Bull. soc. chim. Belg.* **43**, 626, 1934.
- (3) A. Maman, *Compt. rend.* **198**, 1323, 1934.
- (4) B. J. Mair, *J. Research Nat. Bur. Standards* **9**, No. 4, 457, 1932.
- (5) A. F. Shepard, A. L. Henne, and T. Midgley, *J. Am. Chem. Soc.* **53**, 1948, 1931.
- (6) G. Chavanne, *Bull. soc. chim. Belg.* **31**, 331, 1922.
- (7) T. M. Lowry, *J. Chem. Soc.* **105**, 91, 1914.
- (8) J. Timmermans and F. Martin, *J. chim. phys.* **25**, 411, 1928.
- (9) C. P. Smyth and E. W. Engel, *J. Am. Chem. Soc.* **51**, 2649, 1929.
- (10) Mlle. H. van Risseghem, *Bull. soc. chim. Belg.* **30**, 8, 1921.
- (11) Mlle. H. van Risseghem, *Bull. soc. chim. Belg.* **31**, 62, 1922.
- (12) J. Timmermans, *Bull. soc. chim. Belg.* **30**, 62, 1921.
- (13) J. Timmermans, *Proc. Sect. Sciences, Koninklijke Akad. Wetenschappen Amsterdam* **13**, 507, 1910.
- (14) J. Timmermans, *Bull. soc. chim. Belg.* **25**, 300, 1911.
- (15) R. W. Dornte and C. P. Smyth, *J. Am. Chem. Soc.* **52**, 3546, 1930.
- (16) C. R. Noller, *J. Am. Chem. Soc.* **51**, 594, 1929.
- (17) E. H. Leslie and A. R. Carr, *Ind. Eng. Chem.* **17**, 810, 1925.
- (18) G. Chavanne and H. van Risseghem, *Bull. soc. chim. Belg.* **31**, 87, 1922.
- (19) J. Timmermans, *Bull. soc. chim. Belg.* **31**, 389, 1922.
- (20) G. G. Brown and A. R. Carr, *Ind. Eng. Chem.* **18**, 718, 1926.
- (21) G. Chavanne and L. J. Simon, *Compt. rend.* **168**, 1324, 1919.
- (22) G. Chavanne and L. J. Simon, *Ann. chim. anal. chim. appl.* (2) **2**, 76, 1920.
- (23) T. W. Richards and J. W. Shipley, *J. Am. Chem. Soc.* **41**, 2002, 1919.
- (24) H. I. Waterman and W. J. C. De Kok, *Rec. trav. chim.* **52**, 251, 1933.
- (25) G. S. Parks, H. M. Huffman, and S. B. Thomas, *J. Am. Chem. Soc.* **52**, 1032, 1930.
- (26) K. W. F. Kohlrausch and F. Köppl, *Z. physik. Chem.* **26B**, 209, 1934.
- (27) G. W. Stewart, *Phys. Rev.* **32**, 153, 1928.
- (28) W. Fischer and W. Klemm, *Z. physik. Chem.* **147A**, 275, 1930.
- (29) C. Engler and B. Halmai, *Ber.* **43**, 397, 1910.
- (30) W. Huckel, Agnes Kraemer, and F. Thiele, *J. prakt. Chem.* **142**, 207, 1935.
- (32) J. H. Bruun and M. M. Hicks-Bruun, *J. Research Nat. Bur. Standards* **5**, 933, 1930.
- (33) H. Hoog, J. Smittenberg, G. H. Visser, R.51-S.2 11^e Congres Mondial du Pétrol, June, 1937.
- (34) J. H. Bruun, M. M. Hicks-Bruun, and W. B. M. Faulconer, *J. Am. Chem. Soc.* **59**, 2355-60, 1937.
- (35) J. H. Bruun and M. M. Hicks-Bruun, *J. Research Nat. Bur. Standards* **5**, 933-42, 1930.
- (36) B. J. Mair, Private Communication.
- (37) M. Wojciechowski, *J. Research Nat. Bur. Standards* **17**, 453, 1936.
- (38) H. R. Henze and C. M. Blair, *J. Am. Chem. Soc.* **53**, 3084, 1931.
- (39) Landolt and Jahn, *Z. physik. Chem.* **10**, 290, 1892.
- (40) G. S. Parks and H. M. Huffman, *Ind. Eng. Chem.* **23**, 1138, 1931.
- (41) G. B. Kistiakowski, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, *J. Am. Chem. Soc.* **58**, 137, 1936.
- (42) S. Young, *Sci. Proc. Roy. Dublin Soc.* **12**, 374, 1910.
- (43) J. Smittenberg and H. Hoog, Private Communication, June, 1938.
- (44) H. Hoog, J. Smittenberg, and R. A. Henkes, *J. Am. Chem. Soc.* **60**, 17, 1938.
- (45) R. P. Anderson and A. M. Erskine, *Ind. Eng. Chem.* **16**, 263, 1924.
- (46) A. v. Grosse, Unpublished data.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	n_D^{20}	n_D^{20}	Additional Data
n-Heptane	-90.5	98.4	0.68375	1.38774	$\frac{dD}{dt} = -0.0008411 \cdot$ $(1 + 0.0009019t)/^\circ\text{C.}$ (-90° to 90°)
C-C-C-C-C-C-C	-90.2	98.1 ^{1,11}	0.6208 ⁵	1.38510 ⁴	
	-90.0 ⁶	98.15 ¹⁸	@ 90°	@ 25°	
	-90.5 ^{3,15}	98.0 to 98.2 ¹⁸	0.6210 ¹²	1.38553 ¹⁰	$\frac{dn}{dt} = -0.00014/^\circ\text{C.}$ (15° to 25°)
		@ 762mm	@ 90°	@ 25°	
	-90.6 ¹⁵	98.35 ²	0.6300 ⁵	1.4058 ^{16,17}	
			@ 80°	@ 25°	
	-90.62 ^{4,67}	98.365 ⁵¹	0.6392 ⁵	1.3870 ³²	
		98.38 ^{4,10}	@ 70°	1.3872 ²⁴	
	-90.65 ¹⁰	98.39 ³⁵	0.6395 ¹²	1.3874 ^{1,4}	
	-90.9 ²⁸	98.4 ^{1,3,6,32}	@ 70°	1.38746 ²²	
		⁸ _{37,56,57}	0.6483 ⁵	1.38767 ¹³	
	-90.9 ⁸	98.45 ²⁶	@ 60°	1.38774 ¹³	
		98.52 ⁴⁹	0.6575 ⁵		
		98.57 ²²	@ 50°	1.38775 ¹⁰	
		98.65 ¹⁷	0.6577 ¹²		
		98.6 ¹⁶	@ 50°		
		98.4 ¹³	0.6667 ⁵	1.38777 ^{5,12}	
		86.6 ¹⁶	@ 40°		
		@ 525.8mm	0.66623 ²³	1.38939 ¹¹	
		79.5 ¹³	@ 40°	1.3895 ²³	
		@ 419.7mm	0.6755 ^{5,12}	1.4068 ^{16,17}	
		74.8 ¹⁶	@ 30°	1.39002 ²	
		@ 355.1mm	0.67522 ²	@ 15°	
		70.0 ¹³	@ 30°	1.4141 ⁵²	
		@ 301.4mm	0.67955 ³⁵	@ -25°	
		69.5 ¹³	@ 25°		
		@ 297.8mm	0.67963 ¹⁰		
		63.9 ¹⁶	@ 25°		
		@ 233.53mm	0.6838 ⁵		
		61.2 ¹³	0.68288 ²³		
		@ 220.0mm	0.6830 ³²		
		51.2 ¹³	0.6835 ³⁴		
		@ 150.0mm	0.6836 ³		
		51.2 ¹⁶	0.68378 ¹⁰		
		@ 149.19mm	0.6838 ^{13,22}		
		50.0 ¹³	0.6839 ²⁴		
		@ 141.1mm	0.684 ²⁸		
		39.5 ¹⁶	@ 92.30mm	0.6842 ⁵⁶	
		@ 92.30mm	0.68480 ¹¹		
		38.4 ¹³	@ 86.0mm	0.6881 ^{16,17}	
		@ 86.0mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-118.2 -118.2 ³⁴ -119.1 ^{3,28,33}	89.7 89.67 ⁵⁴ 89.7 to 89.8 ³² 90.0 ³ 90.1 ³⁴ 90.10 ⁵⁶ 90.5 ^{18,20}	0.6787₃ 0.6782 ³⁴ 0.6786 ³² 0.6789 ³ 0.6792 ⁵⁴ 0.6842 ^{18,20} @ 15°	1.3851 1.38498 ⁵⁶ 1.3850 ³² 1.38509 ^{3,5} 1.3852 ^{34,37}	$\frac{dD}{dt} = -0.00109/^{\circ}\text{C.}$ (15° to 20°)
3-Methylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-119.4 ⁶	91.8 89.3 to 89.4 ³² 91.8 ^{3,6,7,34} 90.5 ⁶ 98 to 99 ¹⁴ @ 748mm	0.6900 0.6868 ¹⁶ 0.687 ³ 0.6957 ³² 0.6909 ¹⁶ @ 15° 0.684 ¹⁴ @ 19°	1.38873 1.3884 ¹⁶ @ 20.4° 1.3885 ¹⁴ 1.3887 ^{16,34} 1.38873 ^{3,5} 1.3933 ³⁷ 1.3893 ¹⁴ @ 19°	$\frac{dD}{dt} = -0.000176/^{\circ}\text{C.}$ (15° to 20°)
d-3-Methylhexane		92 ²⁷	0.6876 ²⁷	1.3878 ²⁷	$[\alpha]_D^{25} = +3.67^{\circ}$ ⁹
l-3-Methylhexane					$[\alpha]_D^{25} = -7.75^{\circ}$ ⁸

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
3-Ethylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$	-118.8 ^{33,34}	93.3 93.3 ^{3,34} 95 to 98 ¹⁹ 94.0 ²¹ @ 773mm	0.6986₉ 0.6340 ⁵ @ 90° 0.6442 ⁵ @ 80° 0.6540 ⁵ @ 70° 0.6634 ⁵ @ 60° 0.6724 ⁵ @ 50° 0.6812 ⁵ @ 40° 0.6900 ⁵ @ 30° 0.6964 ²¹ @ 22.25° 0.6984 ^{3,34} 0.6988 ⁵ 0.7075 ⁵ @ 10° 0.7160 ⁵ @ 0° 0.7251 ⁵ @ -10° 0.7335 ⁵ @ -20° 0.7419 ⁵ @ -30° 0.7499 ⁵ @ -40° 0.7582 ⁵ @ -50° 0.7666 ⁵ @ -60° 0.7749 ⁵ @ -70° 0.7831 ⁵ @ -80° 0.7912 ⁵ @ -90° 0.7995 ⁵ @ -100° 0.8079 ⁵ @ -110°	1.39366 ^{3,5} 1.3937 ³⁴ 1.3940 ²¹ @ 18.7° 1.4014 ²¹ @ 3.6°	$\frac{dD}{dt} = -0.0008682 \cdot$ $(1 + 0.000826t)/^\circ\text{C.}$ $(-110^\circ \text{ to } 90^\circ)$ $= -0.0008825/^\circ\text{C.}$ $(10^\circ \text{ to } 30^\circ)$

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,2-Dimethylpentane $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array} $	-125.0 -125.0 -137 ^s	78.9 78.8 ^{1,2} 78.9 ¹ 79.3 ^s 80.81 ⁶	0.6736_s 0.6215 ^s @ 80° 0.6301 ^s @ 70° 0.6390 ^s @ 60° 0.6477 ^s @ 50° 0.6564 ^s @ 40° 0.6652 ^s @ 30° 0.6734 ^{15,24} 0.6737 ^{1,3} 0.6738 ^{9,5,8} 0.67388 ³ 0.6780 ^s @ 15° 0.6823 ^s @ 10° 0.6908 ^s @ 0° 0.6993 ^s @ -10° 0.7077 ^s @ -20° 0.7162 ^s @ -30° 0.7249 ^s @ -40° 0.7333 ^s @ -50° 0.7418 ^s @ -60° 0.7502 ^s @ -70°	1.3823_s 1.3820 ^s @ 20.5° 1.3822 ^{12,16} 1.38233 ^{1,2} 1.3828 ^s	$\frac{dD}{dt} = -0.0008517/^{\circ}\text{C.}$ (-120° to 80°)

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,2-Dimethylpentane (Continued)			0.7588 ^s @ -80° 0.7670 ^s @ -90° 0.7757 ^s @ -100° 0.7841 ^s @ -110° 0.7926 ^s @ -120°		
2,3-Dimethylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	Solidifies to a glass at low temper- atures	89.7 89.7 ¹ 89.8 ¹⁵ 90.0 ⁷ 91.6 to 91.7 ¹⁴	0.6944 ₂ 0.6888 ¹³ 0.6944 ¹⁵ 0.6950 ⁷ 0.6952 ^{1,4} 0.6991 ⁷ @ 15° 0.7117 ⁷ @ 0°	1.39200 1.3918 ^{7,42} 1.39201 $\left\{ \begin{array}{l} 1, \\ 2, \\ 3, \\ 5 \end{array} \right.$ 1.3921 ¹⁵	$\frac{dD}{dt} = -0.0008685/^{\circ}\text{C.}$ (0° to 20°)
1,2,3-Dimethylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$					$[\alpha]_D^{21} = -9.44^{\circ}$ ⁴⁰

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
2,4-Dimethylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-119.3 -119.2 ⁴ -119.4 ^{7,8} -120.6 ¹⁴ -123.4 ¹	80.8 78.9 to 80 ¹¹ 80.5 ⁸ 80.8 ^{1,4} 80.8 ⁷	0.6729_s 0.6723 ^{15,34} 0.67275 ⁵⁶ 0.6731 ^{7,8} ^{42,} ⁴³ 0.6742 ¹¹ 0.6745 ^{1,3} 0.6769 ^{7,8} @ 15° 0.6899 ⁷ @ 0°	1.38240 1.3814 ^{7,8} 1.3853 ⁵⁶ 1.3820 ^{15,37} 1.38233 ^{1,} ^{2,} ^{5,} ³⁸ 1.38256 ^{11,} ⁴⁶	$\frac{dD}{dt} = -0.0008433/^{\circ}\text{C.}$ (0° to 20°)
3,3-Dimethylpentane $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-134.9 -134.9 ^{14,33} -135.0 ^{1,3,37}	86.0 85.9 to 86.0 ¹² 86.0 ^{1,3} 86.1 ³⁴ 86.10 ³⁷ 86 to 86.5 ⁶	0.6931_s 0.6920 ^{15,34} 0.6926 ^{12,47} 0.69330 ⁵⁶ 0.6934 ^{1,3} 0.6952 ⁴¹	1.3910₂ 1.39079 ⁵⁶ 1.3908 ^{6,41} 1.3910 ^{14,47} 1.3911 ^{15,37} 1.39114 ^{1,} ^{2,} ^{3,} ^{5,} ³⁸	
2,2,3-Trimethylbutane $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-25.0 -25 ⁹ -25.0 ^{1,3,10,15,} ^{44,45} -25.4 ^{14,33} -26.3 ³⁷	80.8 80.75 ^{3,9,10,} ^{44,45,48} 80.9 ^{1,3,15} 81.0 ³⁷ 81.00 ⁵⁶	0.6901₄ 0.6898 ^{15,34} 0.6900 ^{1,3} 0.6905 ^{44,48} 0.6945 ^{3,9} @ 15° 0.7065 ^{3,9} @ 0° ^{44,48}	1.38943 1.38940 ^{1,} ^{2,} ^{3,} ^{5,} ³⁸ 1.38954 ⁵⁶ 1.3899 ^{15,37} 1.3923 ⁹ @ 15°	$\frac{dD}{dt} = -0.0008195/^{\circ}\text{C.}$ (0° to 20°)

- (1) G. Edgar, *Ind. Eng. Chem.* **19**, 145, 1927.
- (2) J. Timmermans and Mme. Hennaut-Roland, *J. chim. phys.* **32**, 501, 589, 1935.
- (3) G. Edgar and G. Calingaert, *J. Am. Chem. Soc.* **51**, 1540, 1929.
- (4) B. J. Mair, *J. Research Nat. Bur. Standards* **9**, 457, 1936.
- (5) C. P. Smyth and W. N. Stoops, *J. Am. Chem. Soc.* **50**, 1883, 1928.
- (6) J. Timmermans, *Bull. soc. chim. Belg.* **30**, 62, 1921.
- (7) J. Timmermans, *Bull. soc. chim. Belg.* **36**, 502, 1927.
- (8) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 77, 1931.
- (9) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 761, 1931.
- (10) A. F. Shepard, A. L. Henne, T. Midgley, Jr., *J. Am. Chem. Soc.* **53**, 1948, 1931.
- (11) A. Karvonen, *Suomen Kemistilehti* **3**, 101, 1930 (in German).
- (12) R. W. Dornte and C. P. Smyth, *J. Am. Chem. Soc.* **52**, 3546, 1930.
- (13) C. P. Smyth and E. W. Engel, *J. Am. Chem. Soc.* **51**, 2646, 1929.
- (14) J. Tafel and W. Jurgens, *Ber.* **42**, 2548, 1909.
- (15) E. H. Leslie and A. R. Carr, *Ind. Eng. Chem.* **17**, 810, 1925.
- (16) H. de Graef, *Bull. soc. chim. Belg.* **34**, 427, 1925.
- (17) G. Brown and A. R. Carr, *Ind. Eng. Chem.* **18**, 718, 1926.
- (18) G. Chavanne and L. J. Simon, *Compt. rend.* **168**, 1324, 1919.
- (19) R. Binaghi, *Gazz. chim. ital.* **52**, II, 132, 1922.
- (20) G. Chavanne and L. J. Simon, *Ann. chim. anal. chim. appl.* [2] **2**, 76, 1920.
- (21) J. Böeseken and A. J. Wildschut, *Rec. trav. chim.* **51**, 168, 1932.
- (22) J. H. Mathews, *J. Am. Chem. Soc.* **48**, 562, 1926.
- (23) E. Kremers, *J. Am. Pharm. Assoc.* **9**, 860, 1920.
- (24) H. I. Waterman and W. J. C. DeKok, *Rec. trav. chim.* **52**, 298, 1933.
- (25) G. S. Parks, H. M. Huffman, and S. B. Thomas, *J. Am. Chem. Soc.* **52**, 1032, 1930.
- (26) K. W. F. Kohlrausch and F. Koppl, *Z. physik. Chem.* **26B**, 209, 1934.
- (27) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **95**, 1, 1932.
- (28) G. W. Stewart, *Phys. Rev.* **32**, 153, 1928.
- (29) W. Fischer and W. Klemm, *Z. physik. Chem.* **147A**, 275, 1930.
- (30) J. v. Braun and W. Sobecki, *Ber.* **44**, 1918, 1911.
- (31) C. Engler and B. Halmai, *Ber.* **43**, 397, 1910.
- (32) F. J. Soday and C. E. Boord, *J. Am. Chem. Soc.* **55**, 3293, 1933.
- (33) H. M. Huffman, G. S. Parks, and S. B. Thomas, *J. Am. Chem. Soc.* **52**, 3241, 1930.
- (34) H. Hoog, J. Smittenberg, and G. H. Visser, R.51-S.2 11^e *Congres Mondial du Petrol. Paris*, June, 1937.
- (35) W. B. Kay, *Preprint Petrol. Div. Amer. Chem. Soc. Sept.*, 1937.
- (36) A. D. Petrov and D. N. Andreev, *Org. Chem. Ind. (U. S. S. R.)* **2**, 455, 1936.
- (37) J. Smittenberg, H. Hoog, and R. A. Henkes, *J. Am. Chem. Soc.* **60**, 17, 1938.
- (38) C. P. Smyth and W. N. Stoops, *J. Am. Chem. Soc.* **50**, 1883, 1928.
- (39) J. Timmermans, *Bull. soc. chim. Belg.* **36**, 502, 1927.
- (40) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 405, 1931.
- (41) C. R. Noller, *J. Am. Chem. Soc.* **51**, 594, 1929.
- (42) G. Chavanne and H. de Graef, *Bull. soc. chim. Belg.* **33**, 366, 1924.
- (43) H. de Graef, *Bull. soc. chim. Belg.* **34**, 427, 1925.
- (44) G. Chavanne and B. Lejeune, *Bull. soc. chim. Belg.* **31**, 98, 1922.
- (45) J. Timmermans, *Bull. soc. chim. Belg.* **31**, 389, 1922.
- (46) H. I. Waterman and W. J. C. DeKok, *Rec. trav. chim.* **52**, 234, 1933.
- (47) I. Schurman and C. E. Boord, *J. Am. Chem. Soc.* **55**, 4930, 1933.
- (48) G. Chavanne and Mlle. H. van Risseghem, *Bull. soc. chim. Belg.* **31**, 87, 1922.
- (49) J. A. Beattie and W. C. Kay, *J. Am. Chem. Soc.* **59**, 1586, 1937.
- (50) M. Wojciechowski, *J. Research Nat. Bur. Standards* **17**, 453, 1936.
- (51) A. v. Grosse, *J. Am. Chem. Soc.* **59**, 2739, 1937.

- (53) B. J. Mair, Private Communication.
- (54) J. H. Bruun and M. M. Hicks, J. Research Nat. Bur. Standards, **10**, 472, 1933.
- (55) E. R. Smith and H. Matheson, J. Research Nat. Bur. Standards, **20**, 641, 1938.
- (56) J. Smittenberg and H. Hoog, Private Communication, June 1938.
- (57) J. H. Bruun and M. M. Hicks-Bruun, J. Research Nat. Bur. Standards **8**, 534, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Octane	-56.8	125.6	0.70283	1.39764	$\frac{dD}{dt} = -0.0008096 \cdot$ $(1+0.000857t)/^{\circ}\text{C.}$ (-50° to +110°)
C-C-C-C-C-C-C-C	-57.5 ²⁹	123.5 ⁸⁴	0.6257 ²²	1.38567 ²	
	-57 ⁵	124 to 126 ³⁴	@ 110°	@ 45.3°	
	-56.9 ^{2,44}	124.3 ^{24,28}	0.6437 ²²	1.3975 ³⁷	$\frac{dD}{dt} = -0.0008268/^{\circ}\text{C.}$ (10° to 30°)
	-56.82 ¹	124.5 ²⁷	@ 90°	@ 25°	
	-56.8 ⁴⁶	125 ^{20,35,36}	0.6610 ²⁰	1.4037 ^{24,66}	$\frac{dn}{dt} = -0.0004732/^{\circ}\text{C.}$ (15° to 50°)
		125 to 125.6 ²⁰	@ 70°	@ 25°	
		125 to 127 ³²	0.6781 ²²	1.39534 ²	
		125.3 to 126 ⁷²	@ 50°	@ 25°	
		125.4 ⁸¹	0.6945 ²²	1.3961 ⁴⁰	
			@ 30°	1.39750 ⁷²	
		125.59 ^{1,2}	0.69430 ⁵	1.39755 ²²	
		125.6 ^{30,44}	@ 30°	1.39760 ²	
		125.76 ⁴⁴	0.69882 ²	1.39770 ⁴⁴	
		125.8 ^{4,5,28, 43,73}	@ 25°	1.3979 ⁴⁶	
			0.6987 ³⁴	1.39883 ²⁰	
		111.7 ²⁴	@ 25°		
		@ 525.8mm	0.7058 ⁸²	1.4059 ²⁴	
		99.2 ²⁴	0.6984 ¹³	1.40007 ⁸	
		@ 355.1mm	0.702 ³³	@ 15°	
		86.6 ²⁴	0.70232 ⁸	1.4007 ⁸⁴	
		@ 233.53mm	0.7025 ⁷⁸	@ 15.1°	
		74.2 ²⁴	0.7026 ⁸¹		
		@ 149.19mm	0.70279 ²		
		61.8 ²⁴	0.70280 ⁴⁴		
		@ 92.30mm	0.70347 ⁸⁴		
			0.7038 ²⁴		
			0.7044 ⁴⁰		
			0.7046 ²⁰		
			0.7134 ¹⁸		
			0.7123 ¹⁴		
			D ₁₈ ¹⁸		
			0.7083 ³⁶		
			@ 12°		
			0.7114 ²²		
			@ 10°		
			0.71042 ¹⁰		
			@ 10°		
			0.7185 ⁷⁸		
			@ 0°		

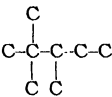
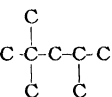
Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Octane—(Continued)			0.7192 ⁸⁰ @ 0° 0.7275 ²² @ -10° 0.7432 ²² @ -30° 0.7588 ²² @ -50°		
2-Methylheptane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-111.3 ⁷⁵	117.2 116 ¹⁴ @ 761mm 116 ²⁷ 117.2 ⁷⁵ 118 ¹⁵ 117.4 ¹³ @ 759mm	0.6978 0.6971 ⁷⁵ 0.6984 ^{13,41} 0.7131 ¹⁶ 0.7035 ¹⁴ D ₁₅ ¹⁵ 0.7025 ¹³ @ 15°	1.3947 1.3919 ⁷⁵ 1.3935 ¹³ 1.39531 ⁴⁴ 1.3987 ¹⁵	$\frac{dD}{dt} = -0.000952/^\circ\text{C.}$ (15° to 20°)
3-Methylheptane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	Glassy at low tempera- tures ⁴⁶	119 117.5 to 119.5 ⁸ 118.95 to 119.05 ⁷ 119.05 ⁴⁴ 119.1 ⁴⁶ 123 to 124 ⁹ @ 750mm	0.7057. 0.7045 ⁴³ 0.70584 ⁴⁴ 0.7059 ⁴⁶ 0.702 ⁹ @ 19° 0.7095 ⁷ @ 15° 0.7219 ⁷ @ 0°	1.3983 1.4022 ¹² @ 25° 1.4011 ⁷ @ 25° 1.398 ⁴⁶ 1.3980 ²⁵ 1.39829 ⁴³ 1.3986 ⁹ @ 19°	$\frac{dD}{dt} = -0.0008022/^\circ\text{C.}$ (0° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{25}	Additional Data
d-3-Methylheptane		116 to 118 ¹²	0.710 ¹² @ 22°		$[\alpha]_D^{25} = +4.45^\circ$ ^{11,12} $[\alpha]_D^{25} = +3.15^\circ$ ¹²
l-3-Methylheptane		115 ⁷⁰			$[M]_D^{25} = -11.4^\circ$ ⁷⁰
4-Methylheptane <chem>CCCC(C)CC</chem>		118.0 117 to 119 ⁶ 117.5 ²³ 117.9 to 118.1 ²⁶ 118 ^{18,44}	0.7163 0.7036 ⁴³ 0.7165 ^{16,26} 0.7166 ²⁶ $D_{12.8}^{20}$ 0.7217 ¹⁸ (@ 15°)	1.39814 1.3978 ¹⁸ @ 25° 1.40063 ^{6,26} @ 25° ²⁶ 1.39814 ⁴³ 1.4039 ¹⁸	$\frac{dD}{dt} = -0.0005/^\circ\text{C.}$ (20° to 25°)
3-Ethylhexane <chem>CCC(CC)CC</chem>		118.9 118.8 to 119 ⁵⁸ @ 766mm 118.6 ⁶⁶ 118.8 to 119 ⁶⁴ 118.9 ⁷⁴	0.7122 0.7121 ⁶⁶ 0.7124 ⁴³ 0.7127 ⁷⁴ 0.7175 ⁶⁵ D_{18}^{15}	1.4020 1.3993 ⁶⁵ @ 25° 1.40128 ⁴³ 1.4023 ⁶⁵	$\frac{dD}{dt} = -0.00094/^\circ\text{C.}$ (15° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
2,2-Dimethylhexane $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		107.0 106 to 107 ¹⁰ 106.8 to 107.1 ³⁸	0.6956 0.6953 ³⁸ 0.6967 ¹⁰	1.3930 1.3930 ³⁸ 1.3931 ¹⁰	
2,3-Dimethylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	Glassy at low temperatures ⁴⁶	115.7 115.7 ⁴⁴ 113.8 to 114 ¹⁶ @ 758mm	0.71240 0.71234 ⁴⁴ 0.7139 ⁴³ 0.72416 ¹⁶ D_{18}^{18} 0.7252 ¹⁶ @ 15°	1.40117 1.4075 ¹⁶ @ 25° 1.40069 ⁴³ 1.40136 ⁴⁴ 1.4015 ⁴⁶	$\frac{dD}{dt} = -0.00226/^\circ\text{C.}$ (15° to 20°)
l-2,3-Dimethylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		113 to 114 ³⁹			$[\alpha]_D^{25} = -0.92^\circ$ ³⁹
2,4-Dimethylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		109 109.8 to 110 ¹⁹ @ 762mm 108.4 to 110 ⁴⁵	0.6993 0.6993 ⁴³ 0.698 ⁹ @ 19° 0.7083 ¹⁹ D_{18}^{18}	1.39582 1.3986 ¹⁹ @ 25° 1.3950 ⁴⁵ 1.39584 ⁴³ 1.3963 ⁹ @ 19°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
d-2,4-Dimethylhexane		111 to 112 ³¹	0.696 ³¹ @ 30°		[α] _D ³⁰ = +2.99° ³¹
l-2,4-Dimethylhexane		110 to 111 ¹¹	0.703 ¹¹ @ 21°		[α] _D ²¹ = -10.85° ¹¹
2,5-Dimethylhexane Diisobutyl $ \begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array} $	-90.7 -94.0 ⁴⁶ -90.7 ³	109.3 108.4 ²⁷ 108.5 to 109.5 ²⁰ 109.2 ^{21,73} 109.25 ⁴⁴ 109.3 ⁴⁶ 109.4 ³ 110 ³⁸ @ 765mm 106.5 to 108 ⁴² @ 750mm	0.6949 ₉ 0.6622 ²⁷ @ 61.2° 0.68851 ³ @ 30° 0.69378 ³ 0.6943 ¹⁰ 0.6951 ²¹ 0.6970 ⁴³ 0.70198 ³ @ 10° 0.71020 ³ @ 0° ⁷³	1.39295 1.39288 ⁴³ 1.39297 ³ 1.3930 ⁴⁶ 1.3932 ²¹ 1.39501 ²⁰ @ 15° 1.3954 ²¹ @ 15°	$\frac{dD}{dt} = -0.0007350/^{\circ}\text{C.}$ (0° to 30°) $\frac{dn}{dt} = -0.00041/^{\circ}\text{C.}$ (15° to 20°)
3,3-Dimethylhexane $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array} $		111 110.7 to 111.2 ³⁸ 111.0 to 112 ¹⁰	0.7086 0.7078 ³⁸ 0.7116 ¹⁰	1.3993 1.3992 ³⁸ 1.3998 ¹⁰	

Name and Carbon Skeleton	M. P., °C	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4-Dimethylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	Glassy at low tempera- tures ⁴⁶	117.8 115 to 116 ²⁰ 116 to 117 ⁸ 117.8 ⁶⁶ 117.85 ⁴⁴ 118.7 ⁶⁸ 116 to 116.2 ⁶⁶ @ 750 mm	0.7195 , 0.7165 ⁶⁶ 0.7193 ⁶⁶ 0.71951 ⁴⁴ 0.7216 ⁴³	1.4045 1.4038 ⁶⁶ @ 25.2° 1.4036 ⁴⁴ 1.4044 ⁶⁶ 1.40470 ⁴³	
2-Methyl-3-ethyl- pentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$		114 114 ^{57, 66}	0.7182 0.7030 ⁶⁶ 0.7182 ⁴¹ 0.7084 ⁶⁷ @ 15°	1.4033 1.3996 ⁶⁷ @ 25° 1.4026 ⁶⁶ 1.40353 ⁴³	
3-Methyl-3-ethyl- pentane $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$	-90.9 ⁴⁶	118.4 118.35 ⁴⁴ 118.4 ⁴⁶ 118.5 ⁶⁶ 118.5 to 118.9 @ 750mm ⁹	0.7256 0.7242 ⁴⁴ 0.7270 ⁶⁶ 0.713 ⁹ @ 19°	1.4081 1.4081 ^{46, 66} 1.4026 ⁹ @ 19°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,2,3-Trimethylpentane		110.3	0.7162	1.4032	
	Glassy at low tempera- tures ⁴⁶	110 ⁶⁵ 110.05 ⁴⁴ 110.2 ⁴⁸ 110.3 ⁶⁶ 110.8 to 111.4 @ 765mm ⁶¹	0.71613 ⁴⁴ 0.7162 ⁶⁶ 0.7173 ⁴⁸ 0.721 ⁶⁶ @ 15.5°	1.4030 ⁴⁸ 1.40302 ⁴⁴ 1.4032 ⁴⁸ 1.4033 ⁶⁶ 1.4056 ⁶⁵	
2,2,4-Trimethylpentane	-107.45	99.3	0.69194	1.39157	$\frac{dD}{dt} = -0.0008299 \cdot$ $(1 + 0.000736t)/^{\circ}\text{C.}$ $(-100^{\circ} \text{ to } 100^{\circ})$ $= -0.0008421/^{\circ}\text{C.}$ $(10^{\circ} \text{ to } 30^{\circ})$
	-107.8 ²⁹ -107.7 ⁵⁹ -107.6 ⁶⁷ -107.41 ⁴⁷ -107.4 ⁶⁶ -107.45 ⁸⁵	99.2 ⁷⁹ 99.234 ⁷⁸ 99.3 ^{48, 49, 50, 66} 99.25 to 99.35 ⁸² 99.3 ⁸⁶	0.6206 ⁵² @ 100° 0.6303 ⁵² @ 90° 0.6402 ⁵² @ 80° 0.6498 ⁵² @ 70° 0.6587 ⁵² @ 60° 0.6680 ⁷⁰ @ 50° 0.6676 ⁵² @ 50° 0.6756 ⁵² @ 40° 0.6837 ⁵² @ 30° 0.6918 ^{49, 52} 0.6919 ⁸² 0.69196 ⁴⁴ 0.6920 ⁶⁶ 0.6914 ⁴⁹ D ₂₀ ²⁰ 0.6998 ⁵² @ 10°	1.3912 ⁵⁹ 1.3915 ⁶⁶ 1.39151 ⁴⁴ 1.3916 ⁴⁸ 1.39162 ⁸² 1.39163 ⁵² 1.3917 ⁷⁹ 1.3921 ⁴⁹ 1.3916 ⁸⁶	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,2,4-Trimethylpentane (Continued)			0.7078 ⁵² @ 0° 0.7160 ⁵² @ -10° 0.7242 ⁵² @ -20° 0.7326 ⁵² @ -30° 0.7407 ⁵² @ -40° 0.7488 ⁵² @ -50° 0.7569 ⁵² @ -60° 0.7652 ⁵² @ -70° 0.7733 ⁵² @ -80° 0.7814 ⁵² @ -90° 0.7897 ⁵² @ -100°		
2,3,3-Trimethylpentane $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array} $	-109.3 ⁴⁴	114.2 113.6 ⁴⁸ 114.8 ⁴⁴	0.7258 0.7257 ⁴⁴ 0.7258 ⁴⁸	1.4075 1.4074 ⁴⁸ 1.4076 ⁴⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3,4-Trimethylpentane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \end{array}$	Glassy at low tempera- tures ⁴⁴	113.4 112.8 ⁴⁸ 114.0 ⁴⁴	0.7195 0.7192 ⁴⁴ 0.7197 ⁴⁸	1.4046 1.4045 ⁴⁸ 1.4047 ⁴⁴	
2,2,3,3-Tetramethyl- butane $\begin{array}{c} \text{C} \quad \text{C} \\ \quad \\ \text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	101 100.7 to 101.4 ⁶⁰ 101 ⁵⁰ 101.5 ⁴⁶ 103.5 ⁸³ 104 ^{51,83}	106.5 106.5 ^{83,86} 106.8 ⁸³	0.7219 ⁷⁷ (Extra- polated, liquid)		

- (1) B. J. Mair, J. Research Nat. Bur. Standards, **9**, 457, 1932.
- (2) A. F. Shepard, O. L. Henne, and T. Midgley, Jr., J. Am. Chem. Soc. **53**, 1948, 1931.
- (3) J. Timmermans and Hennaut-Roland, J. chim. phys. **29**, 592, 1932.
- (4) G. Chavanne and L. J. Simon, Compt. rend. **168**, 1324, 1919.
- (5) J. Timmermans and F. Martin, J. chim. phys. **25**, 411, 1928.
- (6) J. H. Mathews, J. Am. Chem. Soc. **48**, 562, 1926.
- (7) H. van Risseghem, Bull. soc. chim. Belg. **39**, 369, 1930.
- (8) J. Timmermans, Bull. soc. chim. Belg. **30**, 62, 1921.
- (9) J. Tafel and W. Jurgens, Ber. **42**, 4548, 1909.
- (10) C. R. Noller, J. Am. Chem. Soc. **51**, 594, 1929.
- (11) P. A. Levene and R. E. Marker, J. Biol. Chem. **91**, 405, 1931.
- (12) P. A. Levene and R. E. Marker, J. Biol. Chem. **91**, 761, 1931.
- (13) N. Kishner, J. Russ. Phys. Chem. Soc. **45**, 980, 1913.
- (14) L. Clarke, J. Am. Chem. Soc. **31**, 113, 1909.
- (15) A. Buelens, Rec. trav. chim. **28**, 118, 1909.
- (16) L. Clarke, J. Am. Chem. Soc. **33**, 529, 1911.
- (17) L. Clarke, J. Am. Chem. Soc. **31**, 560, 1909.
- (18) L. Clarke, Ber. **40**, 354, 1907.
- (19) L. Clarke, J. Am. Chem. Soc. **30**, 1147, 1908.
- (20) K. v. Auwers and F. Eisenlohr, Z. physik. Chem. **83**, 429, 1913.
- (21) H. De Graef, Bull. soc. chim. Belg. **40**, 315, 1931.
- (22) R. W. Dornte and C. P. Smyth, J. Am. Chem. Soc. **52**, 3546, 1930.
- (23) P. A. Levene and R. E. Marker, J. Biol. Chem. **106**, 173, 1934.
- (24) E. H. Leslie and A. R. Carr, Ind. Eng. Chem. **17**, 810, 1925.
- (25) P. A. Levene and F. A. Taylor, J. Biol. Chem. **59**, 351, 1922.
- (26) G. G. Brown and A. R. Carr, Ind. Eng. Chem. **18**, 718, 1926.
- (27) T. W. Richards, C. L. Speyers and E. K. Carver, J. Am. Chem. Soc. **46**, 1196, 1924.
- (28) G. Chavanne and L. J. Simon, Ann. chim. anal. chim. appl. [2] **2**, 76, 1920.
- (29) G. S. Parks, H. M. Huffman, and S. B. Thomas, J. Am. Chem. Soc. **52**, 1032, 1930.
- (30) K. W. F. Kohlrausch and F. Köppl, Z. physik. Chem. **26B**, 209, 1934.
- (31) P. A. Levene and R. E. Marker, J. Biol. Chem. **95**, 1, 1932.
- (32) P. Schorigin, W. Issaguljang, and A. Gussewa, Ber. **66**, 1426, 1933.
- (33) G. W. Stewart, Phys. Rev. **32**, 153, 1928.
- (34) W. Fischer and W. Klemm, Z. physik. Chem. **147A**, 275, 1930.
- (35) W. J. C. Dyke and W. J. Jones, J. Chem. Soc. 1930, 2426.
- (36) C. Engler and B. Halmai, Ber. **43**, 397, 1910.
- (37) B. Wojcik and H. Adkins, J. Am. Chem. Soc. **55**, 1293, 1933.
- (38) I. Schurman and C. E. Boord, J. Am. Chem. Soc. **55**, 4930, 1933.
- (39) P. A. Levene and R. E. Marker, J. Biol. Chem. **100**, 769, 1933.
- (40) A. Maman, Compt. rend. **205**, 319, 1937.
- (41) J. Smittenberg and H. Hoog, Private Communication; June, 1938.
- (42) M. Tuot, Compt. rend. **197**, 1434, 1933.
- (43) J. Smittenberg, H. Hoog, and R. A. Henkes, J. Am. Chem. Soc. **60**, 17, 1938.
- (44) J. H. Bruun and M. Hicks-Bruun, J. Research Nat. Bur. Standards **9**, 269, 1932.
- (45) K. C. Laughlin and F. C. Whitmore, J. Am. Chem. Soc. **55**, 2607, 1933.
- (46) G. Edgar, Ind. Eng. Chem. **19**, 145, 1927.
- (47) F. C. Whitmore, C. F. Stehman, and J. H. Herndon, J. Am. Chem. Soc. **55**, 3807, 1933.
- (48) G. S. Parks and H. M. Huffman, Ind. and Eng. Chem. **23**, 1138, 1931.
- (49) C. P. Smyth and W. N. Stoops, J. Am. Chem. Soc. **50**, 1883, 1928.
- (50) A. Richards, Ann. chim. phys. **21**, 323, 1910.
- (51) N. Kishner, J. Russ. Phys. Chem. Soc. **45**, 980, 1913.
- (52) Wendell, Am. Chem. J. **26**, 318, 1901.

- (57) L. Clarke, J. Am. Chem. Soc. **30**, 575, 1908.
- (58) J. Timmermans, Bull. soc. chim. Belg. **36**, 502, 1927.
- (59) C. O. Langberg, J. D. Pickens, M. R. Fenske, and F. C. Whitmore, J. Am. Chem. Soc. **54**, 3706, 1932.
- (60) D. T. Flood and G. Calingaert, J. Am. Chem. Soc. **56**, 1211, 1934.
- (61) T. W. Richards and J. W. Shipley, J. Am. Chem. Soc. **41**, 2002, 1919.
- (64) N. D. Zelinsky, B. A. Kasansky, and A. F. Plate, Ber. **68**, 1869, 1935.
- (65) S. F. Birch, F. B. Pim, and T. Tait, J. Soc. Chem. Ind. **55**, 335-337T, 1936.
- (66) G. Calingaert and T. A. G. Edgar, J. Am. Chem. Soc. **51**, 1546, 1926.
- (67) J. Smittenberg, H. Hoog, and R. A. Henkes, Preprint Petrol. Div., Rochester Meeting, Am. Chem. Soc., Sept., 1937.
- (68) A. v. Grosse and J. Mavity, unpublished data.
- (69) M. Wojciechowski, J. Research Nat. Bur. Standards **17**, 453, 1936.
- (70) P. A. Levene, A. A. Rothen, G. M. Meyer, and M. Kuna, J. Biol. Chem. **115**, 401-13, 1936.
- (71) B. J. Mair, Private Communication.
- (72) W. J. C. de Kok, Rec. trav. chim. **53**, 727, 1934.
- (73) S. Young, Sci. Proc. Roy. Soc. Dublin, **12**, 385, 1909 and 1910.
- (74) L. Clark and E. I. Riegel, J. Am. Chem. Soc. **34**, 678, 1912.
- (75) R. T. Leslie, J. Research Nat. Bur. Standards **10**, 609, 1933.
- (77) G. Calingaert, Private Communication.
- (78) E. P. Smith and Matheson, J. Research Nat. Bur. Standards **20**, 641, 1938.
- (79) E. B. Evans, J. Inst. Petr. Tech. **24**, 321-337, 1938.
- (80) G. Chavanne and G. Tock, Bull. soc. chim. Belg. **41**, 630, 1932.
- (81) E. C. Bromiley and D. Quiggle, Ind. Eng. Chem. **25**, 1136, 1933.
- (82) R. E. Cornish, R. C. Archibald, E. A. Murphy, and H. M. Evans, Ind. Eng. Chem. **26**, 397, 1938.
- (83) V. Henry, Compt. rend. **142**, 1075, 1906.
- (84) H. Landolt and H. Jahn, Z. physik. Chem. **10**, 289, 1892.
- (85) S. Lawroski, Private Communication, Petroleum Laboratory, Penn. State College, Oct. 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Nonane	-53.69	150.71	0.71790	1.40562	$\frac{dD}{dt} = -0.0007847 \cdot$ $(1+0.000668t)/^{\circ}\text{C.}$ $(-50^{\circ} \text{ to } 150^{\circ})$ $= -0.0007952/^{\circ}\text{C.}$ $(10^{\circ} \text{ to } 30^{\circ})$
C-C-C-C-C-C-C-C-C	-53.7 ²²	150.20 to	0.6096 ⁹	1.4025 ²	
	-53.70 ³	150.90 ¹⁰	@ 150°	@ 25°	
	-53.68 ⁴	150.4 to	0.6272 ⁹	1.40318 ³	
		150.6 ²	@ 130°	@ 25°	
		150.5 to	0.6445 ⁹	1.40340 ⁴	$\frac{dn}{dt} = -0.000468/^{\circ}\text{C.}$ $(20^{\circ} \text{ to } 25^{\circ})$
		150.7 ¹¹	@ 110°	@ 25°	
		150.55 ³⁸	0.6619 ⁹	1.40550 ⁹	
		150.7 ²²	@ 90°	1.40561 ⁴⁰	
		150.71 ⁴	0.6776 ⁹	1.40563 ⁴	
		150.72 ³	@ 70°	1.4060 ²³	
		150 to	0.6945 ⁹	1.41340 ⁴³	
		151.5 ⁴³	@ 50°	@ 17.2°	
			0.7105 ⁹		
			@ 30°		
			0.71398 ⁴		
			@ 25°		
			0.71770 ³⁷		
			0.7176 ^{38, 41}		
			0.71780 ⁴		
			0.71808 ⁴⁰		
			0.7219 ²		
			D ₁₅ ¹⁵		
			0.7260 ⁹		
			@ 10°		
			0.7417 ⁹		
			@ -10°		
			0.7573 ⁹		
			@ -30°		
			0.7726 ⁹		
			@ -50°		

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
2-Methyloctane	-80.3	143.0	0.7121	1.40288	
Isononane	-80.47	142.8 ¹⁸	0.7107 ¹⁸	1.40285 ¹⁸	
	to	143.255 ²⁰	0.7134 ²⁰	1.4032 ²⁰	
<chem>CCCCC(C)CC</chem>	-80.51 ²⁰				
	-80 ¹⁸				
3-Methyloctane					
<chem>CCCC(C)CCC</chem>	-107.95	144.18 ²⁰	0.7210 ²⁰	1.4065 ²⁰	
	to				
	-108.05 ²⁰				
d-3-Methyloctane		143	0.723		$[\alpha]_D^{28} = +5.27^\circ$ ⁸
		142.4 to	0.725 ⁸		$[\alpha]_D^{17} = +9.38^\circ$ ⁶
		143.3 ⁸	@ 23°		
		143 to 144 ⁸	0.7206 ⁶		
			@ 18°		
l-3-Methyloctane					$[\alpha]_D^{17} = -8.5^\circ$ ⁷
		143 ⁷	0.714 ⁷	1.4052 ⁷	
			@ 27°	@ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methyloctane	-113.3 (?)	142.46	0.7222	1.4069	
<chem>CCCCC(C)CC</chem>	-113.28 to -113.32 ²¹ -119.08 to -119.18 ²⁰	142.433 ²⁰ 142.485 ²¹ 141.7 to 141.9 @ 771mm ²³	0.7245 ²⁰ 0.7199 ²¹ 0.7320 ²³ D ₁₅ ¹⁵	1.4050 ¹ 1.4061 ²¹ 1.4078 ²⁰	
1-4-Methyloctane		141 ⁷	0.716 ⁷ (@) 19°		[α] _D ¹⁹ = -1.06° ⁷
3-Ethylheptane		143.1 ¹⁶	0.7260 ¹⁶		
<chem>CCCCC(CC)CC</chem>					
4-Ethylheptane		138 to 139 ⁵	0.7407 ⁵	1.41564 ⁵	
<chem>CCCCC(CC)CC</chem>					

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
2,3-Dimethylheptane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		140.6 ¹⁶	0.7235 ¹⁶	1.4085 ¹⁶	
2,4-Dimethylheptane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		133 133.0 ³⁹ 132.9 to 133 ²⁵ @ 752mm 130 ²⁴ @ 749mm	0.7158 0.7158 ³⁹ 0.7128 ²⁴ D_{20}^{20} 0.7206 ²⁵ D_{15}^{15}	1.4023 1.4014 ²⁵ @ 25° 1.4023 ²⁴	$\frac{dD}{dt} = -0.00084/^\circ\text{C.}$ (15° to 20°)
l-2,4-Dimethylheptane		131 to 131.5 ³¹	0.733 ³¹ @ 22°		$[\alpha]_D^{25} = -3.51^\circ$ ³¹
2,5-Dimethylheptane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		135.8 135.6 to 135.9 ²⁵ 135.8 ³⁹ 133 ²⁴ @ 741mm	0.7147 0.7147 ²⁴ D_{20}^{20} 0.7190 ²⁵ D_{15}^{15}	1.4033 1.4033 ²⁴ 1.4020 ²⁵ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
d-2,5-Dimethylheptane		135 133 to 137 ⁸ 134 ³² 135 ²⁷	0.715 0.713 ³² @ 27° 0.715 ²⁷ 0.7154 ⁸ @ 16°		[α] _D ²⁷ = +4.19° ³² [α] _D ²² = +3.33° ²⁷ [α] _D ¹⁶ = +9.48° ⁸
2,6-Dimethylheptane $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$		134 134 to 135 ^{29,30} 133 ²⁸ @ 756mm 133 to 134 ²⁸ @ 740mm	0.7049 0.7018 ^{29,30} 0.7129 ²⁸ 0.7209 ²⁸ @ 11° 0.7298 ²⁸ @ 0°	1.3974 1.3955 ^{29,30} 1.4028 ²⁸ 1.40672 ²⁸ @ 10.5°	$\frac{dD}{dt} = -0.00127/^\circ\text{C.}$ (0° to 20°)
3,3-Dimethylheptane $\begin{array}{ccccccc} & & \text{C} & & & & \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \end{array}$		137 to 138 ²⁸	0.7304 ²⁸	1.4095 ²⁸	
2,2,5-Trimethylhexane $\begin{array}{ccccccc} & & \text{C} & & & & \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$	-106.35 ⁴²	126 ³³ @ 764mm 121 to 123 ²⁸ 124.09 ⁴³	0.7075, 0.70755 ⁴² 0.7181 ³³ 0.7191 ²⁸	1.3966 1.39967 ⁴² 1.3987 ³³ 1.3997 ²⁸	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_{20}^{20}	n_D^{20}	Additional Data
2,3,5-Trimethylhexane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \end{array}$		130 130 ³⁴ 129 ²⁴ @ 738mm	0.7171 ²⁴ D_{20}^{20}	1.4051 ²⁴	
3,3-Diethylpentane $\begin{array}{c} \text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$	-40 to -42 ³⁵	139.2 ³⁵ 138.1 ³⁵ @ 740mm 45 to 47.5 ³⁵ @ 19mm	0.75255 0.73758 ³⁵ @ 40° 0.74868 ³⁵ @ 25° 0.75222 ³⁵ 0.75651 ³⁵ @ 15°	1.42057 ³⁵ @ 18°	$\frac{dD}{dt} = -0.0008518 \cdot$ $(1 - 0.0040t)/^\circ\text{C}.$ (15° to 40°)
2,3-Dimethyl-3-ethylpentane $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$		141.6 ¹⁶		1.4186 ¹⁶	
2,2,4,4-Tetramethylpentane $\begin{array}{c} \text{C} \quad \text{C} \\ \quad \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		122.3 ¹⁶	0.7185 ¹⁶		

- (1) L. Clarke, *J. Am. Chem. Soc.* **34**, 680, 1912.
- (2) L. Clarke and R. Adams, *J. Am. Chem. Soc.* **37**, 2536, 1915.
- (3) B. J. Mair, *J. Research Nat. Bur. Standards* **9**, 457, 1936.
- (4) A. P. Shepard, A. L. Henne, and T. Midgley, Jr., *J. Am. Chem. Soc.* **53**, 1948, 1931.
- (5) E. Oberreit, *Ber.* **29**, 2003.
- (6) D. Hardin and S. Sikorsky, *J. chim. phys.* **6**, 179-211, 1908.
- (7) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 77, 1931.
- (8) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 761, 1931.
- (9) R. W. Dornte and C. P. Smyth, *J. Am. Chem. Soc.* **52**, 3546, 1930.
- (10) G. G. Brown and A. R. Carr, *Ind. Eng. Chem.* **18**, 718, 1926.
- (11) K. W. F. Kohlrausch and F. Köppl, *Z. physik. Chem.* **26B**, 209, 1934.
- (12) G. W. Stewart, *Phys. Rev.* **32**, 153, 1928.
- (13) W. Fischer and W. Klemm, *Z. physik. Chem.* **147A**, 275, 1930.
- (14) C. Engler and B. Halmai, *Ber.* **43**, 397, 1910.
- (15) C. S. Marvel, F. D. Hager, and D. D. Coffman, *J. Am. Chem. Soc.* **49**, 2323, 1927.
- (16) Private Communication from H. A. Southgate and F. C. Whitmore, Penn. State College.
- (17) B. A. Kasansky and A. F. Plate, *Ber.* **69B**, 1862-8, 1936.
- (20) J. D. White and A. R. Glasgow, Jr., *J. Research Nat. Bur. Standards* **19**, 423, 1937.
- (21) G. Calingaert and H. Soroos, *J. Am. Chem. Soc.* **58**, 635, 1936.
- (22) J. Smittenberg, H. Hoog, and R. A. Henkes, *J. Am. Chem. Soc.* **60**, 17, 1938.
- (23) R. Escourrou, *Bull. soc. chim.* (4) **43**, 1101, 1928.
- (24) M. Tuot, *Compt. rend.* **197**, 1434, 1933.
- (25) L. Clarke and S. A. Beggs, *J. Am. Chem. Soc.* **34**, 54, 1912.
- (26) N. Kishner, *J. Russ. Phys. Chem. Soc.* **45**, 971, 1913.
- (27) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 405, 1931.
- (28) C. R. Noller, *J. Am. Chem. Soc.* **51**, 594, 1929.
- (29) R. Escourrou, *Rec. trav. chim.* **52**, [4] 14, 1007, 1933.
- (30) H. I. Waterman and W. J. C. De Kok, *Rec. trav. chim.* **52**, 1007, 1933.
- (31) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **92**, 455, 1931.
- (32) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **95**, 1, 1932.
- (33) N. Kishner, *J. Russ. Phys. Chem. Soc.* **45**, 964, 1913.
- (34) R. D. Silva, *Ber.* **5**, 984, 1872.
- (35) G. T. Morgan, S. R. Carter, and A. E. Duck, *J. Chem. Soc.* **127**, 1252, 1925.
- (36) H. R. Henze and C. M. Blair, *J. Am. Chem. Soc.* **53**, 3084, 1931.
- (37) B. J. Mair, Private Communications.
- (38) G. Chavanne and G. Tock, *Bull. soc. chim. Belg.* **41**, 630, 1932.
- (39) T. W. Richards and J. W. Shipley, *J. Am. Chem. Soc.* **38**, 996, 1916.
- (40) J. Smittenberg and H. Hoog, Private Communication; June, 1938.
- (41) G. Calingaert, calc., Private Communication; 1938.
- (42) D. B. Brooks, R. B. Cleaton, and F. R. Carter, *J. Research Nat. Bur. Standards* **19**, 319, 1937.
- (43) F. Schütz, W. Buschmann, and N. Wissebach, *Ber.* **57**, 421, 1924.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Decane	-29.72	174.04	0.72985	1.41205	$\frac{dD}{dt} = -0.0007675 \cdot$ (1+0.00511t)/°C. (-30° to 170°)
C-(C) ₈ -C	-30.1 ²	170.9 to	0.6088 ⁴	1.40961 ⁷	
	-29.76 ³	171.7 ³¹	@ 170°	@ 25°	
	-29.68 ⁷	170.9 to	0.6257 ⁴	1.40986 ³	$\frac{dn}{dt} = -0.000430/°C.$ (20° to 25°)
		171.9 ²⁴	@ 150°	@ 25°	
		171 to 172 ⁵⁸	0.6421 ⁴	1.41791 ⁵⁸	
		172 to 173 ³⁵	@ 130°	@ 22.4°	
		172 to 175 ²⁸	0.6583 ⁴	1.4093 ³⁹	
		173.70 to	@ 110°	1.4117 ⁵⁵	
		173.80 ²	0.6754 ⁴	1.41178 ⁷	
			@ 90°	1.41192 ⁴	
		174.0 ⁵⁵	0.6916 ⁴	1.41203 ³	
		174.02 ⁷	@ 70°	1.4124 ⁴⁰	
		174.06 ³	0.7075 ⁴	1.4136 ²⁸	
		169 to 170 ¹⁹	@ 50°		
		@ 742mm	0.7230 ⁴		
		100 to 102 ³⁴	@ 30°		
		@ 17mm	0.72304 ²		
		98 to 101 ³⁴	@ 30°		
		@ 17mm	0.72643 ³		
			@ 25°		
			0.72805 ¹		
			0.72994 ⁵⁵		
			0.73014 ³		
			0.7307 ⁵⁷		
			0.7473 ²⁸		
			0.764 ⁴³		
			@ 15.5°		
			0.73443 ²		
			@ 15°		
			0.73876 ²		
			@ 10°		
			0.7385 ⁴		
			@ 10°		
			0.74571 ²		
			@ 0°		
			0.7538 ⁴		
			@ -10°		
			0.7687 ⁴		
			@ -30°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-74.64 -74.64 ¹ to -74.74	166.8 ¹	0.72805 0.72805 ¹ 0.764 ⁴³ @ 15.5°	1.4099 ¹	
3-Methylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-84.83 -84.83 ¹ to -84.89	167.8 167.8 ¹ 165 to 166.5 ²⁸ @ 751mm	0.73337 0.73335 ¹ 0.7354 ²⁸	1.4125 1.4125 ¹ 1.4126 ²⁸	
4-Methylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	α, ¹ -101.57 to -101.67 β, -98.9 ¹ to 99.1	165.7 ¹	0.73234 ¹	1.4123 ¹	
1-4-Methylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		76 @ 30mm 76 @ 30mm ⁴³ 72 @ 25mm ¹⁶	0.733 0.726 ²³ @ 27° 0.731 ¹⁶ @ 22°		[α] _D ²⁵ = -0.59° ¹⁶ [α] _D ²⁷ = -1.56° ³³

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
5-Methylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-86.77 ¹ to -86.80	165.1 162 to 163 ¹⁴ 165 ²⁷ 165.1 ¹ 164 to 166 ²⁶ @ 755mm	0.73255 0.7319 ²⁶ 0.73255 ¹ 0.738 ²⁷	1.4117 1.4116 ²⁶ 1.4122 ¹	
2,4-Dimethyloctane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		152.5 ⁶ @ 746mm	0.7259 ⁶ D ₁₀ ²⁰	1.4090 ⁶	
1-2,4-Dimethyloctane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		70 @ 40mm ³²	0.725 ³² @ 24°		[α] _D ²⁴ = -2.51° ³²
d-2,5-Dimethyloctane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		156 ³³	0.723 ³³ @ 28° 0.725 ³³ @ 25°		[α] _D ²⁸ = +1.02° ³³ [α] _D ²⁵ = +1.09° ³³

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6-Dimethyloctane $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & \text{C} & & & \text{C} & & \end{array}$		159 158 to 159.5 ²¹ @ 776mm 160 to 161 ²¹ @ 772mm 158 to 159 ^{11,13} 159 ²⁵ 160 to 161 ²³ 158 to 159 ⁵ @ 750mm 156.5 to 158 ¹² @ 724mm	0.7291₃ 0.7289 ²³ @ 20.2° 0.7286 ²¹ 0.730 ¹² 0.7305 ²³ @ 16.7° 0.7348 ²⁵ @ 15° 0.7340 ¹³ @ 15° 0.7410 ⁵ @ 11° 0.741 ¹² @ 0°	1.41103 ²³ @ 18.2° 1.40924 ⁸ @ 18.1° 1.4135 ¹³ @ 15° 1.414 ²² @ 15° 1.41406 ²⁵ @ 15° 1.41611 ⁵ @ 11°	$\frac{dD}{dt} = -0.0008527/^\circ\text{C.}$ (0° to 20°)
d-2,6-Dimethyloctane		160 160 to 161 ²¹ @ 772mm 159 to 159.5 ²⁰ @ 742mm	0.7300 ²¹	1.4109 ²¹	$[\alpha] = +1.75^\circ$ ²⁰ $[\alpha] = +6.27^\circ$ ²¹

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,7-Dimethyloctane Diisoamyl $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$	-52.5 -52.5 ¹⁰ -52.6 ⁹	160.2 156.5 to 157.5 ²⁹ 158.78 ¹⁹ 159 ⁴² 159.66 ¹⁸ 160.0 ⁹ 160.15 to 160.35 ¹⁰ 158 to 159.5 ⁸ @ 756mm 159.5 ¹⁷ @ 751.7mm 157.1 ¹⁹ @ 732.8mm	0.7247₁ 0.72402 ¹⁵ 0.7248 ⁴² 0.7270 ²⁹ D ₂₀ ²⁰ 0.72156 ¹⁹ @ 22° 0.7278 ⁸ @ 18.1° 0.7358 ¹⁷ @ 9.8°	1.4096 1.4006 ²⁹ 1.4096 ⁴² 1.40924 ⁸ @ 18.1°	$\frac{dD}{dt} = -0.001191/^\circ\text{C.}$ (10° to 25°)
3,6-Dimethyloctane $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$		159 to 160 ⁴⁵ 160 ³⁷	0.7402 ⁴⁵ @ 15°	1.4145 ⁴⁵	
d-3,6-Dimethyloctane		159.8 to 160.8 ⁴⁷	0.7348 ⁴⁷ @ 13°		$[\alpha]_D^{15} = +16.85^\circ$ ⁴⁷

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,5-Dimethyloctane (?) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & & & \text{C} & & \text{C} \end{array}$		146.3 to 146.7 ⁵⁰			
4-n-Propylheptane $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & & & \text{C} & - & \text{C} \\ & & & & & & \text{C} \end{array}$		161.7 ⁴⁹	0.740 ⁴⁹ @ 15.2°	1.414 ⁴⁹	
2,2,6-Trimethylheptane $\begin{array}{ccccccc} & & \text{C} & & & & \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$	-105.0 ⁴⁸	148.93 ⁵⁸ 150.5 to 151.5 @ 748mm ⁴⁸	0.7215 ⁴⁸ 0.7238 ⁵⁸ 0.7250 ⁴⁸ @ 16°	1.4077 ⁵⁸ 1.4090 ⁴⁸ 1.4100 ⁴⁸ @ 16°	$\frac{dn}{dt} = -0.00044/^\circ\text{C.}$ (16° to 20°)
2,4,6-Trimethylheptane $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & \text{C} & & \text{C} & & \text{C} & \end{array}$		143 ⁴⁴ @ 746mm	0.7210 ⁴⁴ D ₂₀ ²⁰	1.4057 ⁴⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,3,5-Trimethylheptane $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array} $		159.1 ⁸²	0.7553 ⁸²	1.4230 ⁸²	
3,4-Diethylhexane $ \begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C}-\text{C} \end{array} $		157.5 ⁸⁴	0.744 ⁸⁴	1.4184 ⁸⁴	
2,2,3,4-Tetramethylhexane $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \end{array} $		156.5 ⁸²	0.7548 ⁸²	1.4224 ⁸²	
3,3,4,4-Tetramethylhexane $ \begin{array}{c} \text{C} \quad \text{C} \\ \quad \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array} $		150 to 156 ³¹			

- (1) G. Calingaert and H. Soroos, *J. Am. Chem. Soc.* **58**, 635, 1936.
- (2) I. Simon, *Bull. soc. chim. Belg.* **38**, 47, 1928.
- (3) A. F. Shepard, A. L. Henne, and T. Midgley, Jr., *J. Am. Chem. Soc.* **53**, 1948, 1931.
- (4) R. W. Dornste and C. P. Smyth, *J. Am. Chem. Soc.* **52**, 3546, 1930.
- (5) R. Escourrou, *Bull. soc. chim.* [4] **43**, 1101, 1928.
- (6) M. Tuot, *Compt. rend.* **197**, 1434, 1933.
- (7) B. J. Mair, *J. Research Nat. Bur. Standards*, **9**, 457, 1932.
- (8) K. v. Auwers and F. Eisenlohr, *Z. physik. Chem.* **83**, 429, 1913.
- (9) J. Timmermans, *Bull. soc. chim. Belg.* **36**, 502, 1927.
- (10) J. Timmermans, *Bull. soc. chim. Belg.* **25**, 300, 1911.
- (11) J. Timmermans, *Bull. soc. chim. Belg.* **30**, 62, 1921.
- (12) R. Willstätter and E. W. Mayer, *Ber.* **41**, 1478, 1908.
- (13) C. J. Enklaar, *Ber.* **41**, 2084, 1908.
- (14) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **106**, 173-178, 1934.
- (15) H. Landolt and H. Jahn, *Z. physik. Chem.* **10**, 291, 1892.
- (16) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **91**, 761, 1931.
- (17) R. Schiff, *Ann.* **200**, 88, 1880.
- (18) W. Longuinine, *Ann. chim. phys.* [7] **13**, 289, 1898.
- (19) Br. Lachowicz, *Ann.* **220**, 168, 1883.
- (20) N. Kishner, *J. Russ. Phys. Chem. Soc.* **43**, 959, 1911.
- (21) N. Kishner, *J. Russ. Phys. Chem. Soc.* **45**, 1786, 1913.
- (22) G. Vavon, *Ann. chim. phys.* [9] **1**, 169, 1914.
- (23) C. J. Enklaar, *Rec. trav. chim.* **36**, 215, 1916.
- (24) K. W. F. Kohlrausch and F. Köppl, *Z. physik. Chem.* **B26**, 209, 1934.
- (25) Y. Asahina, M. Ishio, K. Kashiwagi, S. Mayeda, and A. Fujita, *Acta Phyto chim. (Japan)* **1**, 67-89, 1922.
- (26) P. A. Levene and F. A. Tayler, *J. Biol. chim.* **54**, 351, 1922.
- (27) P. A. Levene and L. H. Cretcher, *J. Biol. Chem.* **33**, 505, 1918.
- (28) A. Pictet and J. Potok, *Helv. Chim. Acta* **2**, 501, 1919.
- (29) B. T. Brooks and I. Humphrey, *J. Am. Chem. Soc.* **40**, 822, 1918.
- (31) E. Späth, *Sitzb. Akad. Wiss. Wien. Math. naturw. Klasse, Abt. IIB*, **122**, 1207, 1913.
- (32) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **92**, 455, 1931.
- (33) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **95**, 1, 1932.
- (34) W. Schrauth, O. Schenck, and K. Stickdorn, *Ber.* **64**, 1314, 1931.
- (35) P. Rowland, *Z. Elektrochem.* **4**, 120, 1897.
- (36) G. W. Stewart, *Phys. Rev.* **32**, 153, 1928.
- (37) W. J. C. Dyke and W. J. Jones, *J. Chem. Soc.* **1930**, 2426.
- (38) J. v. Braun and W. Sobiecki, *Ber.* **44**, 1918, 1911.
- (39) C. Engler and B. Halmi, *Ber.* **43**, 397, 1910.
- (40) H. I. Waterman, P. van't Spijker, and H. A. van Westen, *Rec. trav. chim.* **48**, 1097, 1929.
- (42) B. A. Kasansky and A. F. Plate, *Ber.* **69**, 1862-69, 1936.
- (43) S. F. Birch, F. B. Pim, and T. Tait, *J. Soc. Chem. Ind.* **55**, 335-337T, 1936.
- (44) M. Tuot, *Compt. rend.* **197**, 1434, 1933.
- (45) G. Dupont, *Compt. rend.* **156**, 1623, 1913.
- (46) N. Kishner, *J. Russ. Phys. Chem. Soc.* **50**, 15, 1920.
- (47) D. Hardin and S. Sikorsky, *J. chim. phys.* **6**, 179-211, 1908.
- (49) *International Critical Tables* **1**, 241, 1926.
- (50) G. Festracte, *Bull. soc. chim. Belg.* **41**, 333-36, 1932.
- (51) H. R. Henze and C. M. Blair, *J. Am. Chem. Soc.* **53**, 3084, 1931.
- (52) N. L. Drake and L. H. Welsh, *J. Am. Chem. Soc.* **60**, 488-9, 1938.
- (54) W. G. Lovell, *Private Communication*.
- (55) J. H. Bruun and M. M. Hicks-Bruun, *J. Research Nat. Bur. Standards* **8**, 587, 1932.

- (56) D. B. Brooks, R. B. Cleaton, and F. R. Carter, J. Research Nat. Bur. Standards, **19**, 319, 1937.
- (57) E. A. Bried and G. F. Hennion, J. Am. Chem. Soc. **60**, 1717, 1938.
- (58) F. Schütz, W. Buschmann and N. Wissebach, Ber. **57**, 421, 1924.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Undecane	-25.61	195.8	0.7404_s	1.41902	$\frac{dD}{dt} = -0.0007061 \cdot$ $(1 + 0.000617t)/^{\circ}\text{C.}$ (-10° to 190°)
C-(C) ₉ -C	-25.61 ^{6,7}	192 to 197 ¹⁵	0.6038 ⁸	1.40611 ⁷	
		193 to	@ 190°	@ 45.3°	
	-26.5 ¹	194 ^{28,30}	0.6224 ⁸	1.41495 ⁶	$\frac{dD}{dt} = -0.0007150/^{\circ}\text{C.}$ (10° to 30°)
	-28 ¹⁸	193 to 195.5 ⁵	@ 170°	@ 25°	
		193 to 196 ¹⁷	0.6398 ⁸	1.4200 ¹⁸	
		194 ¹⁴	@ 150°	@ 25°	
		194.2 to	0.6563 ⁸	1.4164 ¹⁹	$\frac{dn}{dt} = -0.0005201/^{\circ}\text{C.}$ (20° to 45°)
		195.6 ⁹	@ 130°	@ 25°	
		194.5 ²⁸	0.6720 ⁸	1.4220 ¹⁵	
		195.84 ⁷	@ 110°	@ 22°	
		195 to 198 ¹⁸	0.6816 ¹	1.4158 ^{3,14}	
			@ 99°		
		196 to 197 ³	0.6875 ⁸	1.41727 ⁷	
		193 to 195 ²	@ 90°	1.41817 ²	
		@ 754mm	0.7027 ⁸	1.42440 ²⁸	
		189 to 190 ¹⁹	@ 70°	1.4730 ⁸	
		@ 740mm	0.7182 ⁸		
		192 to 194 ⁴	@ 50°		
		@ 720mm	0.7333 ⁸		
		127.8 to	@ 30°		
		128.2 ⁴	0.73667 ⁷		
		@ 100mm	@ 25°		
		127 ¹	0.73995 ⁴		
		@ 100mm	0.74025 ⁷		
		79 @ 16mm ²⁰	0.741 ⁵		
			0.7411 ¹		
			0.744 ¹⁴		
			0.7457 ¹⁸		
			0.7581 ³		
			0.7601 ²⁸		
			@ 18.2°		
			0.7466 ²		
			D ₁₈ ¹⁸		
			0.7482 ⁸		
			@ 10°		
			0.7630 ⁸		
			@ -10°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Undecane (?) (from coal tar)		194.5 ²⁰	0.7596 ²⁸	1.42440 ²⁸	
l-5-Methyldecane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-(\text{C})_5-\text{C} \\ \\ \text{C} \end{array}$		94 @ 30mm ¹⁰	0.738 ¹⁰ @ 24°		[α] _D ²⁴ = -0.39° ¹⁰
d-4-Ethylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		77 @ 20mm ¹²	0.745 ¹² @ 23°		[α] _D ²² = +0.70° ¹²
l-4-Ethylnonane		77 @ 20mm ¹²	0.745 ¹² @ 23°		[α] _D ¹² = -0.50° ¹²
5-Ethylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		71 @ 16mm ²	0.7513 ² @ 19.2°	1.42092 ² @ 19.5°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3-Dimethylnonane $\begin{array}{cccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & \\ & & & & \text{C} & & \text{C} & & & & & & & & \end{array}$		170 to 180 ¹			
1-2,4-Dimethylnonane $\begin{array}{cccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & \\ & & & & \text{C} & & & & \text{C} & & & & & & \end{array}$		75 (l) 25mm ⁴	0.731 ⁴ (n 24°)		[α] _D ²⁴ = -1.82° ⁴
1-2,5-Dimethylnonane $\begin{array}{cccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & \\ & & & & \text{C} & & & & \text{C} & & & & & & \end{array}$		109 ³ @ 100mm	0.738 ³ (n 25°)		[α] _D ²⁵ = -0.49° ³
2,6-Dimethylnonane $\begin{array}{cccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & \\ & & & & \text{C} & & & & \text{C} & & & & & & \end{array}$		173 to 176 ¹¹ @ 745mm	0.7506 ¹¹ (n 11°)	1.4214 ¹¹ (n 11°)	
2,3,7-Trimethyloctane $\begin{array}{cccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & \\ & & & & \text{C} & & & & \text{C} & & & & \text{C} & & \end{array}$		173 to 176 ¹¹ @ 752mm	0.7637 ¹¹ @ 10.5°	1.4270 ¹¹ @ 10.5°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,4,7-Trimethyloctane $ \begin{array}{ccccccc} & C & - & C & - & C & - & C & - & C & - & C & - & C \\ & & & & & & & & & & & & & \\ & C & & & & & & & & & & & & C \end{array} $		167.5 ¹⁴ @ 746 mm	0.7344 ¹³ D ₂₀ ²⁰	1.4132 ¹³	

- (1) F. Kraft, Ber. **15**, 1697, 1882.
- (2) R. Ross and J. P. Leather, Analyst **31**, 284, 1906.
- (3) C. F. Mabery and E. J. Hudson, Am. Chem. J. **19**, 482, 1897.
- (4) C. Scholl, Ber. **25**, 1489, 1892.
- (5) E. Clemmensen, Ber. **46**, 1841, 1913.
- (6) B. J. Mair, J. Research Nat. Bur. Standards **9**, No. 4, 457, 1936.
- (7) A. F. Shepard, A. L. Henne, and T. Midgley, Jr., J. Am. Chem. Soc. **53**, 1948-58, 1931.
- (8) R. W. Dornte and C. P. Smyth, J. Am. Chem. Soc. **52**, 3546, 1930.
- (9) K. W. F. Kohlrausch and F. Köppl, Z. physik. Chem. **B26**, 209, 1934.
- (10) P. A. Levene and R. E. Marker, J. Biol. Chem. **91**, 791, 1931.
- (11) R. Escourrou, Bull. soc. chim. [4] **43**, 1101 (1928).
- (12) P. A. Levene and R. E. Marker, J. Biol. Chem. **91**, 687, 1931.
- (13) M. Tuot, Compt. rend. **197**, 1434, 1933.
- (14) C. Engler and B. Halmay, Ber. **43**, 397, 1910.
- (15) C. S. Marvel, F. D. Hager, and D. D. Coffman, J. Am. Chem. Soc. **49**, 2323, 1927.
- (16) F. Sigmund, Monatsh. **52**, 185, 1929.
- (17) H. Gilman and N. Beaber, J. Am. Chem. Soc. **47**, 518, 1925.
- (18) J. R. Ruhoff, J. Am. Chem. Soc. **55**, 3889, 1933.
- (19) B. Wojcik and H. Adkins, J. Am. Chem. Soc. **55**, 1293, 1933.
- (20) K. Hess and R. Bappert, Ann. **441**, 137, 1925.
- (21) K. Hess and R. Bappert, Ann. **441**, 151, 1925.
- (22) G. M. Robinson, J. Chem. Soc. **125**, 226, 1924.
- (23) E. Späth, Monatsh. **34**, 1965, 1913; Sitzber. Akad. Wiss. Wien. Math. naturw. Klasse, Abt. IIb, **122**, 1207, 1913.
- (24) P. A. Levene and R. E. Marker, J. Biol. Chem. **95**, 1, 1932.
- (25) P. A. Levene and R. E. Marker, J. Biol. Chem. **92**, 455, 1931.
- (26) Saburo Sakami, Mem. Coll. Sci., Kyoto Imp. Univ. **A11**, 505, 1928.
- (27) C. F. Mabery, J. Amer. Chem. Soc. **39**, 2015, 1917.
- (28) F. Schütz, W. Buschmann, and H. Wissebach, Ber. **57**, 421, 1924.
- (29) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. **53**, 3084, 1931.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Dodecane	-9.65	216.2	0.7493	1.42182	$\frac{dD}{dt} = -0.0006942 \cdot$ (1 + 0.000584t)/°C. (-10° to 210°)
C-(C) ₁₀ -C	-12 to	201 ⁹	0.5986 ¹	1.4108 ³	
	13 ¹⁰	214 ¹⁰	@ 210°	@ 45.3°	
	-12 ⁶	214 to 216 ⁷	0.6170 ¹	1.41952 ⁴	$\frac{dD}{dt} = -0.0007023/°C.$ (10° to 30°)
	-11 ⁸	214.5 ⁶	@ 190°	@ 25°	
	-9.73 ³	215 ¹⁰	0.6345 ¹	1.41967 ³	
	-9.61 ⁴	216.23 ³	@ 170°	@ 25°	$\frac{dn}{dt} = -0.0004400/°C.$ (20° to 45°)
		212.3 ¹⁰	@ 150°	1.42170 ¹	
		@ 754mm	0.6665 ¹	1.42188 ³	
		193 to 196 ¹⁰	@ 130°		
		@ 752mm	0.6820 ¹		
		145.5 ⁶	@ 110°		
		@ 100mm	0.6930 ⁶		
		50 @ 126mm ⁶	@ 99.1°		
			0.6974 ¹		
			@ 90°		
			0.7125 ¹		
			@ 70°		
			0.7274 ¹		
			@ 50°		
			0.7424 ¹		
			@ 30°		
			0.74542 ³		
			@ 25°		
			0.751 ¹⁰		
			0.7511 ^{6,10}		
			0.7684 ^{7,10}		
			0.7642 ¹⁰		
			@ 10.5°		
			0.7571 ¹		
			@ 10°		
			0.7715 ¹		
			@ -10°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Dodecane (?)					
(from rice bran tar)		95 @ 15mm ²⁷			
(from coal tar)		212 to 215 ²⁸	0.7728 ²⁸ @ 19.5°	1.43091 ²⁸	
d-3-Methylundecane					
d-Methyl-ethyl-n-octyl methane		94 @ 15mm ²²	0.7491 ²² @ 25°	1.4216 ²² @ 25°	[α] _D ²⁵ = +3.87° ²² [M] _D ²⁵ = +6.59° ²²
$\begin{array}{c} \text{C}-\text{C}-\text{C}-(\text{C})_8 \\ \\ \text{C} \end{array}$					
l-2,3-Dimethyldecane					[α] _D ²⁵ = -0.30° ²³
$\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		112 ²³ @ 20mm			
l-2,5-Dimethyldecane					
$\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		122 ²⁵ @ 100mm	0.739 ²⁵ @ 25°		[α] _D ²⁵ = -0.05° ²⁵

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
5-<i>n</i>-Propylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \\ \\ \text{C} \\ \\ \text{C} \end{array}$		197 204 to 205 ²⁹ @ 763mm 195 to 196 ²⁸ @ 740mm	0.7559 0.7506 ²⁸ @ 25° 0.7559 ²⁹	1.4228 1.4217 ²⁸ @ 25° 1.4228 ²⁹	
2-Methyl-5-<i>n</i>-propyloctane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \\ \qquad \qquad \text{C} \\ \text{C} \qquad \qquad \text{C} \end{array}$		189 ¹¹	0.7538 ¹¹ @ 14°	1.425 ¹¹ @ 14°	
3,6-Diethyloctane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		203 ³¹	0.76745 ³¹	1.43158 ³¹	
2,2,7,7-Tetramethyloctane $\begin{array}{c} \text{C} \qquad \qquad \text{C} \\ \qquad \qquad \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		185 to 190 ¹²			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3,6,7-Tetramethyloctane $ \begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ \text{C} & & \text{C} & & & & \text{C} \\ & & & & & & \\ & & & & & & \text{C} \end{array} $		92 @ 20 to 22mm ¹⁷	0.7593 ¹⁷ @ 25°	1.42527 ¹⁷ @ 25°	
2,4,5,7-Tetramethyloctane $ \begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ \text{C} & & \text{C} & & \text{C} & & \text{C} \end{array} $		208 to 210 ¹³			
2,6-Dimethyl-3-Isopropylheptane $ \begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ \text{C} & & \text{C} & - & \text{C} & & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \end{array} $		186 to 188 ¹⁴	0.7654 ¹⁴	1.432 ¹⁴	

- (1) R. W. Dornte and C. P. Smyth, *J. Am. Chem. Soc.* **52**, 3546, 1930.
- (2) K. W. F. Kohlrausch and F. Köppl, *Z. physik. Chem.* **B26**, 209, 1934.
- (3) A. F. Shepard, A. L. Henne, and T. Midgley, Jr., *J. Am. Chem. Soc.* **53**, 1948, 1931.
- (4) B. J. Mair, *J. Research Nat. Bur. Standards* **9**, No. 4, 457, 1936.
- (5) K. Ziegler, F. Dersch, and H. Wollthan, *Ann.* **511**, 13, 1934.
- (6) F. Krafft, *Ber.* **15**, 1698, 1882.
- (7) C. F. Mabery and Palm, *Am. Chem. J.* **19**, 419, 1897.
- (8) C. F. Mabery and E. J. Hudson, *Am. Chem. J.* **19**, 482, 1897.
- (9) C. Schorlemmer, *Ann.* **161**, 277, 1872.
- (10) R. Escourrou, *Bull. soc. chim.* [4] **43**, 1101, 1928.
- (11) G. Amouroux and M. Murat, *Compt. rend.* **154**, 993, 1912.
- (12) M. Delacre, *Bull. soc. chim.* [4] **9**, 1023, 1911.
- (13) L. Clarke and R. N. Shreve, *Am. Chem. J.* **35**, 517, 1906.
- (14) M. Murat and G. Amouroux, *Bull. soc. chim.* [4] **15**, 160, 1914.
- (15) C. Engler and B. Halmai, *Ber.* **43**, 397, 1910.
- (16) P. Rohland, *Z. Elektrochem.* **4**, 120, 1897.
- (17) T. Midgley, Jr. and A. L. Henne, *J. Am. Chem. Soc.* **52**, 2077, 1930.
- (18) H. Gilman and N. Beaber, *J. Am. Chem. Soc.* **47**, 518, 1925.
- (19) G. W. Stewart, *Phys. Rev.* **32**, 153, 1928.
- (20) A. Dobryanski and J. Chessin, *Azerbaidzhanskoe Neftyanoe Khoz.* **1929**, No. 8-9, 80.
- (22) P. A. Levene and S. A. Harris, *J. Biol. Chem.* **112**, 195-208, 1935.
- (23) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **100**, 769, 1933.
- (24) W. J. C. Dyke and W. J. Jones, *J. Chem. Soc.* **1930**, 2426.
- (25) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **95**, 1, 1932.
- (26) L. A. Wälter and S. M. McElvain, *J. Am. Chem. Soc.* **56**, 1614, 1934.
- (27) Saburo Sakami, *Mem. Coll. Sci., Kyoto Imp. Univ. A* **11**, 505, 1928.
- (28) F. Schütz, W. Buschmann, and H. Wissebach, *Ber.* **57**, 421, 1924.
- (29) P. A. Levene and F. A. Taylor, *J. Biol. Chem.* **54**, 351, 1922.
- (30) H. R. Henze and C. M. Blair, *J. Am. Chem. Soc.* **53**, 3084, 1931.
- (31) V. N. Krestinskii and N. I. Summ, *J. Gen. Chem. (U.S.S.R.)* **1**, 440, 1937.
- (32) G. Calingaert, *Calc. Private Communication*, 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
<i>n</i>-Tridecane C-(C) ₁₁ -C	-6 -7 to -8 ⁹ -6 ^{1,8} -6.2 ¹ -5.5 ¹¹	226 ³ 230 to 234 ¹¹ 234 ^{1,8} 161 to 165 ⁸ @ 100mm 162.5 ¹ @ 100mm 140.5 ¹ @ 50mm 124 to 126 ³ @ 50mm	0.7568 0.7008 ¹ @ 99° 0.7543 ⁸ 0.7571 ^{1,5} 0.7567 ¹⁴ 0.7834 ³ D ₂₀ ²⁰ 0.7608 ¹ @ 15° 0.7713 ¹ @ 0°	1.4354 ³	$\frac{dD}{dt} = -0.0007104/^{\circ}\text{C.}$ (0° to 99°)
(from rice bran tar)		225 to 226 ¹⁸ 114 ¹⁰ @ 15mm			
5-Methyldodecane C-C-C-C-C-(C) ₆ -C C		225.5 to 227 ¹² @ 758mm	0.7576 ¹²	1.4244 ¹²	
2,5,9-Trimethyldecane C-C-C-C-C-C-C-C-C-C C C C		206 to 208 ⁴ @ 745mm	0.7756 ⁴ @ 11°	1.43362 ⁴ @ 11°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
5-<i>n</i>-Butylnonane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$		217.5 to 218.5 °	0.7635 ° @ 18.5°	1.4273 ° @ 18.5°	

- (1) F. Krafft, Ber. 15, 1699, 1882.
- (2) J. Mai, Ber. 22, 2133, 1889.
- (3) C. F. Mabery, Am. Chem. J. 28, 170, 1902.
- (4) R. Escourrou, Bull. soc. chim. [4] 43, 1101, 1928.
- (5) C. Engler and B. Halmai, Ber. 43, 397, 1910.
- (7) D. Ivanoff, Bull. soc. chim. [4] 37, 287, 1925.
- (8) J. R. Ruhoff, J. Am. Chem. Soc. 55, 3889, 1933.
- (9) B. Wojcik and H. Adkins, J. Am. Chem. Soc. 55, 1293, 1933.
- (10) Saburo Sakami, Mem. Coll. Sci., Kyoto Imp. Univ., A 11, 505, 1928.
- (11) S. Skraup and F. Nieten, Ber. 57, 1294, 1924.
- (12) P. A. Levene and F. A. Taylor, J. Biol. Chem. 54, 351, 1922.
- (13) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. 53, 3084, 1931.
- (14) G. Calingaert, Calc. Private Communication, 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tetradecane	5.5	251	0.7636₀		$\frac{dD}{dt} = -0.0007069/^\circ\text{C}.$ (5° to 100°)
C-(C) ₁₃ -C	4 to 4.5 ¹²	250 ⁹	0.7078 ¹		
	4.5 ¹	252 ¹¹	@ 99°		
	5 ^{13,18}	252.5 ¹	0.7630 ²⁷		
	5.4 to	245 ⁷	0.7640 ²⁸		
	5.5 ²	@ 750mm	0.761 ¹⁰		
	5.5 ¹⁹	178.5 ¹	0.7645 ^{1,4}		
	6 ⁷	@ 100mm	0.766 ¹⁸		
		158 ¹	0.7681 ¹		
		@ 50mm	@ 15°		
		129.5 ²	0.7738 ²		
		@ 15mm	@ 5.4°		
n-Tetradecane (?)		237			
(from petroleum)		237 to 238 ⁸	0.7814 ³	1.4360 ³	
		236 to 238 ⁸	D ₂₀ ²⁰		
		142 to 143 ⁸			
		@ 50mm			
(from kerogen)		80 to 85 ²¹	0.7820 ²¹	1.4370 ²¹	
		@ 1mm	@ 25°	n _D ²⁰ _{daylight}	
				1.4405	
				n _D ²⁰ _{daylight}	
(from distillation of sodium stearate)		235 to 238 ²⁰	0.7709 ²⁰	1.4358 ²⁰	
(from rice bran tar)		99 to 101 ¹⁴			
		@ 3mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,11-Dimethyldodecane $\begin{array}{c} \text{C}-\text{C}-\text{C}-(\text{C})_6-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \qquad \\ \text{C} \qquad \qquad \qquad \text{C} \end{array}$	-8.5 °	117 @ 13mm °	0.7138 ° @ 99° 0.7276 ° @ 80° 0.7484 ° @ 50° 0.7691 ° 0.7751 ° @ 10° 0.7820 ° @ 0°	1.43023 ° @ 13.85°	$\frac{dD}{dt} = -0.0006874/^{\circ}\text{C.}$ (0° to 100°)
4,5-Di-<i>n</i>-propyloctane <i>sym</i> -Tetra- <i>n</i> -propylethane $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C}-\text{C}-\text{C} \quad \text{C}-\text{C}-\text{C} \end{array}$	Below ¹ - 80	220 ²⁴ 225 ²⁵	0.7735 ²⁴ @ 25°	1.4322 ²⁴ @ 25°	

- (1) F. Krafft, Ber. 15, 1700, 1882.
- (2) F. Krafft, Ber. 19, 2218, 1886.
- (3) C. F. Mabery, Am. Chem. J. 28, 171, 1902.
- (4) R. Willstätter, O. Schuppli, and E. W. Mayer, Ann. 418, 145, 1919.
- (5) S. Landa and A. Kejvan, Collection Czechoslovak. Chem. Commun. 3, 367, 1931.
- (6) C. Engler and B. Halmai, Ber. 43, 397, 1910.
- (7) K. B. B. Sorabji, J. Chem. Soc. 47, 37-41, 1885.
- (8) C. F. Mabery, J. Soc. Chem. Ind. 19, 502, 1900.
- (9) F. O. Rice and O. L. Polly, Ind. Eng. Chem. 27, 915, 1935.
- (10) H. Gilman and N. Beaber, J. Am. Chem. Soc. 47, 518, 1925.
- (11) W. H. Zartman and H. Adkins, J. Am. Chem. Soc. 54, 3398, 1932.
- (12) W. E. Bachmann and H. T. Clarke, J. Am. Chem. Soc. 49, 2089, 1929.
- (13) S. Skraup and E. Schwamberger, Ann. 462, 135, 1928.
- (14) W. H. Carothers and G. J. Berchet, J. Am. Chem. Soc. 55, 2813, 1933.
- (16) G. W. Stewart, Phys. Rev. 32, 153, 1928.
- (17) Saburo Sakami, Mem. Coll. Sci., Kyoto Imp. Univ., A 11, 505, 1928.
- (18) D. Vorländer and W. Selke, Z. physik. Chem. 129, 435, 1927.
- (19) G. S. Parks and D. W. Light, J. Am. Chem. Soc. 56, 1511, 1934.
- (20) A. Pictet and J. Potok, Helv. Chim. Acta 2, 501, 1919.
- (21) J. W. McKinney, J. Am. Chem. Soc. 46, 968, 1924.
- (23) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. 53, 3084, 1931.
- (24) J. Piccard and R. Q. Brewster, J. Am. Chem. Soc. 43, 2626, 1921.
- (25) A. Dobryanski and J. Chessin, Azerbaidzhanskoe Neftyanoe Khoz., 1929, No. 8-9, 80-85.
- (26) G. Calingaert, Calc. Private Communication, 1938.
- (27) J. Sherman Calculation by Molal Volume of Normal Paraffins.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Pentadecane	10	268	0.7688	1.431 @ 25°	$\frac{dD}{dt} = -0.0006962/^\circ\text{C.}$ (0° to 100°)
C-(C) ₁₄ -C	9.6 to 9.8 ¹⁸ 10 ^{1,9}	264 to 265 ¹⁸ 270.5 ¹ 194 ¹ @ 100mm 173 ¹ @ 50mm 160 ¹ @ 30mm 144 ² @ 15mm 125 to 127 ⁹ @ 6mm	0.7136 ¹ @ 99.3° 0.7615 ⁹ D ₃₀ ²⁰ 0.7689 ¹ 0.772 ¹⁸ 0.7924 ¹ @ 15° 0.7757 ¹ @ 10°	1.431 ⁹ @ 25° 1.4532 ⁸ @ 16.22°	
n-Pentadecane (?)					
(from petroleum)		256 to 257 ^{3,7} 158 to 159 ³ @ 50mm	0.7896 ³ D ₂₀ ²⁰	1.4413 ³	
(from Sanna, the rhizome of Hedychium spicatum Ham.)	10 ¹¹	143 to 148 ¹¹ @ 16mm	0.7743 ¹¹ @ 15°		
(from rice bran tar)		144 ¹⁶ @ 18mm			
(from distillation of sodium stearate)		257 to 260 ¹⁸	0.7750 ¹⁸		
(from kerogen)		90 to 95 ¹⁷ @ 1mm	0.7825 ¹⁷ D ₂₅ ²⁵	1.4380 ¹⁷ n _D ²⁵ _{daylight}	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Propyldodecane $\begin{array}{c} \text{C}-(\text{C})_4-\text{C}-\text{C}-\text{C}-(\text{C})_3-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		241 to 243 ²⁰ @ 730mm	0.7729 ²⁰ @ 18.6°	1.43321 ²⁰ @ 18.6°	
6-Methyl-7-ethyl- dodecane $\begin{array}{c} \text{C}-(\text{C})_4-\text{C}-\text{C}-\text{C}-(\text{C})_3-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$		240 to 242 ²⁰ @ 726mm	0.7769 ²⁰ @ 21.9°	1.43462 ²⁰ @ 21.9°	
2,6,10-Trimethyl- dodecane Farnesane $\begin{array}{c} \text{C}-\text{C}-(\text{C})_3-\text{C}-(\text{C})_3-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \quad \\ \text{C} \quad \quad \text{C} \quad \quad \text{C} \end{array}$		119.5 to 120 ⁸ @ 11mm	0.7682 ⁸ @ 25°	1.4303 ⁸ @ 25°	
4-Methyl-6-propyl- undecane $\begin{array}{c} \text{C}-(\text{C})_2-\text{C}-\text{C}-\text{C}-\text{C}-(\text{C})_4-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C}-\text{C} \end{array}$		235 to 236 ²⁰ @ 727mm	0.7733 ²⁰ @ 18.6°	1.43311 ²⁰ @ 18.6°	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Pentadecane					
of unknown structure (from spartein) (probably 6-Propyl- dodecane or 4-Methyl- 6-propylundecane)		242 ²⁰ @ 729mm	0.7740 ²⁰ @ 18.7°	1.43351 ²⁰ @ 18.7°	
Pentadecane					
of unknown structure (from phytol)		260.5 to 263.5 ⁴ 249 to 250 ¹⁴ @ 718mm 131 to 132 ¹⁴ @ 13mm 127 to 130 ⁴ @ 9.5mm	0.789 ⁴ @ 0°	1.43322 ⁴	
Octahydrosesqui- citronellene					
		115 to 117 ⁵ @ 9mm	0.7789 ⁵	1.43518 ⁵	[α] _D = ±0°
Pentadecane					
of unknown structure (from Echinocea angusti- folia) C ₈ H ₁₁ -C-C-C-C-C-C ₈ H ₁₁ (amyl groups not normal)	8.7 ¹²		0.7681 ¹² @ 24° 0.7692 ¹² @ 15°	1.423 ¹² @ 25°	

- (1) F. Krafft, Ber. **15**, 1700, **1882**.
- (2) J. Mai, Ber. **22**, 2133, **1889**.
- (3) C. F. Mabery, Am. Chem. J. **28**, 173, **1902**.
- (4) R. Willstätter, E. W. Mayer, and E. Hüni, Ann. **378**, 73, **1911**.
- (5) F. W. Semmler and K. E. Spornitz, Ber. **46**, 4027, **1913**.
- (6) A. Bartoli and E. Stracciati, Gazz. chim. ital. **15**, 417, **1885**.
- (7) C. F. Mabery, J. Soc. Chem. Ind. **19**, 502, **1900**.
- (8) F. G. Fischer and K. Löwenberg, Ann. **464**, 69, **1928**.
- (9) P. M. B. Panicker, B. S. Rao, and J. L. Simonsen, J. Indian Inst. Sci., Ser. A. **9**, 133, **1926**.
- (11) M. Nakao and C. Shibuye, J. Pharm. Soc. Japan **1924**, No. 513, 2-3.
- (12) F. Bischoff, J. Am. Pharm. Assoc. **13**, 898, **1924**.
- (13) G. W. Stewart, Phys. Rev. **32**, 153, **1928**.
- (14) R. Willstätter, O. Schuppli, and E. W. Mayer, Ann. **418**, 121, **1919**.
- (15) Saburo Sakami, Mem. Coll. Sci., Kyoto Imp. Univ., A **11**, 505, **1928**.
- (16) A. Pictet and J. Potok, Helv. Chim. Acta **2**, 501, **1919**.
- (17) J. W. McKinney, J. Am. Chem. Soc. **46**, 968, **1924**.
- (18) S. Skraup and F. Nieten, Ber. **57**, 1294, **1924**.
- (19) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. **53**, 3084, **1931**.
- (20) P. Karrer, B. Shibata, A. Wettstein, and L. Jacobowicz, Helv. Chim. Acta **13**, 1292, **1930**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
n-Hexadecane	18.1	280	0.7749,	1.4352	$\frac{dD}{dt} = -0.0006932/^\circ\text{C.}$ (15° to 100°)
(Cetane)	16 to	270. ³	0.7197 ¹	1.4570 ¹⁷	
	17 ¹⁴	278 ¹⁶	@ 99°	@ 16°	
C-(C) ₁₄ -C	16.5 ²¹	280 to 285 ²⁴	0.7544 ²⁴	1.4352 ²¹	
	16.9 ²⁴	287.5 ¹	@ 50°		
	17.5 ⁷	288.6 ²⁷	0.7707 ¹		
	17.6 ²⁰	@ 764.8mm	@ 25°		
	17.8 ²¹	208.5 ¹	0.7742 ¹		
		@ 100mm	0.7751 ²¹		
	18 ^{{1,2}	187.5 ¹	0.7752 ²⁴		
	22,23	@ 50mm	0.7754 ⁸		
	18 to	174 ¹	@ 18.2°		
	20 ¹⁶	@ 30mm	0.7754 ¹		
	18.10 ^{8,9}	157.5 ⁸	@ 18°		
	18.12 ⁸	@ 15mm			
	18.13 ⁸	158 ²⁷			
	19 to	@ 15mm			
	20 ¹⁰	161 to 162 ⁷			
	20 ^{3,4}	@ 15mm			
	Meta-	156 to 158 ¹⁴			
	stable	@ 14mm			
	form	138 to 140 ²⁴			
	16.2 ⁸	@ 13mm			
		110 @ 1mm ⁴			
n-Hexadecane (?)		275		1.4413	
(from petroleum)		275 ¹²	0.7835 ²⁹	1.4413 ¹²	
		274 ¹⁹	D_{25}^{25}	1.4379 ²⁹	
		174 to 175 ¹²	0.7911 ¹²	n_D^{25} daylight	
		@ 50mm	D_{20}^{20}		
		168 to 170 ²³			
		@ 24mm			
		100 to 105 ²⁹			
		@ 1mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Hexadecane (Continued)					
(from rose wax)	18 ²³	169 ²³ @ 24mm			
(from kerogen)		102.5 ²⁹ @ 1mm	0.7846 ²⁹	1.4401 ²⁹	
3-Ethyltetradecane $\begin{array}{c} \text{C}-\text{C}-\text{C}-(\text{C})_{10}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$			0.7829 ¹³ @ 14.2°	1.43921 ¹³ @ 14.2	
6,9-Dimethyltetradecane $\begin{array}{c} \text{C}-(\text{C})_4-\text{C}-\text{C}-\text{C}-\text{C}-(\text{C})_4-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		103 to 104 ²⁶ @ 1.5mm	0.7787 ²⁶	1.4348 ²⁶	
7,8-Dimethyltetradecane $\begin{array}{c} \text{C}-(\text{C})_4-\text{C}-\text{C}-\text{C}-\text{C}-(\text{C})_4-\text{C} \\ \qquad \\ \text{C} \qquad \text{C} \end{array}$	< -30 ³²	267.5 to 269.5° 268 to 270 ¹⁸ 140 to 145 ¹⁸ @ 10mm	0.7923° @ 14° 0.8022° @ 0°		$\frac{dD}{dt} = -0.00071/^\circ\text{C.}$ (0° to 15°)

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
2,6,7,11-Tetramethyl- dodecane $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & (\text{C})_8 & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & \\ & & \text{C} & & & & \text{C} & & \text{C} & & & & \text{C} \end{array}$		103 to 108 ³³ @ 3mm			
4,7-Di-<i>n</i>-propyldecane $\begin{array}{ccccccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & (\text{C})_3 \\ & & & & & & & & & & & & & & & & \\ & & & & (\text{C})_3 & & & & (\text{C})_3 & & & & & & & & \end{array}$		125 to 127 ¹¹ @ 18mm 92 to 93 ²⁸ @ 1.5mm	0.7846 0.7841 ²⁸ 0.7887 ¹¹	1.4376 1.4368 ²⁸ 1.4450 ¹¹	

- (1) F. Krafft, Ber. **15**, 1702, **1882**.
- (2) S. Landa, Chimie et industrie **21**, No. 2, 524.
- (3) G. Oddo, Gazz. chim. ital. **31** I, 347, **1901**.
- (4) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. **20**, 521, **1915**.
- (5) P. C. Carey and J. C. Smith, J. Chem. Soc. **1933**, 346.
- (6) J. C. Smith, J. Chem. Soc. **1932**, 737.
- (7) K. Ziegler, F. Dersch, and H. Wollthan, Ann. **511**, 13, **1934**.
- (8) F. Krafft, Ber. **19**, 2218, **1886**.
- (9) Alechin, J. Russ. Phys. Chem. Soc. **15**, 175, **1883**.
- (10) Br. Lachowicz, Ann. **220**, 168, **1883**.
- (11) G. Dupont, Ann. chim. phys. [8] **30**, 517, **1913**.
- (12) C. F. Mabery, Am. Chem. J. **28**, 174 and 197, **1902**.
- (13) J. F. Eykman, Verhandeligen Haarlem [3] **8**, 441, **1919**.
- (14) P. A. Levene, Organic Syntheses, Vol. **15**, 27, **1935**.
- (15) J. v. Braun, H. Deutsch, and A. Schmatloch, Ber. **45**, 1254, **1912**.
- (16) K. B. B. Sorabji, J. Chem. Soc. **47**, 37, **1885**.
- (17) A. Bartoli and E. Stracciati, Atti dei Lincei [3] **19**, 643, **1883-4**; Gazz. chim. ital. **15**, 417, **1885**.
- (18) E. Spath, Sitzb. Akad. Wiss. Wien, Math. Naturw. Klasse, Abt. II b, **122**, 1207, **1913**.
- (19) C. F. Mabery, J. Soc. Chem. Ind. **19**, 502, **1900**.
- (20) J. W. C. Phillips and S. A. Mumford, J. Chem. Soc. **1931**, 1732.
- (21) H. I. Waterman, P. van't Spijker, and H. A. van Westen, Rec. trav. chim **48**, 1097, **1929**.
- (22) S. Landa, Bull. soc. chim. [4] **43**, 1086, **1928**.
- (23) H. Prophete, Compt. rend. **183**, 609, **1926**.
- (24) Motooki Matsui and Shingo Arakawa, Mem. Coll. Sci., Kyoto Imp. Univ., A **15**, 189, **1932**.
- (25) P. Schorigin, W. Issaguljanz, and A. Gussewa, Ber. **66**, 1426, **1933**.
- (26) A. T. Blomquist and C. S. Marvel, J. Am. Chem. Soc. **55**, 1655, **1933**.
- (27) F. Francis and N. E. Wood, J. Chem. Soc. **129**, 1420, **1926**.
- (28) A. Dobryanski and J. Chessin, Azerb. Neft. Khozy. **1929**, No. 8-9, 80.
- (29) J. W. McKinney, J. Am. Chem. Soc. **46**, 968, **1924**.
- (30) A. v. Grosse. Unpublished data.
- (31) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. **53**, 3084, **1931**.
- (32) H. Suida and R. Planckh, Ber. **66B**, 1445-54 **1933**.
- (33) D. A. Peak and R. Robinson, J. Chem. Soc. **1937**, 1581-91.
- (34) E. B. Evans, J. Inst. Petr. Tech. **24**, 38-53, **1938**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Heptadecane	22.0	303	0.7767 @ 22°	1.4360 @ 25°	$\frac{dD}{dt} = -0.000681/^{\circ}\text{C.}$ (22° to 100°)
C-(C) ₁₅ -C	20 to 21 ¹⁸	288 to 289 ^{8,10}	0.7245 ² @ 99°	1.4357 ¹⁹ @ 36.5°	
	20.5 to 22.5 ¹²	303 ² 290 to 292 ¹³	0.7379 ¹⁸ @ 80.85°	1.4360 ¹³ @ 25°	
	21 ¹⁸	@ 738mm	0.7714 ² @ 30°	1.43583 ⁷ @ 23.7°	
	21.8 ²³	223 ² @ 100mm	0.7749 ² @ 25°		
	21.92 ¹⁷	180 to 189 ⁸ @ 50mm	0.77554 ²² @ 22.5°		
	21.97 ¹⁷	201.5 ² @ 50mm	0.7777 ⁴ @ 22.5°		
	22 ^{1,14,16}	186 to 189 ⁴ @ 30mm	0.7767 ^{1,2} @ 22.5°		
	22.5 ^{2,4}	187.5 ² @ 30mm	0.7766 ⁴ @ 22.5°		
	23 ^{8,10}	170 ² @ 155mm	0.7764 ² @ 22.5°		
		170 ¹² @ 13mm	0.7805 ⁴ D ₁₅ ¹⁸		
		158 to 163 ⁹ @ 10mm			
		81 @ 0mm ³			
n-Heptadecane (?)					
(from sardine oil)	22 to 22.5 ¹¹				
(from petroleum)		288 to 289 ⁸ 188 to 189 ⁸ @ 50mm	0.7986 0.8000 ⁸ D ₂₀ ²⁰		
(from sardine oil)		288 to 289 ¹⁰			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
<i>n</i>-Heptadecane (Continued) (from kerogen)		115 to 120 ²⁰ @ 1mm	0.7839 ²⁰ D ₂₅ ²⁵	1.4377 ²⁰ n _D ²⁵ _{daylight}	
5,5-Di-<i>n</i>-butyloctane					
Tetra- <i>n</i> -butylmethane $ \begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array} $		94 to 95.5 ¹⁸ @ 12mm	0.7679 ¹⁸ @ 23.3° 0.7685 ¹⁸ @ 21.9	1.43472 ¹⁸ @ 23.3 1.43532 ¹⁸ @ 21.9	
Heptadecane					
of unknown structure (from phytol)		161.5 ⁶ @ 15mm	0.794 ⁶ @ 0°	1.43763 ⁶	

- (1) J. Mai, Ber. **22**, 2133, **1889**.
- (2) F. Krafft, Ber. **15**, 1702, **1882**.
- (3) F. Krafft and H. Weilandt, Ber. **29**, 1323, **1896**.
- (4) F. W. Semmler and J. Feldstein, Ber. **47**, 2687, **1914**.
- (5) C. F. Mabery, Am. Chem. J. **28**, 176, **1902**.
- (6) R. Willstätter, O. Schuppli, and E. W. Mayer, Ann. **418**, 138, **1919**.
- (7) J. F. Eykman, Verhandeligen Haarlem [3] **8**, 441, **1919**.
- (8) A. Müller and W. B. Saville, J. Chem. Soc. **127**, 599, **1925**.
- (9) E. Späth, Sitzb. Akad. Wiss. Wien, Math. Naturw. Klasse, Abt. II b, **122**, 1207, **1913**.
- (10) C. F. Mabery, J. Soc. Chem. Ind. **19**, 502, **1900**.
- (11) Yoshiyuki Toyama, J. Soc. Chem. Ind., Japan **38**, Suppl. binding 258-61, **1935**.
- (12) R. Schaal, Ber. **40**, 4784, **1907**.
- (13) B. Wojcik and H. Adkins, J. Am. Chem. Soc. **55**, 1293, **1933**.
- (14) A. Muller, Proc. Roy. Soc. (London) A **127**, 417, **1930**.
- (15) J. F. Eykman, Rec. trav. chim. **15**, 52, **1896**.
- (16) Motooki Matsui and Shingo Arakawa, Mem. Coll. Sci., Kyoto Imp. Univ., A **15**, 189, **1932**.
- (17) P. C. Carey and J. C. Smith, J. Chem. Soc. **1933**, 1348.
- (18) P. Karrer and C. Ferri, Helv. Chim. Acta **17**, 358, **1934**.
- (19) D. Vorlander and W. Selke, Z. physik. Chem. **129**, 435, **1927**.
- (20) J. W. McKinney, J. Am. Chem. Soc. **46**, 968, **1924**.
- (21) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. **53**, 3084, **1931**.
- (22) S. H. Bertram, Chem. Weekblad **33**, 457-9, **1936**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Octadecane	28.0	308	0.7767 @ 28°	1.4367 @ 28°	$\frac{dD}{dt} = -0.0006744/^\circ\text{C.}$ (25° to 100°)
C-(C) ₁₆ -C	Stable form	305 to 307 ⁶ 308 ³⁰	0.7288 ³ @ 99°	1.4344 ⁸ @ 32°	
	25 ⁸	312 to 313 ¹⁶	0.7409 ¹⁷ @ 81.2°	1.4367 ²⁸ @ 28°	
	27 ^{28, 29, 30}	317 ³	0.7411 ¹⁷ @ 80.95°		
	27 to 28 ²³	236 ³ @ 100mm			
	27.3 ²	214.5 ³ @ 50mm	0.7756 ⁸ @ 42°		
	27.5 ¹		0.7685 ³ @ 40°		
	27.82 ²	180 to 183 ²⁹ @ 15mm	0.7719 ³ @ 35°		
	27.90 ¹	181.5 ^{1, 9} @ 15mm	0.7720 ¹⁷ @ 35.2°		
	27.9 ²²	177 ⁵ @ 15mm	0.7790 ⁸ @ 32°		
	28 { ^{3, 5, 7, 9} 14, 27	155 to 160 ³⁰ @ 5mm	0.7754 ³ @ 30°		
	28 to 29 ²⁶	157 to 158 ²⁸ @ 3mm	0.7766 ⁹ @ 28°		
	28.01 ¹		0.7768 ²⁸ @ 28°		
	29.9 ¹⁶				
	30 ⁸				
	Meta-stable form				
	27.4 ²²				
	27.6 ¹				
n-Octadecane (?)					
(from petroleum)	20 ¹⁰	300 to 301 ¹⁰ 199 to 200.5 ¹⁰ @ 50mm	0.7830 ¹⁰ D ₂₀ ²⁰	1.440 ¹⁰	
(from petroleum wax)	27.0 ¹¹		0.7347 ¹¹ @ 84°	1.4133 ¹¹ @ 84°	
(from kerogen)		125 to 130 ³¹ @ 1mm	0.7916 ³¹ @ 25°	1.4423 ³¹ n _D ²⁵ daylight	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylheptadecane $\begin{array}{c} \text{C}-\text{C}-(\text{C})_{11}-\text{C} \\ \\ \text{C} \end{array}$	5 ¹⁸	311 ¹² 231.5 ¹² @ 100mm 178.5 ¹² @ 15mm 103 ¹² @ 8mm	0.7836 ¹³ @ 15.6° 0.7838 ¹² @ 15°	1.44038 ¹³ @ 15.6° 1.43942 ¹² @ 13°	
3,12-Diethyltetradecane $\begin{array}{c} \text{C}-\text{C}-\text{C}-(\text{C})_8-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C}-\text{C} \qquad \qquad \text{C}-\text{C} \end{array}$	About -30 ³⁴	170 to 171 ³⁴ @ 18mm 159 ³⁴ @ 4mm 151 @ 2mm ³⁴	0.7924 ³⁴	1.4473 ³⁴ @ 15.2°	$\frac{dD}{dt} = -0.000675/^\circ\text{C}.$
Pristane (from fish oils)	-11 ²⁴	293 296 ²⁵ 292 ²⁰ 220 ²⁵ @ 100mm 187 ²⁵ @ 30mm 167 to 170 ²⁴ @ 15mm 158 ²⁵ @ 10mm	0.7885 ²⁰	1.4412 1.4395 ²³ 1.4412 ²⁰ 1.4419 ²⁴ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octadecanes					
of unknown structure (from Lichen islandicus)		190 to 200 ¹⁸			
(from liver oil)		85 to 86 ²¹ @ vacuum			

- (1) P. C. Carey and J. C. Smith, J. Chem. Soc. 1933, 346.
- (2) J. C. Smith, J. Chem. Soc. 1932, 737.
- (3) F. Krafft, Ber. 15, 1687, 1882.
- (4) F. Krafft and H. Weilandt, Ber. 29, 1323, 1896.
- (5) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. 20, 524, 1915.
- (6) J. v. Braun and W. Sobocki, Ber. 44, 1470, 1911.
- (7) A. Gascard, Ann. chim. (9) 15, 332, 1921.
- (8) M. V. Dover and W. A. Hensley, Ind. Eng. Chem. 27, 337, 1935.
- (9) F. Krafft, Ber. 19, 2218, 1886.
- (10) C. F. Mabery, Am. Chem. J. 28, 177, 1902.
- (11) C. C. Buckler and G. D. Graves, Ind. Eng. Chem. 19, 718, 1927.
- (12) S. Landa and R. Riedl, Collection Czechoslovak. Chem. Commun. 2, 520, 1930.
- (13) J. F. Eykman, Verhandeligen Haarlem [3] 8, 441, 1919.
- (14) A. Müller and W. B. Saville, J. Chem. Soc. 127, 599, 1925.
- (15) E. Terres and W. Vollmer, Petroleum Z. 31, No. 19, 1, 1935.
- (16) K. B. B. Sorabji, J. Chem. Soc. 47, 37, 1885.
- (17) J. F. Eykman, Rec. trav. chim. 15, 52, 1896.
- (18) R. Böhme, Arch. Pharm. 241, 1, 1903.
- (19) C. F. Mabery, J. Soc. Chem. Ind. 19, 502, 1900.
- (20) Yoshiyuki Toyama and Tomotaro Tsuchiya, J. Soc. Chem. Ind., Japan, 38, Suppl. binding 254, 1935.
- (21) Ziro Nakamiya, Bull. Inst. Phys. Chem. Research (Tokyo) 13, 883-900, 1934.
- (22) P. C. Carey and J. C. Smith, J. Chem. Soc. 1933, 1348.
- (23) R. Schaal, Ber. 40, 4784, 1907.
- (24) Yoshiyuki Toyama and Tomotaro Tsuchiya, J. Soc. Chem. Ind., Japan, 32, Suppl. 374B, 1929.
- (25) Yoshiyuki Toyama, Fettchem. Umschau 30, 181, 1923.
- (26) I. M. Heilbron and W. M. Owens, J. Chem. Soc. 1928, 942.
- (27) A. Müller, Proc. Roy. Soc. (London) A 127, 417, 1930.
- (28) J. Gorniak and A. Szayna, Przemysl Chem. 18, 57, 1934.
- (29) W. Schrauth, O. Schenck, and K. Stickdorn, Ber. 64, 1314, 1931.
- (30) Motooki Matsui and Shingo Arakawa, Mem. Coll. Sci. Kyoto Imp. Univ., A 15, 189, 1932.
- (31) J. W. McKinney, J. Am. Chem. Soc. 46, 968, 1924.
- (32) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. 53, 3084, 1931.
- (33) M. Tsujimoto, Ind. Eng. Chem. 9, 1098, 1917.
- (34) S. Landa and M. Habada, Collection Czechoslovak. Chem. Commun. 8, 473-6, 1936.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Nonadecane	32	330	0.7776, @ 32°		$\frac{dD}{dt} = -0.0006668/^\circ\text{C.}$ (30° to 100°)
C-(C) ₁₇ -C	30 to 31 ³ 31 ¹³ 31.5 to 32.5 ¹² 31.8 to 32 ⁴ 32 ^{2,7,9,14} 33 ¹⁸	330 ² 320 ³ @ 750mm 248 ² @ 100mm 226.5 ² @ 50mm 109 @ 0mm ⁴ 111 @ 0mm ²	0.7323 ² @ 99.3° 0.7451 ¹⁰ @ 81.9° 0.7720 ² @ 40° 0.7754 ² @ 35° 0.7766 ¹⁰ @ 34.6° 0.7774 ² @ 32°	1.4335 ¹⁸ @ 38° 1.4340 ¹⁸ @ 36°	
n-Nonadecane (?)					
(from petroleum)	33 to 34 ⁵ 31.4 ⁶	316 ⁸ 210 to 212 ⁵ @ 50mm	0.7397 ⁶ @ 84°	1.4155 ⁶ @ 84°	
(from coal tar)	33 ¹⁸	328 ¹⁸ @ 770mm			
(from kerogen)	27.1 ¹⁷	135 to 140 ¹⁷ @ 1mm	0.7833 ¹⁷ D ₄₀ ²⁰	1.4356 ¹⁷ n _D ²⁰ _{day light}	
7-Isopropylhexadecane					
$\begin{array}{c} \text{C}-(\text{C})_6-\text{C}-(\text{C})_8-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		175 to 185 ¹¹ @ 10mm			

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Nonadecane of unknown structure (from sardine oil)	- 5 ¹⁴	148 to 150 ¹⁴ @ 4mm			

- (1) F. Krafft and H. Weilandt, Ber. 29, 1323, 1896.
- (2) F. Krafft, Ber. 15, 1704, 1882.
- (3) E. Clemmensen, Ber. 46, 1841, 1913.
- (4) F. Krafft, Ber. 40, 4779, 1907.
- (5) C. F. Mabery, Am. Chem. J. 28, 181, 1902.
- (6) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. 19, 718, 1927.
- (7) A. Müller and W. B. Saville, J. Chem. Soc. 127, 599, 1925.
- (8) C. F. Mabery, J. Soc. Chem. Ind. 19, 502, 1900.
- (9) D. E. Tsakalotos, Compt. rend. 143, 1235, 1906.
- (10) J. F. Bykman, Rec. trav. chim. 15, 52, 1896.
- (11) E. Späth, Monatsh. 34, 1965, 1913; Sitzb. Akad. Wiss. Wien, Math. Naturw. Klasse, Abt. IIb, 122, 1207, 1913.
- (12) R. Schaal, Ber. 40, 4784, 1907.
- (13) A. Müller, Proc. Roy. Soc. (London) A 127, 417, 1930.
- (14) Sei-ichi Ueno and Rūchiro Yamasaki, J. Soc. Chem. Ind., Japan 33, Suppl. 451B, 1930.
- (15) O. Kruber, Ber. 65, 1382, 1932.
- (16) D. Vorländer and W. Selke, Z. physik. Chem. 129, 435, 1927.
- (17) J. W. McKinney, J. Am. Chem. Soc. 46, 968, 1924.
- (18) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. 53, 3084, 1931.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Eicosane	36.4	309.7	0.7777₄ @ 36.4°	1.4307 @ 50°	$\frac{dD}{dt} = -0.0006759/^\circ\text{C.}$ (36.4° to 100°)
C-(C) ₁₈ -C	35 to 35.6 ⁴ 36.4 ⁷ 36.4 ^{10,21} 36.4 ^{22,23} 36.3 to 36.6 ⁶ 36.7 ^{1,5} 37 ^{11,13,25} 38 ^{3,20,24}	309.7 ¹³ 205 ^{1,4,20} @ 15mm 148 ³ @ 0.6mm 60 ⁴ @ 0.0001mm	0.7110 ²⁴ @ 136° 0.7363 ¹ @ 99.2° 0.7417 ⁷ @ 84° 0.7487 ¹ @ 80.2° 0.7499 ¹⁴ @ 79.3° 0.7502 ¹⁴ @ 78.9° 0.7721 ¹⁴ @ 45.6° 0.7738 ¹⁴ @ 43.1° 0.7741 ¹⁴ @ 42.9° 0.7762 ²⁶ @ 38.3° 0.7775 ⁶ @ 36.7° 0.7776 ⁵ @ 36.7° 0.7779 ¹ @ 36.7°	1.4325 ²⁵ @ 46.8° 1.4312 ²⁵ @ 47.3° 1.4173 ⁷ @ 84°	$\frac{dn}{dt} = -0.0003939/^\circ\text{C.}$ (45° to 85°)
n-Eicosane (?) (from kerogen) (from rose wax)	32.2 ³² 36.5 ²⁹	220 ²⁹ @ 30mm 145 to 150 ³² @ 1mm	0.7787 ³² @ 40°	1.4370 ³² ^{n_D⁴⁰} _{daylight}	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylnonadecane $\begin{array}{c} \text{C}-\text{C}-(\text{C})_{18}-\text{C} \\ \\ \text{C} \end{array}$	18.3 °		0.7876 ° @ 18.1 °	1.44229 ° @ 18.1 °	
9-Methylnonadecane $\text{C}-(\text{C})_7-\text{C}-(\text{C})_9-\text{C} \\ \\ \text{C}$		200 ° @ 14mm			
3-Ethylotadecane $\begin{array}{c} \text{C}-\text{C}-\text{C}-(\text{C})_{14}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$	-3 °	341 ° 204 ° @ 15mm 202 ° @ 12mm	0.7948, 0.7428 ° @ 99° 0.7487 ° @ 90° 0.7553 ° @ 80° 0.7617 ° @ 70° 0.7684 ° @ 60° 0.7750 ° @ 50° 0.7817 ° @ 40° 0.7886 ° @ 30° 0.7951 ° 0.7959 ° @ 15.5° 0.8018 ° @ 10° 0.8091 ° @ 0°	1.44632 @ 15° 1.4476 ° @ 10.6° 1.44618 ° @ 15.5°	$\frac{dD}{dt} = -0.0006609/^{\circ}\text{C.}$ (0° to 100°) $\frac{dn}{dt} = -0.000290/^{\circ}\text{C.}$ (10° to 16°)

<i>Name and Carbon Skeleton</i>	<i>M. P., °C</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
2,6,11,15-Tetramethylhexadecane, "Di-tetrahydrogeranyl" $\begin{array}{ccccccc} & & & & & & \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & \text{C} & & & \text{C} & & \end{array}$		171.8 to 172.6 @ 11mm ¹⁹	0.7853 ¹⁹ @ 25°	1.4382 ¹⁹ @ 25°	
Crocetane Probably 2,6,11,15-Tetramethylhexadecane		135 ¹⁸ @ 0.5mm	0.8027 ¹⁸ @ 19.8°	1.44937 ¹⁸ @ 19.8°	
Phytane Probably Tetramethylhexadecane		169.5 ¹⁷ @ 9.5mm 170.5 to 170.7 @ 9.6mm ¹⁸ 169.5 ¹⁸ @ 9.5mm	0.803 ^{17,18} @ 0°		
Eicosane of unknown structure (from spinach)	67.5 to 68.5 ³⁰ 69 ³¹				

- (1) F. Krafft, Ber. **15**, 1717, **1882**.
- (2) F. Krafft and H. Weilandt, Ber. **29**, 1323, **1896**.
- (3) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. **20**, 526, **1915**.
- (4) W. H. Carothers, J. W. Hill, J. E. Kirby, and R. A. Jacobson, J. Am. Chem. Soc. **52**, 5279, **1930**.
- (5) F. Krafft, Ber. **19**, 2218, **1886**.
- (6) F. Krafft, Ber. **40**, 4779, **1907**.
- (7) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, **1927**.
- (8) S. Landa and V. Sliva, Collection Czechoslovak Chem. Commun. **4**, 538, **1932**.
- (9) J. F. Eykman, Verhandelingen Haarlem [3] **8**, 441, **1919**.
- (10) G. S. Parks, H. M. Huffman, and S. B. Thomas, J. Am. Chem. Soc. **52**, 1032-41, **1930**.
- (11) A. Müller and W. B. Saville, J. Chem. Soc. **127**, 599, **1925**.
- (12) D. E. Tsakalotos, Compt. rend. **143**, 1235, **1906**.
- (13) J. v. Braun and W. Sobecki, Ber. **44**, 1918, **1911**.
- (14) J. F. Eykman, Rec. trav. chim. **15**, 52, **1896**.
- (15) P. Karrer and Th. Golde, Helv. Chim. Acta **13**, 709, **1930**.
- (16) J. v. Braun and G. Manz, Ber. **67B**, 1696, **1934**.
- (17) R. Willstätter and E. W. Mayer, Ber. **41**, 1475, **1908**.
- (18) R. Willstätter, E. W. Mayer, and E. Hünig, Ann. **378**, 73, **1910**.
- (19) F. G. Fischer and K. Löwenberg, Ann. **475**, 183, **1929**.
- (20) K. Ziegler, F. Dersch, and H. Wolltham, Ann. **511**, 13-44, **1934**.
- (21) G. S. Parks and S. S. Todd, Ind. Eng. Chem. **21**, 1235, **1929**.
- (22) G. S. Parks, H. M. Huffman, and S. B. Thomas, J. Am. Chem. Soc. **52**, 1032, **1930**.
- (23) G. S. Parks and H. M. Huffman, Ind. Eng. Chem. **23**, 1138, **1931**.
- (24) A. Müller, Proc. Roy. Soc. (London) A **127**, 417, **1930**.
- (25) D. Vorländer and W. Selke, Z. physik. Chem. **129**, 435, **1927**.
- (26) J. F. Eykman, Rec. trav. chim. **14**, 185, **1895**.
- (27) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. **54**, 1538, **1935**.
- (28) H. Prophète, Compt. rend. **183**, 609, **1926**.
- (29) F. W. Heyl, E. C. Wise and J. H. Speer, J. Biol. Chem. **82**, 111, **1929**.
- (30) T. P. Hilditch and E. E. Jones, J. Soc. Chem. Ind. **46**, 174T, **1927**.
- (31) J. W. McKinney, J. Am. Chem. Soc. **46**, 968, **1924**.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Heneicosane	40.4		0.7782₆ @ 40.4		$\frac{dD}{dt} = -0.0006562/^\circ\text{C.}$ (40.4° to 100°)
C-(C) ₁₈ -C	39.9 to 40.2 ⁷ 40 ¹² 40.3 to 40.5 ¹⁶ 40.4 ^{1,3,16} 40.5 ⁸ 41 ⁸	215 @ 15mm ¹ 172 to 172.5 ¹⁶ @ 2.5mm	0.7400 ¹ @ 98.9° 0.7522 ¹¹ @ 80.9° 0.7557 ¹ @ 74.7° 0.7585 ¹⁸ @ 70° 0.7729 ¹¹ @ 49.5° 0.7778 ⁷ @ M.P. 0.7783 ¹ @ 40.4°	1.4240 ¹⁸ @ 70°	
<i>n</i>-Heneicosane (?)					
(from kerogen)	36.8 ¹⁶	155 to 160 ¹⁶ @ 1mm	0.7777 ¹⁶ @ 50°	1.4363 ¹⁶ @ 50°	
(from coal)	39 ¹³				
(from rose wax)	40.5 ¹⁰	222 to 223 ¹⁰ @ 24mm			
(from petroleum)	40.4 ¹⁴ 40.5 ⁴ 40.8 ⁸	215 ¹⁴ @ 15mm 230 to 231 ⁴ @ 50mm 340 to 345 ⁹	0.7458 ⁸ @ 84°	1.4191 ⁸ @ 84°	

- (1) F. Krafft, Ber. **15**, 1718, **1882**.
- (2) F. Krafft and H. Weilandt, Ber. **29**, 1323, **1896**.
- (3) S. Landa and R. Riedl, Collection Czechoslovak. Chem. Commun. **2**, 520, **1930**.
- (4) C. F. Mabery, Am. Chem. J. **28**, 185, **1902**.
- (5) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, **1927**.
- (6) A. Müller and W. B. Saville, J. Am. Chem. Soc. **127**, 599, **1925**.
- (7) F. Krafft, Ber. **40**, 4779, **1907**.
- (8) R. Schaal, Ber. **40**, 4784, **1907**.
- (9) W. E. Bachmann and H. T. Clarke, J. Am. Chem. Soc. **49**, 2089, **1927**.
- (10) H. Prophète, Compt. rend. **183**, 609, **1926**.
- (11) J. F. Eykman, Rec. trav. chim. **15**, 52, **1896**.
- (12) D. Vorländer and W. Selke, Z. physik. Chem. **129**, 435, **1927**.
- (13) F. Hofmann and P. Damm, Brennstoff-Chem. **4**, 65, **1923**.
- (14) J. Read and A. C. P. Andrews, J. Soc. Chem. Ind. **39**, 289T, **1920**.
- (15) J. W. McKinney, J. Am. Chem. Soc. **46**, 968, **1924**.
- (16) J. Strating and H. J. Backer, Rec. trav. chim. **55**, 903, **1936**.
- (17) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, **1932**.
- (18) D. S. McKittrick, H. J. Henriques, and H. S. Wolff, J. Inst. Petr. Tech. **23**, 630, **1937**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Docosane	44.4		0.7778, @ 44.4°	1.43321 H_a 44.4° 1.44181 H_β 44.4°	$\frac{dD}{dt} = -0.0006466/^\circ\text{C.}$ (44.4° to 100°)
C-(C) ₂₀ -C	43.8 ⁷ 44 ^{5,15,16} 44.0 to 44.5 ⁴ 44.4 ^{1,8} 44.5 ^{1,12,18} 47 ³	327 ¹⁸ @ 768mm 242 @ 50mm ⁵ 224.5 ^{1,8} @ 15mm 230 ¹² @ 15mm	0.7422 ¹ @ 99.2° 0.7548 ⁹ @ 80.9° 0.7549 ¹ @ 79.6° 0.7560 ⁹ @ 78.85° 0.7665 ⁵ @ 60° 0.7769 ⁹ @ 46.7° 0.7782 ¹ @ 44.4° 0.7776 ⁴ @ M. P. 0.7778 ¹⁰ @ M. P.	1.42015 ⁹ n _{H_a} ^{50.9} 1.42749 ⁹ n _{H_β} ^{50.9} 1.42084 ⁹ n _{H_a} ^{78.85} 1.42818 ⁹ n _{H_β} ^{78.85} 1.43332 ⁹ n _{H_a} ^{46.7} 1.44091 ⁹ n _{H_β} ^{46.7}	$\frac{dn_{H_a}}{dt} =$ -0.0003864/°C (45° to 85°) $\frac{dn_{H_\beta}}{dt} =$ -0.0003939/°C. (45° to 85°)
n-Docosane (?)					
(from kerogen)	40.0 ¹⁹	165 to 170 ¹⁹ @ 1mm	0.7844 ¹⁹ @ 50°	1.4400 ¹⁹ n _{D₄} ⁵⁰ daylight	
(from coal)	42.3 to 43.5 ¹⁷ 43 ¹²	224 to 225 ¹⁷ @ 15mm			
(from rose wax)	44.5 ¹¹	245 to 248 ¹¹ @ 30mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,19-Dimethyleicosane $\begin{array}{c} \text{C}-\text{C}-(\text{C})_{16}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$	41 °		0.7496 ° @ 90° 0.7561 ° @ 80° 0.7626 ° @ 70° 0.7691 ° @ 60° 0.7757 ° @ 50° 0.7816 ° @ 41°		$\frac{dD}{dt} = -0.0006530/^{\circ}\text{C.}$ (41° to 90°)
4-n-Propylnonadecane 	6.5 °	210 to 211 ° @ 10mm	0.7971 ° 0.7441 ° @ 99° 0.8039 ° @ 30° 0.7968 ° @ 20° 0.8109 ° @ 0°	1.44855 ° @ 14.0°	$\frac{dD}{dt} = -0.0006726/^{\circ}\text{C.}$ (0° to 100°)

- (1) F. Krafft, Ber. 15, 1718, 1882.
- (2) F. Krafft and H. Weilandt, Ber. 29, 1323, 1896.
- (3) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. 20, 528, 1915.
- (4) F. Krafft, Ber. 40, 4779, 1907.
- (5) C. F. Mabery, Am. Chem. J. 28, 186, 1902.
- (6) S. Landa and A. Kejvan, Collection Czechoslovak. Chem. Commun. 3, 367, 1931.
- (7) W. E. Garner, Katherine Van Bibber, and Annie M. King, J. Chem. Soc. 1931, 1533.
- (8) J. Petersen, Z. Elektrochem. 12, 141, 1906.
- (9) J. F. Eykman, Rec. trav. chim. 15, 52, 1896.
- (10) F. Krafft, Chem. Ztg. 7, 153, 1883.
- (11) H. Prophète, Compt. rend. 183, 609, 1926.
- (12) F. Francis and N. E. Wood, J. Chem. Soc. 129, 1420, 1926.
- (13) E. Berl and H. Schildwachter, Brennstoff-Chem. 9, 105, 1928.
- (14) S. Landa, J. Cech, and V. Slíva, Collection Czechoslovak. Chem. Commun. 5, 204, 1933.
- (15) A. Muller, Proc. Roy. Soc. (London) A 138, 514, 1932.
- (16) D. Vorländer and W. Selke, Z. physik. Chem. 129, 435, 1927.
- (17) F. Hofmann and P. Damm, Brennstoff-Chem. 4, 65, 1923.
- (18) G. M. Robinson, J. Chem. Soc. 125, 226, 1924.
- (19) J. W. McKinney, J. Am. Chem. Soc. 46, 986, 1924.
- (20) D. Perry, J. Am. Chem. Soc. 54, 2918-20, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tricosane	47.4		0.7797₁ @ 47.4°	1.43470 H_α 47.4° 1.44228 H_β 47.4°	$\frac{dD}{dt} = -0.0006619/^\circ\text{C.}$ (47.4° to 100°) $\frac{dn_{H\alpha}}{dt} =$ $\frac{dn_{H\beta}}{dt} =$
C-(C) ₃₁ -C	46 ^{13,17} 47 ⁷ 46.9 to 47.4 ¹⁹ 47.2 to 47.5 ⁸ 47.7 ¹	320.7 ⁸ 234 @ 15mm ¹ 190 to 191 ¹⁹ @ 1.5mm 142.5 ² @ 0mm	0.7456 ¹ @ 98.8° 0.7570 ¹ @ 80.8° 0.7577 ¹⁰ @ 8.16° 0.7785 ¹ @ 47.7° liq. 0.7788 ¹⁰ @ 48.95° 0.7799 ⁸ @ M. P.	1.43410 ¹⁰ n _{Hα} ^{10,16} 1.42150 ¹⁰ n _{Hα} ^{11,6} 1.44167 ¹⁰ n _{Hβ} ^{10,16} 1.42882 ¹⁰ n _{Hβ} ^{11,6}	-0.0003859/°C. (48° to 85°) -0.0003936/°C. (48° to 85°)
n-Tricosane (?)					
(from kerogen)	44.1 ¹⁶	175 to 180 ¹⁰ @ 1mm	0.7858 ¹⁰ @ 50°	1.4410 ¹⁶ n _{Hα} ¹⁰ daylight	
(from petroleum)	45 ³ 47.1 ⁴ 48 ^{6,9}	258 to 260 ³ @ 50mm 256 to 258 ⁶ @ 40mm 234 @ 15mm ⁹	0.7513 ⁴ @ 84° 0.7587 ⁶ @ 80° 0.7641 ⁶ @ 70° 0.7765 ³ @ 60° 0.7705 ⁶ @ 60°	1.4217 ⁴ @ 84°	
(from coal tar)	46 ¹⁷				
(from coal)	47 ¹⁴	234 to 235 ¹⁴ @ 15mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tricosane (Continued)					
(from fossil wax)	47 ¹⁵	247 ¹⁵ @ 34mm			
(from rose wax)	48 ¹¹	254 to 255 ¹¹ @ 30mm			
(from oil of geranium)	49.5 ¹²				

- (1) F. Krafft, Ber. 15, 1712, 1882.
- (2) F. Krafft and H. Weilandt, Ber. 29, 1323, 1896.
- (3) C. F. Mabery, Am. Chem. J. 28, 188, 1902.
- (4) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. 19, 718, 1927.
- (5) F. Krafft, Ber. 40, 4779, 1907.
- (6) C. F. Mabery, Am. Chem. J. 33, 286, 1905.
- (7) A. Müller and W. B. Saville, J. Chem. Soc. 127, 599, 1925.
- (8) D. E. Tsakalotos, Compt. rend. 143, 1235, 1906.
- (9) J. Read and A. C. P. Andrews, J. Soc. Chem. Ind. 39, 289T, 1920.
- (10) J. F. Eykman, Rec. trav. chim. 15, 52, 1896.
- (11) H. Prophète, Compt. rend. 183, 609, 1926.
- (12) P. Rovesti, Notiz. chim. ind. 2, 438, 1927.
- (13) A. Müller, Proc. Roy. Soc. (London) A 138, 514, 1932.
- (14) F. Hofmann and P. Damm, Brennstoff-Chem. 4, 65, 1923.
- (15) R. Ciusa and R. Vois, Gazz. chim. ital. 52, I, 135, 1922.
- (16) J. W. McKinney, J. Am. Chem. Soc. 46, 968, 1924.
- (17) E. Fromm and H. Eckard, Ber. 56, 948, 1923.
- (18) D. Perry, J. Am. Chem. Soc. 54, 2918-2920, 1932.
- (19) J. Strating and H. J. Backer, Rev. trav. chim. 55, 903, 1936.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Tetracosane	51.1		0.7786, @ 51.1°	1.43026 @ 65°	$\frac{dn}{dt} = -0.0006380/^{\circ}\text{C.}$ (51.1° to 100°)
C-(C) ₁₁ -C	49.5 ⁴ (sinters) 51 ^{11,15} 51.1 ² 51.2 ²⁰ 54 ^{3,16} 55 ¹	324.1 ¹² 237 to 240 ^{1,3} @ 15mm 243 @ 15mm ² 243 to 244 ⁴ @ 15mm 241 ¹³ @ 12mm	0.7481 ² @ 98.9° 0.7628 ² @ 76° 0.7786 ² @ 51.1° liq.	1.43026 ⁴ @ 65° 1.42448 ⁴ @ 80°	$\frac{dn}{dt} = -0.000385/^{\circ}\text{C.}$ (65° to 80°)
<i>n</i>-Tetracosane (?) (from olive oil)	45 to 46 ²⁸				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tetacosane (?)—(Continued) (from petroleum)	48 ⁵ 49.4 ⁷ 50 to 51 ⁶ 50.9 to 51.1 ²³	272 to 274 ⁶ @ 50mm 272 to 274 ⁵ @ 30mm 243 ²³ @ 15mm	0.7526 ⁷ @ 84° 0.7653 ⁵ @ 80° 0.7718 ⁵ @ 70° 0.7770 ⁵ @ 60° 0.7768 ⁶ @ 60°	1.4226 ⁷ @ 84°	
(from coal)	49.2 to 50.8 ²¹ 51 ¹⁷ 50.7 to 51.3 ⁸	242 to 243 ²¹ @ 15mm			
(from kerogen)	48.4 ²³	185 to 190 ²³ @ 1mm	0.7740 ²³ @ 60°	1.4370 ²³ @ 60°	
(from fossil wax)	51 ²³	250 ²³ @ 22.5mm			
(from brown coal tar)	52 ²⁴				
(from paraffin)		250 @ 15mm ¹³			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyltricosane $\begin{array}{c} \text{C}-\text{C}-(\text{C})_{20}-\text{C} \\ \\ \text{C} \end{array}$	42° 42° 37.7 ²⁸ 38.0 to 38.5 ²⁷	207.5 to 208 ²⁷ @ 3mm	0.7881, 0.7508 ⁹ @ 100° 0.7662 ²⁸ @ 70° 0.7827 ⁹ @ 50° 0.7882 ⁹ @ 42°	1.4279 ²⁸ @ 70°	$\frac{dD}{dt} = -0.000644/^{\circ}\text{C.}$ (42° to 100°)
"Isotetracosane" (structure unknown)	51 to 51.5 ^{1,10}	222 to 225 ¹⁰ @ 9mm			
2,2-Dimethyldocosane $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-(\text{C})_{19}-\text{C} \\ \\ \text{C} \end{array}$	34.55 to 34.75 ²⁷	191 to 191.5 @ 4mm ²⁷			

- (1) P. A. Levene and C. J. West, *J. Biol. Chem.* **18**, 477, 1914.
- (2) F. Krafft, *Ber.* **15**, 1718, 1882.
- (3) P. A. Levene, C. J. West, and J. van der Scheer, *J. Biol. Chem.* **20**, 528, 1915.
- (4) W. Gluud, *Ber.* **52**, 1040, 1919.
- (5) C. F. Mabery, *Am. Chem. J.* **28**, 190, 1902.
- (6) C. F. Mabery, *Am. Chem. J.* **33**, 280, 1905.
- (7) C. C. Buchler and G. D. Graves, *Ind. Eng. Chem.* **19**, 718, 1927.
- (8) F. Krafft, *Ber.* **40**, 4779, 1907.
- (9) S. Landa and R. Riedl, *Collection Czechoslovak. Chem. Commun.* **2**, 520, 1930.
- (10) P. A. Levene and C. J. West, *J. Biol. Chem.* **14**, 265, 1913.
- (11) A. Müller and W. B. Saville, *J. Chem. Soc.* **127**, 599, 1925.
- (12) D. E. Tsakalotos, *Compt. rend.* **143**, 1235, 1906.
- (13) F. Krafft, *Chem. Ztg.* **7**, 153, 1883.
- (14) R. Kuhn and L. Elmann, *Helv. Chim. Acta* **12**, 904, 1929.
- (15) K. Ziegler, F. Dersch, and H. Wollthan, *Ann.* **511**, 13, 1934.
- (16) A. Müller, *Proc. Roy. Soc. (London) A* **127**, 417, 1930.
- (17) E. Berl and H. Schildwachter, *Brennstoff-Chem.* **9**, 105, 1928.
- (18) F. Francis and N. E. Wood, *J. Chem. Soc.* **129**, 1420, 1926.
- (19) S. Landa, J. Cech, and V. Slíva, *Collection Czechoslovak. Chem. Commun.* **5**, 204, 1933.
- (20) A. Müller, *Proc. Roy. Soc. (London) A* **138**, 514, 1932.
- (21) F. Hofmann and P. Damm, *Brennstoff-Chem.* **4**, 65, 1923.
- (22) R. Ciusa and R. Vois, *Gazz. chim. ital.* **52**, I, 135, 1922.
- (23) J. W. McKinney, *J. Am. Chem. Soc.* **46**, 968, 1924.
- (24) E. Fromm and H. Eckard, *Ber.* **56**, 948, 1923.
- (25) T. H. Easterfield and N. McClelland, *J. Soc. Chem. Ind.* **42**, 936, 1923.
- (26) D. Perry, *J. Am. Chem. Soc.* **54**, 2918-20, 1932.
- (27) J. Strating and H. J. Backer, *Rec. trav. chim.* **55**, 903, 1936.
- (28) Henri Marcelet, *Compt. rend.* **202**, 867-9, 1936.
- (29) D. S. McKittrick, H. J. Henriques, and H. I. Wolff, *J. Inst. Petr. Tech.* **23**, 630, 1937.
- (30) J. v. Braun and P. Kurtz, *Ber.* **70B**, 1224-9, 1937.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Pentacosane	53.3				
C-(C) ₂₃ -C	53.3 ^{8,12,28} 55.5 to 56 ⁸	259 ¹⁸ @ 15mm			
<i>n</i>-Pentacosane (?)					
(from kerogen)	52.3 ²¹	195 to 200 ²¹ @ 1mm	0.7774 ²¹ @ 60°	1.4380 ²¹ @ 60°	
(from coal tar)	52.6 to 53.4 ²⁰ 53.5 to 54 ⁸	254 ^{8,20} @ 15mm		1.43202 ⁸ @ 65° 1.42624 ⁸ @ 80°	
(from brown coal)	53.8 to 54 ²		0.7785 ² @ M. P.		
(from paraffin wax)	53.3 ¹⁰ 53.4 ¹⁷				
(from birch bark)	53 to 54 ¹⁸				
(from petroleum)	53.3 ¹ 53.2 to 53.4 ²⁴ 53 to 54 ⁴ 54 ^{3,22} 54.3 to 54.8 ⁹	282 to 284 ³ @ 40mm 280 to 282 ⁴ @ 50mm	0.7582 ³ @ 90° 0.7558 ¹ @ 84° 0.7648 ³ @ 80° 0.7706 ³ @ 70° 0.7778 ³ @ 60°	1.4244 ¹ @ 84°	
(from tachardiacerin)	54 to 55 ¹⁴				

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Pentacosane (?) (Continued)					
(from Utah crude tar)	54 ¹⁸				
(from beeswax)	54 to 54.5 ¹⁹				
Isopentacosane					
(from cerebronic acid) (structure unknown)	56 ²³				
Pentacosanes					
of unknown structure	49 to 51 ¹¹ 53 to 54 ^{7,12}				

- (1) C. C. Buchler and G. D. Graves, *Ind. Eng. Chem.* **19**, 718, 1927.
- (2) F. Krafft, *Ber.* **40**, 4783, 1907.
- (3) C. F. Mabery, *Am. Chem. J.* **33**, 288, 1905.
- (4) C. F. Mabery, *Am. Chem. J.* **28**, 192, 1902.
- (5) W. Gluud, *Ber.* **52**, 1040, 1919.
- (6) P. Brigl, *Z. physiol. Chem.* **95**, 179, 1915.
- (7) P. A. Levene and C. J. West, *J. Biol. Chem.* **14**, 264, 1913.
- (8) G. S. Parks, H. M. Huffman, and S. B. Thomas, *J. Am. Chem. Soc.* **52**, 1032, 1930.
- (9) J. Read and A. C. P. Andrews, *J. Soc. Chem. Ind.* **39**, 289T, 1920.
- (10) G. S. Parks and H. M. Huffman, *Ind. Eng. Chem.* **23**, 1138, 1931.
- (11) F. Reindel, *Ann.* **480**, 76, 1930.
- (12) F. Petrii and J. Hadacek, *Collection Czechoslovak. Chem. Commun.* **7**, 90, 1935.
- (13) G. S. Parks and S. S. Todd, *Ind. Eng. Chem.* **21**, 1235, 1929.
- (14) A. Tschirch and H. H. Schaefer, *Pharm. acta Helv.* **1**, 9, 1926.
- (15) J. D. Davis and K. M. Irey, *Ind. Eng. Chem.* **23**, 186, 1931.
- (16) F. Francis and N. E. Wood, *J. Chem. Soc.* **129**, 1420, 1926.
- (17) M. E. Spaght, S. B. Thomas, and G. S. Parks, *J. Phys. Chem.* **36**, 882, 1932.
- (18) L. Ruzicka, G. F. Frame, H. M. Leicester, M. Liguori, and H. Brüngger, *Helv. Chim. Acta* **17**, 426, 1934.
- (19) A. Gascard and G. Damoy, *Compt. rend.* **177**, 1442, 1923.
- (20) F. Hofmann and P. Damm, *Brennstoff-Chem.* **4**, 65, 1923.
- (21) J. W. McKinney, *J. Am. Chem. Soc.* **46**, 968, 1924.
- (22) J. Dolinski and D. Wandycz, *Przemysl Chem.* **5**, 221, 1921.
- (23) P. A. Levene and F. A. Taylor, *J. Biol. Chem.* **52**, 227, 1922.
- (24) T. H. Easterfield and N. McClelland, *J. Soc. Chem. Ind.* **42**, 936, 1923.
- (25) H. R. Henze and C. M. Blair, *J. Am. Chem. Soc.* **54**, 1538, 1935.
- (26) S. Kuwada and S. Morimoto, *J. pharm. Soc. Japan*, **57**, 62-3, 1937.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Hexacosane	57		0.7573_s @ 90°		$\frac{dD}{dt} = -0.0006490/^\circ\text{C.}$ (90° to 160°)
C-(C) ₂₄ -C	56.1 ¹¹ 56.4 to 56.6 ¹³ 56.5 ^{6,10} 56.6 ¹ 56.8 to 57 ² 57 ¹⁷ 58.0 ¹⁶ 59 to 60 ⁵	262 @ 15mm ⁶ 199 ⁵ @ 0.4mm	0.7130 ¹⁷ @ 158.3° 0.7190 ¹⁷ @ 149 2° 0.7305 ¹⁷ @ 131.1° 0.7370 ¹⁷ @ 121.8° 0.7440 ¹⁷ @ 111° 0.7495 ¹⁷ @ 102.2° 0.7560 ¹⁷ @ 91.7° 0.7787 ² @ M. P.	1.42815 ⁶ @ 80° 1.42774 ⁶ @ 80° 1.43353 ⁶ @ 65° 1.43332 ⁶ @ 65°	
n-Hexacosane (?)					
(from olive oil)	51.8 ²⁴				
(from kerogen)	54.9 ²⁰	205 to 210 ²⁰ @ 1mm	0.7815 ²⁰ @ 60°	1.4408 ²⁰ ^{72°50} daylight	
(from fossil wax)	55 to 56 ¹⁹	280 ¹⁹ @ 32mm			
(from coal)	55.2 to 56.2 ¹⁸	262 to 263 ¹⁸ @ 15mm			
(from rose wax)	56 ¹²	272 to 275 ¹² @ 30mm			
(from supa*oil)	56.4 to 56.6 ¹⁶				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
<i>n</i>-Hexacosane (?) (Continued)					
(from petroleum)	55 to 56 ³ 56.4 ⁷ 55.7 ⁷ 56.7 ²² 58 ⁸ 73 ⁹	292 to 294 ⁸ @ 50mm 294 to 296 ³ @ 40mm 265 to 270 ⁹ @ 30mm 258 to 260 ²² @ 15mm	0.7606 ³ @ 90° 0.7580 ⁷ @ 84° 0.7719 ⁸ @ 80° 0.7671 ³ @ 80° 0.7779 ⁸ @ 70° 0.7742 ³ @ 70° 0.7843 ⁸ @ 60° 0.7805 ³ @ 60°	1.4257 ⁷ 1.4255 ⁷	
(from coal tar)	57.5 ²¹				
(from a plant)	64 ²³				
(from paraffin)		268 ¹⁴ @ 15mm			
Cerane					
(from ceryl alcohol)	61 ⁵	207 ⁵ @ 0.7mm			
13-Methylpentacosane					
Methyldilaurylmethane	28.8 to 29 ²⁸ 29 ²⁷		0.7720 ²⁷ @ 70°	1.4308 ²⁷ @ 70°	
$\begin{array}{c} \text{C}-(\text{C})_{11}-\text{C}-(\text{C})_{11}-\text{C} \\ \\ \text{C} \end{array}$					

- (1) J. Petersen, *Z. Elektrochem.* **12**, 144, 1906.
- (2) F. Krafft, *Ber.* **40**, 4783, 1907.
- (3) C. F. Mabery, *Am. Chem. J.* **33**, 288, 1905.
- (4) Fr. Nafzger, *Ann.* **224**, 236, 1884.
- (5) P. A. Levene, C. J. West, and J. van der Scheer, *J. Biol. Chem.* **20**, 528, 1915.
- (6) W. Gluud, *Ber.* **52**, 1040, 1049, 1919.
- (7) C. C. Buchler and G. D. Graves, *Ind. Eng. Chem.* **19**, 718, 1927.
- (8) C. F. Mabery, *Am. Chem. J.* **28**, 193, 1902.
- (9) C. F. Mabery and S. Tokano, *Am. Chem. J.* **25**, 304, 1901.
- (10) A. Gascard, *Ann. chim.* (9) **15**, 332, 1921.
- (11) W. E. Garner, Katherine Van Bibber, and Annie M. King, *J. Chem. Soc.* **1931**, 1533.
- (12) H. Prophète, *Compt. rend.* **183**, 609, 1926.
- (13) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, *Biochem. J.* **25**, 2072, 1932.
- (14) F. Francis and N. E. Wood, *J. Chem. Soc.* **129**, 1420, 1926.
- (15) A. Pollard, A. C. Chibnall, and S. H. Piper, *Biochem. J.* **25**, 2111, 1931.
- (16) A. Müller, *Proc. Roy. Soc. (London) A* **138**, 514, 1932.
- (17) R. Schenck and Maria Kintzinger, *Rec. trav. chim.* **42**, 759, 1923.
- (18) F. Hofmann and P. Damm, *Brennstoff-Chem.* **4**, 65, 1923.
- (19) R. Ciusa and R. Vois, *Gazz. chim. ital.* **52**, I, 135, 1922.
- (20) J. W. McKinney, *J. Am. Chem. Soc.* **46**, 968, 1924.
- (21) E. Fromm and H. Eckard, *Ber.* **56**, 948, 1923.
- (22) T. H. Easterfield and N. McClelland, *J. Soc. Chem. Ind.* **42**, 936, 1923.
- (23) J. Zellner and J. Scherr, *Arch. Pharm.* **262**, 381, 1924.
- (24) Henri Marcelet, *Compt. rend.* **202**, 867-9, 1936.
- (25) D. Perry, *J. Am. Chem. Soc.* **54**, 2918-2920, 1932.
- (26) J. Strating and H. J. Backer, *Rec. trav. chim.* **55**, 903, 1936.
- (27) D. S. McKittrick, H. J. Henriques, and H. I. Wolff, *J. Inst. Petr. Tech.* **23**, 630, 1937.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Heptacosane	60		0.7776 @ 60°		$\frac{dD}{dt} = -0.0006151/^\circ\text{C.}$ (60° to 100°)
C-(C) ₂₅ -C	59 ⁶	270 ^{1,6} @ 15mm	0.7528 ⁶ @ 100°	1.42874 ⁶ @ 80°	$\frac{dn}{dt} = -0.000383/^\circ\text{C.}$ (65° to 80°)
	59 to 59.1 ¹⁸	269 to 270 ⁶ @ 15mm	0.7545 ¹ @ 99°	1.43453 ⁶ @ 65°	
	59.4 ³		0.7730 ⁶ @ 65°	1.43442 ⁶ @ 65°	
	59.5 ^{1,5,6,9}		0.7796 ¹ @ 59.5°		
	60.5 ²⁰		liq.		
	61 ¹⁸		0.7789 ³ @ M. P. liquid		
			0.9169 ⁶ @ 25° solid		
n-Heptacosane (?)					
(from oil of cloves)	53 to 54 ²¹				
(from coal)	57.3 to 59 ²³	268 to 270 ²³ @ 15mm			
(from a plant)	58 to 59 ¹²				
(from apples)	59.0 to 59.1 ¹⁷				
(from beeswax)	59.2 59.5 ²²				
(from carnauba wax)	59 to 59.5 ¹⁴				
(from petroleum)	57.9 ⁷ 59.1 ⁷		0.7609 ⁷ @ 84° 0.7600 ⁷ @ 84°	1.4269 ⁷ @ 84° 1.4263 ⁷ @ 84°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Heptacosane (?) (Continued)					
(from rose wax)	59.5 ¹¹				
(from Ghedda wax)	59 to 59.5 ²⁴				
(from crude oil)	60.5 to 60.8 ¹⁰				
(from Utah crude tar)	60 ¹⁸				
(from Chinese wax)	61 to 62 ⁸				
(from sugar beet)	61.5 to 63.5 ¹³			1.4382 ¹³ @ 73°	
(from pine)		270 ¹⁹ @ 12mm	0.7729 ¹⁹ @ 70°		

- (1) F. Krafft, Ber. **15**, 1713, 1882.
- (2) F. Krafft and H. Weilandt, Ber. **29**, 1323, 1896.
- (3) F. Krafft, Ber. **40**, 4783, 1907.
- (4) F. B. Power and A. H. Salway, Am. J. Pharm. **83**, 1, 1911.
- (5) A. Gascard, Ann. chim. (9) **332**, 1921.
- (6) W. Gluud, Ber. **52**, 1039, 1919.
- (7) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.
- (8) W. Humnicki, Roczniki Chem. **15**, 52, 1935.
- (9) A. Müller and W. B. Saville, J. Chem. Soc. **127**, 599, 1925.
- (10) J. Read and A. C. Andrews, J. Soc. Chem. Ind. **39**, 289T, 1920.
- (11) H. Prophète, Compt. rend. **183**, 609, 1926.
- (12) M. C. Tummin Katti and S. V. Puntambekar, J. Indian Chem. Soc. **7**, 221, 1930.
- (13) A. Kiesel and B. Rubin, Z. physiol. Chem. **182**, 241, 1929.
- (14) S. Gottfried and F. Ulzer, Chem. Umschau Fette, Oele, Wachse, Harze **33**, 141, 1926.
- (15) J. D. Davis and K. M. Irey, Ind. Eng. Chem. **23**, 186, 1931.
- (16) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2072, 1932.
- (17) A. C. Chibnall, S. H. Piper, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2095, 1931.
- (18) A. Müller, Proc. Roy. Soc. (London) A **138**, 514, 1932.
- (19) Fr. Balas, Casopis Československého Lékařnictva **7**, 320, 1927.
- (20) H. Staudinger and F. Staiger, Ber. **68**, 707, 1935.
- (21) L. S. Gliitchitch, Bull. soc. chim. [4] **35**, 205, 1924.
- (22) A. Gascard and G. Damoy, Compt. rend. **177**, 1442, 1923.
- (23) F. Hofmann and P. Damm, Brennstoff-Chem. **4**, 65, 1923.
- (24) A. Lipp and E. Casimir, J. prakt. Chem. [2] **99**, 256, 1919.
- (25) D. Perry, J. Am. Chem. Soc. **54**, 2918-20, 1932.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Octacosane	61.6		0.7792 @ 61.6°	1.43679 @ 61.6°	$\frac{dn}{dt} = -0.000392/^{\circ}\text{C.}$ (65° to 80°)
C-(C) ₂₆ -C	59.4 ² 60 ¹ 61.5 ⁹ 61.6 ⁴ 62 ⁷ 64 to 65 ⁸	278 ⁷ @ 15mm 224 ⁸ @ 1.1mm 205 ¹ @ 0.2mm	0.7614 ² @ 84° 0.7792 ⁴ @ 61.6°	1.4270 ² @ 84° 1.42946 ⁷ @ 80° 1.42971 ⁷ @ 80° 1.43553 ⁷ @ 65° 1.43539 ⁷ @ 65°	
<i>n</i>-Octacosane (?)					
(from petroleum)	60 ^{3,5} 61.5 ¹⁴	310 to 312 ³ @ 50mm 316 to 318 ⁵ @ 40mm 272 to 274 ¹⁴ @ 15mm 286 ¹⁰ @ 15mm	0.7637 ³ @ 90° 0.7704 ³ @ 80° 0.7769 ³ @ 70°		
(from silk cocoons)	62 ¹¹				
(from a plant)	70 ¹²				
(from coal tar)	62 ¹³				
(from paraffin)		286 ¹⁰ @ 15mm			

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
10-<i>n</i>-Nonyl-<i>n</i>-Nonadecane $\begin{array}{c} \text{C}-(\text{C})_8-\text{C}-(\text{C})_8-\text{C} \\ \\ (\text{C})_8 \\ \\ \text{C} \end{array}$	-6 to -5.5 ¹⁵ -5.5 ¹⁷	232.5 to 233 ¹⁵ @ 3mm	0.7770 ¹⁷ @ 70°	1.4325 ¹⁷ @ 70°	

- (1) K. Zieler, F. Dersch, and H. Wollthan, *Ann.* **511**, 13-44, 1934.
- (2) C. C. Buchler and G. D. Graves, *Ind. Eng. Chem.* **19**, 718, 1927.
- (3) C. F. Mabery, *Am. Chem. J.* **28**, 195, 1902.
- (4) F. Krafft, *Ber.* **40**, 4783, 1907.
- (5) C. F. Mabery, *Am. Chem. J.* **33**, 289, 1905.
- (6) Menozzi and Moreschi, *Atti. accad. Lincei*, **17T**, 100, 1908.
- (7) W. Gluud, *Ber.* **52**, 1040, 1919.
- (8) P. A. Levene, C. J. West, and J. van der Scheer, *J. Biol. Chem.* **20**, 529, 1915.
- (9) S. H. Piper, A. C. Chibnall, S. J. Hopkins, J. A. B. Smith, and E. F. Williams, *Biochem. J.* **25**, 2072, 1932.
- (10) F. Francis and N. E. Wood, *J. Chem. Soc.* **129**, 1420, 1926.
- (11) D. Ongaro, *Ann. chim. applicata* **23**, 567, 1933.
- (12) H. Vogl, *Monatsh.* **44**, 19, 1923.
- (13) E. Fromm and H. Eckard, *Ber.* **56**, 948, 1923.
- (14) T. H. Easterfield and N. McClelland, *J. Soc. Chem. Ind.* **42**, 936, 1923.
- (15) J. Strating and H. J. Backer, *Rec. trav. chim.* **55**, 903, 1936.
- (16) D. Perry, *J. Am. Chem. Soc.* **54**, 2918-2920, 1932.
- (17) D. S. McKittrick, H. J. Henriques, and H. I. Wolff, *J. Inst. Petr. Tech.* **23**, 630, 1937.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
<i>n</i>-Nonacosane	64				$\frac{dn}{dt} = -0.000386/^\circ\text{C}.$ (65° to 85°)
C-(C) ₂₇ -C	62 to 62.5 ²³ 63.4 to 63.6 ¹⁴ 63.5 ²⁶ 63.9 ¹ 64 ⁶ 64.4 ¹⁷	286 ²⁶ @ 15mm	0.7797 ¹ @ 63.8°	1.43061 ²⁶ @ 80° 1.43640 ²⁶ @ 65°	
<i>n</i>-Nonacosane (?)					
(from petroleum)	62 to 63 ² 62.3 ⁵ 63.1 ⁵ 64 ²⁰ 64.0 ²²	346 to 348 ² @ 40mm 280 to 282 ²² @ 15mm	0.7644 ⁵ @ 84° 0.7642 ⁵ @ 84°	1.4286 ⁵ @ 84°	
(from coal tar)	63.5 ³	286 ³ @ 15mm		1.43061 ³ @ 80° 1.43640 ³ @ 65°	
(from gum myrrh)	62 to 63 ⁸		0.7790 ⁸ @ 65°	1.4361 ⁸ @ 65°	
(from cabbage leaves)	62.7 to 62.8 ⁷				
(from Haschisch)	63 ⁹				
(from oils of <i>Tetrademia glabrata</i>)	64 ¹¹				
(from apples)	63.4 to 63.6 ¹⁸ 65.1 ¹⁰				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Nonacosane (?) (Continued)					
(from lignin)	67 to 68 ¹²				
(from supa oil)	64 to 65 ¹³				
(from beeswax)	63.5 ¹⁹				
(from pollen of corn)	63.5 to 64 ²¹				
(from paraffin)		293.5 to 296.5 @ 15mm ¹⁶			

- (1) F. Krafft, Ber. **40**, 4783, 1907.
- (2) C. F. Mabery, Am. Chem. J. **33**, 289, 1905.
- (3) W. Gluud, Ber. **52**, 1040, 1919.
- (4) A. C. Chapman, J. Chem. Soc. **111**, 67, 1917; **113**, 459, 1918.
- (5) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.
- (6) A. Müller, Proc. Roy. Soc. (London) A **127**, 417, 1930.
- (7) H. J. Channon and A. C. Chibnall, Biochem. J. **23**, 168, 1929.
- (8) F. Trost and B. Doro, Ann. chim. applicata **25**, 227, 1935.
- (9) R. S. Cahn, J. Chem. Soc. **1931**, 630.
- (10) K. S. Markley, S. B. Hendricks, and C. E. Sando, J. Biol. Chem. **98**, 103, 1932.
- (11) M. Adams and G. R. Adams, J. Am. Chem. Soc. **56**, 991, 1934.
- (12) M. Phillips and M. J. Goss, Ind. Eng. Chem. **24**, 1436, 1932.
- (13) A. Müller, Proc. Roy. Soc. (London) A **120**, 437, 1928.
- (14) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2072, 1932.
- (15) F. Francis and N. E. Wood, J. Chem. Soc. **129**, 1420, 1926.
- (16) A. C. Chibnall, S. H. Piper, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2095, 1931.
- (17) A. Müller, Proc. Roy. Soc. (London) A **138**, 514, 1932.
- (18) A. C. Chapman, J. Chem. Soc., **123**, 769, 1923.
- (19) A. Gascard and G. Damoy, Compt. rend. **177**, 1442, 1923.
- (20) C. F. Mabery, J. Am. Chem. Soc. **39**, 2015, 1917.
- (21) R. J. Anderson, J. Biol. Chem. **55**, 611, 1923.
- (22) T. H. Easterfield and N. McClelland, J. Soc. Chem. Ind. **42**, 936, 1923.
- (23) C. E. Sando, K. S. Markley, and M. B. Matlack, J. Biol. chem. **114**, 39-45, 1936.
- (24) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, 1932.
- (25) C. F. Mabery, Am. Chem. J. **28**, 195, 1902.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Triacontane	66				
C-(C) ₂₉ -C	65.2 to 65.5	304 ^{16,25} @ 15mm	0.7797 ¹ @ 65.9°		
	65 to 66 ⁸	235 @ 1mm ⁴			
	65.5 ⁹	100 ⁸			
	65.6 ¹	@			
	65.6 to 66 ⁶	0.00001mm			
	66 ^{7,15}				
	66.1 ²				
	66 to 67 ¹⁷				
	69 to 70 ⁴				
<i>n</i>-Triacontane (?)					
(from paraffin)	70 ²⁰		0.7635 ²⁰ @ 105.4°	1.42254 ²⁰ <i>n</i> _{H₂} ^{105.4}	
				1.42996 ²⁰ <i>n</i> _{H₂} ^{108.4}	
(from rose wax)	65.5 to 66 ¹⁸	315 ¹³ @ 30mm			

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Triacontane (?)—(Continued)					
(from coal)	60 ²⁶	270 to 300 ²⁹ @ 20mm			
(from petroleum)	65.2 to 65.4 ²²	290 to 292 ²² @ 15mm			
(from supa oil)	63 to 64 ²³				
(from a plant)	65 ^{21, 28} 66 ²⁷ 66 to 66.5 ¹⁴				
(from brown coal)	64 to 65 ²²				
(from apple skins)	63.5 to 64 ³¹				
Mellisane					
(from melissyl alcohol)	73 to 74 ^{4, 30}	222 ⁴ @ 0.3mm			

Melting point of 63° to 64° ²³
is that of C₂₈H₅₈ according to
¹⁷.

- (1) F. Krafft, Ber. 40, 4783, 1907.
- (2) J. Petersen, Z. Elektrochem. 12, 144, 1906.
- (3) A. Gascard, Compt. rend. 153, 1485, 1911.
- (4) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. 20, 530, 1915.
- (5) M. Tsujimoto, Ind. Eng. Chem. 8, 895, 1916.
- (6) A. Gascard, Ann. chim. (9) 15, 332, 1921.
- (7) S. Landa, Paliva a topeni 11, 1-4, 1929.
- (8) W. H. Carothers, J. W. Hill, J. E. Kirby, and R. A. Jacobson, J. Am. Chem. Soc. 52, 5279, 1930.
- (9) W. E. Garner, Katherine Van Bibber, and Annie M. King, J. Chem. Soc. 1931, 1533.
- (10) I. M. Heilbron, T. P. Hilditch, and E. D. Kamm, J. Chem. Soc. 1926, 3131.
- (11) A. C. Chapman, J. Chem. Soc. 123, 769, 1923.
- (12) A. C. Chapman, J. Chem. Soc. 111, 56, 1917.
- (13) H. Prophète, Compt. rend. 183, 609, 1926.
- (14) Y. R. Naves, Parfums de France 7, 304, 1929.
- (15) A. Müller, Proc. Roy. Soc. (London) A 127, 417, 1930.
- (16) F. Francis and N. E. Wood, J. Chem. Soc. 129, 1420, 1926.
- (17) A. Müller, Proc. Roy. Soc. (London) Ser. A. 120, 437, 1928.
- (18) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. 25, 2072, 1932.
- (19) A. Müller, Proc. Roy. Soc. (London) A 138, 514, 1932.
- (20) J. F. Eykman, Rec. trav. chim. 12, 157-197, 1893.
- (21) R. L. McMurray, Am. J. Pharm. 105, 573, 1933.
- (22) S. Ruhemann and H. Raud, Brennstoff-Chem. 13, 341, 1932.
- (23) G. G. Henderson, W. M'Nab, and J. M. Robertson, J. Chem. Soc. 1926, 3077,
- (24) S. Landa, Chemické Listy 22, 294, 499, 1928.
- (25) F. Francis and N. E. Wood, J. Chem. Soc. 1927, 1897.
- (26) G. Rivière and G. Pichard, Compt. rend. 179, 775, 1924.
- (27) J. A. Goodson, Biochem. J. 16, 489, 1922.
- (28) J. Einleger, J. Fischer, and J. Zellner, Monatsh. 44, 277, 1923.
- (29) C. F. Mabery, J. Am. Chem. Soc. 39, 2015, 1917.
- (30) Farbenfabriken vorm. Friedr. Bayer & Co., German Patent 296741, Feb. 24, 1917.
- (31) C. E. Sando, J. Biol. Chem. 56, 457, 1923.
- (32) T. H. Easterfield and N. McClelland, J. Soc. Chem. Ind. 42, 936, 1923.
- (33) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. 53, 3084, 1931.
- (34) I. M. Heilbron, Proc. 5th Pacific Sci. Congr. 5, 3683-92, 1934.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
<i>n</i>-Hentriacontane	68.4 .				$\frac{dD}{dt} = -0.0006035/^{\circ}\text{C.}$ (68.4° to 100°)
C-(C) ₂₈ -C	67.6 to 67.8 ¹⁰ 68 to 69 ^{7,16} 68.1 ² 68.4 ^{3,11} 69 ^{6,8}	302 @ 15mm ² 199 @ 0mm ¹ 193.5 ³ @ 0mm 	0.7619 ² @ 98.8° 0.7730 ² @ 80.8° 0.7808 ² @ 68.1° 0.7799 ³ @ 68.4°		
<i>n</i>-Hentriacontane (?)					
(from petroleum)	65.3 ⁵ 65.9 ⁵ 66 ^{4,24} 67.8 to 68.2 ²⁷	316 to 318 ⁴ @ 50mm 299 to 303 ²⁷ @ 15mm 200 to 205 ¹³ @ 0.01mm	0.7677 ⁵ @ 84° 0.7660 ⁵ @ 84° 0.7997 ⁴ D ₇₀ ⁷⁰	1.4297 ⁵ @ 84° 1.4300 ⁵ @ 84°	
(from apricots)	68 ¹³				
(from mentha piperita)	69 to 69.5 ¹⁸				
(from Ghedda wax)	68 to 68.5 ²⁶				
(from myricyl iodide)	69 ²³				
(from beeswax)	68.4 to 69 ²²				
(from silk)	68 ²⁰				
(from spinach)	68 to 68.5 ¹⁷				
(from pine)	68.5 ¹²				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Hentriacontane (?) (Continued) (from a plant)	67 to 69 ^{14,18} 68 ° 68 to 69 ¹⁹ 68 to 69.5 ²¹				

- (1) F. Kraft and H. Weilandt, Ber. 29, 1323, 1896.
- (2) F. Kraft, Ber. 15, 1714, 1882.
- (3) F. Kraft, Ber. 40. 4783, 1907.
- (4) C. F. Mabery, Am. Chem. J. 33, 281, 1905.
- (5) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. 19, 718, 1927.
- (6) A. Gascard, Ann. chim. [9] 15, 332, 1921.
- (7) A. Müller, Proc. Roy. Soc. (London) A 120, 437, 1928.
- (8) A. Müller and W. B. Saville, J. Chem. Soc. 127, 599-603, 1925.
- (9) R. R. Agarwal and S. Dutt, Current Sci. 3, 250-1, 1934.
- (10) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. 25, 2072, 1932.
- (11) A. Muller, Proc. Roy. Soc. (London) A 138, 514, 1932.
- (12) Fr. Balas, Casopis Československého Lékařnictva 7, 320, 1927.
- (13) H. Brockman, Z. physiol. Chem. 216, 45, 1933.
- (14) D. N. Majumdar and P. C. Guha, J. Indian Inst. Sci., Ser. A., 16, 29, 1933.
- (15) L. Schmid and W. Rumpel, Monatsh 60, 8, 1932.
- (16) R. Pummerer and H. Kranz, Ber. 62, 2620, 1929.
- (17) Edith Clenshaw and Ida Smedley-Maclean, Biochem. J. 23, 107, 1929.
- (18) H. A. Braun, Am. J. Pharm. 102, 202, 1930.
- (19) M. C. Tummin Katti and V. P. Shintre, Arch. Pharm. 268, 314, 1930.
- (20) Oku-Masami, Bull. Agricult. Chem. Soc. Japan 4, 123, 1929.
- (21) R. Kuhn, A. Winterstein, and E. Lederer, Z. physiol. Chem. 197, 141, 1931.
- (22) A. Gascard and G. Damoy, Compt. rend. 177, 1442, 1923.
- (23) A. Gascard, Compt. rend. 170, 886, 1920.
- (24) C. F. Mabery, J. Am. Chem. Soc. 39, 2015, 1917.
- (25) M. C. Hart and F. W. Heyl, J. Am. Chem. Soc. 38, 2805, 1916.
- (26) A. Lipp and E. Casimer, J. prakt. Chem. [2] 99, 256, 1919.
- (27) T. H. Easterfield and N. McClelland, J. Soc. Chem. Ind. 42, 936, 1923.
- (28) D. Perry, J. Am. Chem. Soc. 54, 2918-2920, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Dotriacontane (?)—(Continued)					
(from paraffin wax)	66.6 ¹⁷	217 to 219 ¹⁷ @ 0.05	0.7678 ¹⁷ @ 100°		
(from candelilla wax)	71 ⁸	310 @ 15mm ⁸			
(from brown coal)	70 to 71 ³⁸				
(from mentha aquatica)	69.5 to 70 ²¹				
(from crude tar)	69.6 ²⁸				
16-Methylhentriacontane					
$\text{C}-(\text{C})_{14}-\underset{\text{C}}{\underset{ }{\text{C}}}-\text{C}-(\text{C})_{14}-\text{C}$	32 to 34 ¹⁵		0.7824 ¹⁵ @ 83° 0.8086 ¹⁵ @ 42°	1.4395 ¹⁵ @ 71.5° 1.4517 ¹⁵ @ 40.5°	$\frac{dD}{dt} = -0.000639/^{\circ}\text{C.}$ (40° to 90°) $\frac{dn}{dt} = -0.000394/^{\circ}\text{C.}$ (40° to 90°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
7,12-Dimethyl-9,10-di-<i>n</i>-hexyloctadecane (?) $\begin{array}{c} \text{C}-(\text{C})_6-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-(\text{C})_6-\text{C} \\ \qquad \qquad \qquad \qquad \qquad \\ \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \end{array}$		256 ²² @ 13mm	0.8182 ²²	1.4607 ²²	
7,9,10,12-Tetramethyl-8,11-di-<i>n</i>-pentyl-octadecane (?) $\begin{array}{c} \text{C}-(\text{C})_6-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-(\text{C})_6-\text{C} \\ \quad \quad \quad \quad \quad \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \end{array}$		256 ²⁰ @ 13mm	0.8182 ²⁰	1.4607 ²⁰	Probably identical with preceding hydrocarbon.

- (1) K. Ziegler, F. Dersch, and H. Wollthan, *Ann.* **511**, 13, 1934.
- (2) F. Kraft, *Ber.* **19**, 2218, 1886.
- (3) C. C. Buchler and G. D. Graves, *Ind. Eng. Chem.* **19**, 718, 1927.
- (4) F. Kraft and H. Weilandt, *Ber.* **29**, 1323, 1896.
- (5) J. H. Hildebrand and A. Wächter, *J. Am. Chem. Soc.* **51**, 2487, 1929.
- (6) F. Kraft, *Ber.* **40**, 4783, 1907.
- (7) C. F. Mabery, *Am. Chem. J.* **33**, 282, 1905.
- (8) H. Meyer and W. Soyka, *Monatsh.* **34**, 1163, 1913.
- (9) P. A. Levene, C. J. West, and J. van der Scheer, *J. Biol. Chem.* **20**, 530, 1915.
- (10) R. F. Rutten, *VIIIth Inter. Congr. of Pure Applied Chem.* **25**, 435, 1912.
- (11) A. Gascard, *Compt. rend.* **159**, 259, 1914.
- (12) A. Gascard, *Ann. chim.* [9] **15**, 332, 1921.
- (13) K. B. B. Sorabji, *J. Chem. Soc.* **47**, 37, 1885.
- (14) E. Späth, *Sitzb. Akad. Wiss. Wien, Math. naturw. Klasse, abt. II b*, **122**, 1207, 1913.
- (15) H. Suida and R. Planckh, *Ber.* **66**, 1445, 1933.
- (16) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, *Biochem. J.* **25**, 2072, 1932.
- (17) F. Francis, C. M. Watkins, and R. W. Wallington, *J. Chem. Soc.* **121**, 1529, 1922.
- (18) S. Ruhenann and H. Raud, *Brennstoff-Chem.* **13**, 341, 1932.
- (19) L. Defiet, *Bull. soc. chim. Belg.* **44**, 41, 97, 1935.
- (20) Y. Delcourt, *Bull. soc. chim. Belg.* **40**, 284, 1931.
- (21) S. M. Gordon, *Am. J. Pharm.* **100**, 433, 509, 1928.
- (22) M. Lerer, *Ann. combustibles liquides* **8**, 681-733, 1933.
- (23) D. D. Coffman, June Chien-Yu Tsao, L. E. Schniepp, and C. S. Marvel, *J. Am. Chem. Soc.* **55**, 3792, 1933.
- (24) D. Vorländer and W. Selke, *Z. physik. Chem.* **129**, 435, 1927.
- (25) J. F. Eykman, *Rec. trav. chim.* **14**, 185, 1895.
- (26) H. H. Schlubach and E. C. Goes, *Ber.* **55**, 2889, 1922.
- (27) J. F. Eykman, *Chem. Weekblad* **3**, 653-62, 1906.
- (28) E. Fromm and H. Eckard, *Ber.* **56**, 948, 1923.
- (29) W. F. Seyer and R. Fordyce, *J. Am. Chem. Soc.* **58**, 2029-2031, 1936.
- (30) G. Hugel, *Chim. et Ind.* **26**, 1282-88, Dec. 1931; *Congr. Graissage, Strasbourg, Compt. rend.* **1931**, 146-61.
- (31) D. Perry, *J. Am. Chem. Soc.* **54**, 2918-2920, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tritriacontane	71.6				
C-(C) ₃₁ -C	71.1 ^{3,6} 71.5 ¹² 71.8 ¹ 72 ¹⁰	328 ⁷ @ 15mm	0.7801 ¹ @ 71.8°		
n-Tritriacontane (?)					
(from paraffin wax)	69.4 ² 71.0 ⁸ 71.1 ⁵		0.7706 ² @ 84° 0.7695 ² @ 84°	1.4323 ² @ 84° 1.4316 ² @ 84°	
(from Hypericum perforatum L.)	63 ⁹				
16-Ethylhentriacontane					
(C) ₁₅ -C-(C) ₁₅ C-C	14 to 18 ⁴ 32 ¹¹		0.7934 ⁴ @ 66° 0.8214 ⁴ @ 22.5°		$\frac{dD}{dt} = -0.000644/^\circ\text{C.}$ (20° to 70°)

- (1) F. Krafft, Ber. 40, 4783, 1907.
- (2) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. 19, 718, 1927.
- (3) G. S. Parks, H. M. Huffman, and S. B. Thomas, J. Am. Chem. Soc. 52, 1032, 1930.
- (4) H. Suida and R. Planckh, Ber. 66, 1445, 1933.
- (5) G. S. Parks and H. M. Huffman, Ind. Eng. Chem. 23, 1138, 1931.
- (6) G. S. Parks and S. S. Todd, Ind. Eng. Chem. 21, 1235, 1929.
- (7) F. Francis and N. E. Wood, J. Chem. Soc. 129, 1420, 1926.
- (8) M. E. Spaght, S. B. Thomas, and G. S. Parks, J. Phys. Chem. 36, 882, 1932.
- (9) J. Zellner and Z. Porodko, Arch. Pharm. 263, 161, 1925.
- (10) D. Vorländer and W. Selke, Z. physik. Chem. 129, 435, 1927.
- (11) H. Staudinger and F. Staiger, Ber. 68, 707, 1935.
- (12) N. Titow, Brennstoff-Chem. 13, 266, 1932.
- (13) D. Perry, J. Am. Chem. Soc. 54, 2918-2920, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tetratriacontane	73		0.7806 @ 73°		
C-(C) ₁₂ -C	72.4 ⁸	336 @ 15mm ⁹	0.8073 ¹⁴		
	72.5 to	255 @ 1mm ⁴	@ 80°		
	72.8 ¹⁰	215 @ 0mm ²	0.7806 ³		
	72.6 to		@ 73°		
	72.8 ¹²				
	72.8 ¹¹				
	72.9 ¹				
	73 ²				
	73.2 ^{5,8}				
	73.5 ¹⁴				
	76 to				
	76.5 ⁴				
n-Tetratriacontane (?)					
(from paraffin)	72.3 ⁷		0.7715 ⁷	1.4329 ⁷	
			@ 84°	@ 84°	
			0.7706 ⁷	1.4323 ⁷	
			@ 84°	@ 84°	
(from petroleum)	71 to 72 ³	366 to 368 ³	0.8009 ³		
		@ 50mm	D ₂₀ ²⁰		
(from oleander)	70 ¹³				
(from brown coal tar)	73 ¹⁸				

- (1) J. Petersen, Z. Elektrochem. **12**, 144, 1906.
- (2) F. Krafft, Ber. **40**, 4783, 1907.
- (3) C. F. Mabery, Am. Chem. J. **33**, 284, 1905.
- (4) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. **20**, 531, 1915.
- (5) A. Gascard, Compt. rend. **153**, 1486, 1911.
- (6) A. Gascard, Ann. chim. [9] **15**, 332, 1921.
- (7) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.
- (8) W. E. Garner, Katherine Van Bibber, and Annie M. King, J. Chem. Soc. **1931**, 1533.
- (9) F. Francis and N. E. Wood, J. Chem. Soc. **129**, 1420, 1926.
- (10) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2072, 1932.
- (11) A. Müller, Proc. Roy. Soc. (London) **A138**, 514, 1932.
- (12) A. C. Chibnall, A. L. Latner, E. F. Williams, and C. A. Ayre, Biochem. J. **28**, 313, 1934.
- (13) H. Tauber and J. Zellner, Arch. Pharm. **264**, 689, 1926.
- (14) A. Pictet and J. Potok, Helv. Chem. Acta **2**, 501, 1919.
- (15) E. Fromm and H. Eckard, Ber. **56**, 948, 1923.
- (16) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Pentatriacontane	74.6		0.7814 @ 74.6°		$\frac{dD}{dt} = -0.000613/^\circ\text{C.}$ (74.6° to 100°)
C-(C) ₃₃ -C	73 ^{4,5,14} 74 ^{1,7,8} 74.4 to 74.6 ¹⁰ 74.6 ¹² 74.7 ²	331 @ 15mm ³ 222 @ 0mm ¹	0.7664 ² @ 99.2° 0.7775 ² @ 80.8° 0.7816 ² @ 74.5° 0.7813 ¹ @ 74°		
n-Pentatriacontane (?)					
(from petroleum)	76 ³	380 to 384 ² @ 50mm	0.8052 ³ D ₈₀ ⁸⁰		
(from paraffin)	73.6 to 73.9 ⁶		0.7728 ⁶ @ 84° 0.7727 ⁶ @ 84°	1.4334 ⁶ @ 84° 1.4333 ⁶ @ 84°	
(from the cotton plant)	75 ¹¹				
(from Agave rigida)	70 to 72 ¹³				
(from bitumen)	75 to 76 ¹⁶				
16-Butylhentriacontane					$\frac{dD}{dt} = -0.000648/^\circ\text{C.}$ (20° to 70°)
(C) ₁₅ -C-(C) ₁₅ (C) ₄	23 ⁹		0.7913 ⁹ @ 70° 0.8263 ⁹ @ 16°	1.4408 ⁹ @ 70° 1.4602 ⁹ @ 19°	$\frac{dn}{dt} = -0.000380/^\circ\text{C.}$ (20° to 70°)

- (1) F. Krafft, Ber. **40**, 4779, 1907.
- (2) F. Krafft, Ber. **15**, 1715, 1882.
- (3) C. F. Mabery, Am. Chem. J. **33**, 284, 1905.
- (4) E. Clemmensen, Ber. **46**, 1842, 1913.
- (5) T. H. Easterfield and C. M. Taylor, J. Chem. Soc. **99**, 2305, 1911.
- (6) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.
- (7) W. E. Garner, Katherine Van Bibber, and Annie M. King, J. Chem. Soc. **1931**, 1533.
- (8) A. Müller and W. B. Saville, J. Chem. Soc. **127**, 599, 1925.
- (9) H. Suida and R. Planckh, Ber. **66**, 1445, 1933.
- (10) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2072, 1932.
- (11) F. B. Power and V. K. Chesnut, J. Am. Chem. Soc. **48**, 2721, 1926.
- (12) Ad. Grün, E. Ulbrick, and F. Krczil, Z. angew. Chem. **39**, 421, 1926.
- (13) V. H. Legg and R. V. Wheeler, J. Chem. Soc. **1929**, 2444.
- (14) H. Staudinger and F. Staiger, Ber. **68**, 707, 1935.
- (15) N. Titow, Brennstoff-Chem. **13**, 266, 1932.
- (16) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Hexatriacontane	76				
C-(C) ₃₄ -C	75 ^a 75.7 to 75.9 ^b 76 ^{1,2,7} 76.5 ³ 78.5 ⁴	265 @ 1mm ⁴ 230 to 240 @ 0.02mm ⁵ 230 @ 0mm ¹	0.7819 ¹ @ 75°		
n-Hexatriacontane (?)					
(from paraffin)	74.8 to 75.6 ⁶		0.7741 ⁶ @ 84° 0.7739 ⁶ @ 84°	1.4342 ⁶ @ 84° 1.4339 ⁶ @ 84°	

(1) F. Krafft, Ber. **40**, 4783, 1907.

(2) A. Gascard, Compt. rend. **153**, 1486, 1911.

(3) Oskerko, J. Russ. Phys. Chem. Soc. **46**, 414, 1914.

(4) P. A. Levene, C. J. West, and J. van der Scheer, J. Biol. Chem. **20**, 531, 1915.

(5) K. Ziegler, F. Dersch, and H. Wollthan, Ann. **511**, 13, 1934.

(6) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.

(7) A. Gascard, Ann. chim. [9] **15**, 332, 1921.

(8) S. H. Piper, A. C. Chibnall, S. J. Hopkins, A. Pollard, J. A. B. Smith, and E. F. Williams, Biochem. J. **25**, 2072, 1932.

(9) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, 1932.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
<i>n</i>-Heptatriacontane (?)					
(from paraffin)	76.2 ¹ 76.4 ¹		0.7753 ¹ @ 84° 0.7743 ¹ @ 84°	1.4347 ¹ @ 84° 1.4345 ¹ @ 84°	
18-Ethylpentatriacontane					
$\begin{array}{c} \text{C}-(\text{C})_{18}-\text{C}-(\text{C})_{18}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$	20 to 21 ⁴ 27 to 28 (after stand- ing) ⁴ 39 ² 39.5 ⁶	260 to 265 ⁴ @ 0.5mm	0.773 ⁶ @ 100°	1.4348 ⁶ @ 90°	
C₃₈H₇₈					
<i>n</i>-Octatriacontane					
C-(C) ₃₆ -C	79.3 ⁶		0.7688 ⁶ @ 100°	1.4326 ⁶ @ 90°	
<i>n</i>-Octatriacontane (?)					
(from paraffin)	77.1 ¹ 77.2 ¹ 79.4 ⁶		0.7759 ¹ @ 84° 0.7757 ¹ @ 84° 0.961 ⁶	1.4351 ¹ @ 84° 1.4349 ¹ @ 84°	Octatriacontanes: (8, 964, 747, 474, 595 Structural Isomers possible ²)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
18-<i>n</i>-Propylpentatriacontane $\begin{array}{c} \text{C}-(\text{C})_{16}-\text{C}-(\text{C})_{18}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$	64.5 ⁶		0.781 ⁶ @ 100°	1.4376 ⁶ @ 90°	
C₂₃H₄₆ <i>n</i>-Nonatriacontane (?) (from paraffin)	78.8 ¹ 79.0 ¹		0.7771 ¹ @ 84°	1.4359 ¹ @ 84° 1.4358 ¹ @ 84°	Nonatriacontanes: (23,647,478,933,969 structural isomers possible ³)

(1) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. 19, 718, 1927.

(2) H. Staudinger and F. Staiger, Ber. 68, 707, 1935.

(3) D. Perry, J. Am. Chem. Soc. 54, 2918-2920, 1932.

(4) H. Staudinger and W. Kern, Ber. 66, 373-8, 1933.

(5) J. Morozewicz, Anz. Akad. Wiss. Krakov. 1908, 1067.

(6) M. Pogacnik, "Isostructure of Ceresin Hydrocarbons," discussion quoted in K. Müller and F. Pilat, J. Inst. Petr. Tech. 21, 887, 1935.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
n-Tetracontane C-(C) ₃₈ -C	80.5 to 81 ¹	150 ¹ @ 0.00001mm			
n-Tetracontane (?) (from paraffin)	80.3 ² 80.5 ²		0.7785 ² @ 84° 0.7780 ² @ 84°	1.4365 ² 1.4363 ²	
2,6,10,14,19,23,27,31-Octamethyldotriacontane (from phytol)		240 to 242 ³ @ 0.3mm 212 to 214 ⁴ @ 0.02mm	0.824 ⁴ @ 18°	1.4590 ⁴ @ 18°	
Perhydrolycopin (probably 2,6,10,14,19,23,27,31-octamethyldotriacontane)		238 to 240 ⁴ @ 0.3mm 212 to 214 ⁴ @ 0.02mm	0.8211 ³ @ 18° 0.822 ⁴ @ 18°	1.45837 ³ @ 18° 1.4584 ⁴ @ 18°	

- (1) W. H. Carothers, J. W. Hill, J. E. Kirby, and R. A. Jacobson, J. Am. Chem. Soc. **52**, 5279, 1930.
- (2) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.
- (3) P. Karrer, A. Helfenstein, and Rose Widmer, Helv. Chim. Acta **11**, 1201, 1928.
- (4) P. Karrer, A. Helfenstein, B. Pieper, and A. Wettstein, Helv. Chim. Acta **14**, 435, 1931.
- (5) H. R. Henze and C. M. Blair, J. Am. Chem. Soc. **53**, 3084, 1931.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Hentetracontane (?)					
(from paraffin)	80.7 ¹ 82.5 ¹		0.7784 ¹ @ 84°	1.4366 ¹ @ 84° 1.4372 ¹ @ 84°	
C₄₃H₈₆					
<i>n</i>-Dotetracontane (?)					
(from paraffin)	82.9 ¹		0.7803 ¹ @ 84°	1.4375 ¹ @ 84°	
C₄₅H₈₈					
<i>n</i>-Tritetracontane (?)					
(from paraffin)	83.3 ¹ 83.8 ¹		0.7810 ¹ @ 84°	1.4378 ¹ @ 84° 1.4379 ¹ @ 84°	
C₄₆H₉₀					
<i>n</i>-Tetratetracontane					
C-(C) ₄₄ -C	86.4 ²				
C₄₈H₉₂					
<i>n</i>-Pentatetracontane (?)					
(from rubber)		350 @ 1mm ³			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,8,13,17,22,26,31,35-Octamethyloctatriacontane (Dibixane)		270 to 275 ° @ 0.2mm 255 to 260 ° @ 0.08mm	0.8287 ° @ 20.9°	1.46265 ° @ 20.9°	
C₄₇H₉₈ 16-Pentadecyldotriacontane 16-Cetylhentriacontane					
$\begin{array}{c} \text{(C)}_{16}-\text{C}-(\text{C})_{16} \\ \\ (\text{C})_{15} \end{array}$	45.5 to 46 °			1.4450 ° @ 66°	

- (1) C. C. Buchler and G. D. Graves, Ind. Eng. Chem. **19**, 718, 1927.
- (2) A. Müller, Proc. Roy. Soc. (London) **A138**, 514, 1932.
- (3) R. Pummerer and A. Koch, Ann. **438**, 294, 1924.
- (4) P. Karrer, M. Stoll, and P. Stevens, Helv. Chim. Acta **14**, 1194-1204, 1931.
- (5) H. Suida and R. Planckh, Ber. **66**, 1445, 1933.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Tetrapentacontane					
Diceryl	95 ⁴				
C-(C) ₁₂ -C					

- (1) M. Lerer, Ann. combustibles liquides **8**, 681, 1933.
 (2) W. H. Carothers, J. W. Hill, J. E. Kirby, and R. A. Jacobson, J. Am. Chem. Soc. **52**, 5279, 1930.
 (3) F. S. Sinnatt and M. Barash, Inst. Min. Eng., Nov. 11, 1919; J. Soc. Chem. Ind. **39**, 289A, 1920.
 (4) A. Gascard, Ann. chim. [9] **15**, 332, 1921.
 (5) E. Huppert, H. Swiatkowski, and J. Zellner, Monatsh. **48**, 491, 1927.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
19,34-Diethyldopentacontane $\begin{array}{c} \text{C}_{18}-\text{C}-(\text{C})_{14}-\text{C}-(\text{C})_{18} \\ \qquad \qquad \\ \text{C}-\text{C} \qquad \text{C}-\text{C} \end{array}$	26 ⁶				
C₆₀H₁₂₂ n-Hexacontane $\text{C}-(\text{C})_{58}-\text{C}$	98.5 to 99.3 ¹	250 ¹ (@ 0.00001mm	0.7203 ⁵ @ 190.6° 0.7244 ⁵ @ 178.8° 0.7311 ⁵ @ 159.9° 0.7335 ⁵ @ 153.15° 0.7417 ⁵ @ 129.5° 0.7465 ⁵ @ 115.4°		Hexacontanes: (22,158,734,535,770, 411,074,184 struc- tural isomers pos- sible ⁶) $\frac{dD}{dt} = -0.0003491/^{\circ}\text{C.}$ (115° to 195°)
C₆₂H₁₂₆ n-Doehexacontane Dimyricyl $\text{C}-(\text{C})_{60}-\text{C}$	100.5 ³ 101 to 102 ³ 101 to 102 ⁴				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
<i>n</i>-Tetrahexacontane					
Dilacceryl C-(C) ₆₂ -C	102 °				
$C_{66}H_{134}$ <i>n</i>-Hexahexacontane					Impure 7
C-(C) ₆₄ -C	103.6 7				
$C_{67}H_{136}$ <i>n</i>-Heptahexacontane					Impure 7
C-(C) ₆₅ -C	104.1 7				

- (1) W. H. Carothers, J. W. Hill, J. E. Kirby, and R. A. Jacobson, J. Am. Chem. Soc. **52**, 5279, 1930.
 (2) A. Gascard, Ann. chim. [9] **15**, 332, 1921.
 (3) K. Struve, Ann. **362**, 123, 1908.
 (4) C. Hell and C. Hägele, Ber. **22**, 504, 1889.
 (5) R. Schenck and M. Kintzinger, Rec. trav. chim. **42**, 759, 1923.
 (6) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, 1932.
 (7) F. Francis, A. M. King, and J. A. V. Willis, J. Chem. Soc. 1937, 999-1004.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
<i>n</i>-Heptacontane C-(C) ₆₈ -C	105 to 105.5 ¹	300 ¹ @ 0.00001mm			
C₇₀H₁₄₀ 2,5,9,13,17,24,28,32,36, 41,45,49,53,60,64,68,72, 75-Octadecamethyl- hexaheptacontane		330 ² @ 0.04mm			

(1) W. H. Carothers, J. W. Hill, J. E. Kirby, and R. A. Jacobson, J. Am. Chem. Soc. **52**, 5279, 1930.(2) P. Karrer, M. Stoll, and P. Stevens, Helv. Chim. Acta **14**, 1194, 1931.(3) F. Fischer and H. Tropsch, Ber. **60**, 1330, 1927.(4) D. Perry, J. Am. Chem. Soc. **54**, 2918-2920, 1932.

III. PHYSICAL CONSTANTS OF ALKENES OR OLEFINS

1. Alkenes or Monoolefins
2. Alkadienes or Diolefins
3. Alkatrienes or Triolefins
4. Alkatetraenes or Tetraolefins
5. Alkapentaenes or Pentaolefins
6. Alkahexaenes or Hexaolefins

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Ethene	-169.44	-102.4	0.6104₁ @ -102.4°		log ₁₀ P _{atm} = $\frac{-995.30018}{T}$ + 8.7083545 - 0.025907196 T + 0.00006380597 T ² - 0.00000005603635 T ³ (0.0517 to 48.162 atm.) (T = t°C + 273.09) ¹⁸
C=C				1.3632 ¹² @ -100°	$\frac{dD}{dt} = -0.002033$ (1 + 0.002859t)/°C. (-150° to -70°)
-183 ¹⁹ ca.	-101.4 ⁷ @ 800mm	0.21597 ¹⁵ @ 9.5°			
-181.4 ¹⁷	-103.9 ⁸ @ 767.5mm	0.335 ¹ @ 8°			
-169.44 ⁸	-105.4 ⁹	0.28726 ¹⁵ @ 7.98°			
-169.4 ¹⁴	-105 ⁴	0.30342 ¹⁵ @ 6.50°			
-169.00 ⁶	-104.3 ⁶	0.306 ⁵ @ 6.2°			
-169 ¹⁷	-104 ²⁰	0.361 ¹ @ 6°			
	-103.9 ^{2,3,14}	0.30840 ¹⁵ @ 5.84°			
	-103.55 ²²	0.332 ⁵ @ 4.3°			
	-103.50 ²¹	0.386 ¹ @ 3°			
	-102.5 ^{17,19}	0.353 ⁵ @ -3.7°			
	-102.45 ¹⁸	0.37721 ¹⁵ @ -7.70°			
	-102.4 ⁷	0.38818 ¹⁵ @ -10.93°			
	-102 to -103 ²³	0.39855 ¹⁵ @ -14.18°			
	-100 ¹²	0.41313 ¹⁵ @ -19.205°			
	-102.7 ¹¹ @ 756.9mm	0.414 ⁵ @ -21°			
	-102.65 ¹¹ @ 756.9mm	0.42655 ¹⁵ @ -24.33°			
	-102.6 ⁷ @ 750mm	0.45610 ¹⁵ @ -37.13°			
	-103 ¹⁶ @ 750mm	0.47822 ¹⁵ @ -48.15°			
	-102.9 ¹¹ @ 744.3mm				
	-110.33 ¹⁶ @ 508mm				
	-126 ¹⁶ @ 107mm				
	-129.2 ¹⁹ @ 100mm				
	-132.2 ^{2,3} @ 100mm				
	-150.4 ¹⁶ @ 9.8mm				
	-154.8 ^{2,3} @ 9mm				

<i>Name and Carbon Skeleton</i>	<i>M. P., °C</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Ethene—(Continued)			0.50588 ¹⁴ @ 63.41° 0.5172 ¹⁴ @ - 69.45° 0.5247 ¹⁴ @ - 74.2° 0.5400 ¹⁴ @ - 84.05° 0.5482 ¹⁴ @ - 89.4° 0.5559 ¹⁴ @ - 94.3° 0.5630 ¹⁴ @ - 99.05° 0.5631 ¹³ @ - 99.4° 0.56740 ¹⁵ @ - 103.01° 0.5657 ¹³ @ - 103.3° 0.5696 ¹⁴ @ - 103.7° 0.5699 ¹⁴ @ - 103.9° 0.5669 ¹³ @ - 105.0° 0.5710 ⁹ @ - 105.4°		

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Ethene—(Continued)			0.5674 ¹³ @ — 105.9° 0.5696 ¹³ @ — 107.7° 0.5762 ¹⁴ @ — 108.7° 0.5752 ¹³ @ — 114.2° 0.58380 ¹⁵ @ — 114.69° 0.60449 ¹⁵ @ — 129.90° 0.62465 ¹⁵ @ — 145.07° 0.6585 ⁹ @ — 169°		

- (1) M. L. Bleekrode, *Rec. trav. chim.* **4**, 77, 1885.
- (2) G. A. Burrell and I. W. Robertson, *J. Am. Chem. Soc.* **37**, 1893, 1915.
- (3) G. A. Burrell and I. W. Robertson, U. S. Bureau of Mines, *Tech. Paper* **142**, 1916.
- (4) L. Cailletet, *Compt. rend.* **94**, 1224, 1882.
- (5) L. Cailletet and Mathias, *Compt. rend.* **102**, 1207, 1886.
- (6) E. Cardoso and E. Arni, *J. chim. phys.* **10**, 504, 1912.
- (7) M. A. Hunter, *J. Phys. Chem.* **10**, 330, 1906.
- (8) G. B. Kistiakowsky, H. Romeyn, Jr., J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, *J. Am. Chem. Soc.* **57**, 65, 1935.
- (9) A. Ladenburg and C. Krügel, *Ber.* **32**, 46, 1899.
- (10) A. Ladenburg and C. Krügel, *Ber.* **32**, 1415, 1899.
- (11) A. Ladenburg and C. Krügel, *Ber.* **32**, 1818, 1899.
- (12) Liveing and J. Dewar, *Phil. Mag.* [5] **34**, 205, 1893.
- (13) O. Maass and D. McIntosh, *J. Am. Chem. Soc.* **36**, 737, 1914.
- (14) O. Maass and C. H. Wright, *J. Am. Chem. Soc.* **43**, 1098, 1921.
- (15) E. Mathias, C. A. Crommelin, and H. G. Watts, *Ann. Phys.* [10] **11**, 343, 1929.
- (16) K. Olszewski, *Compt. rend.* **99**, 133, 1884.
- (17) K. Olszewski, *Monatsh* **8**, 72, 1887.
- (18) W. Ramsay and M. W. Travers, *Phil. Trans. A.*, **19**, 747, 1901.
- (19) M. W. Travers and W. Ramsay, "Study of Gases," 1901, 243.
- (20) P. Villard, *Ann. chim. phys.* [7] **10**, 387, 1897.
- (21) A. W. Witkowski, *Phil. Mag.* [5] **42**, 1, 1896.
- (22) S. v. Wroblewski, *Sitz. Akad. Wiss. Wien.* **97**, Abt. 2a, 1321, 1888.
- (23) S. v. Wroblewski and K. Olszewski, *Monatsh* **4**, 338, 1883.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Propene	-185	-47.7	0.6104₃ @ -47.7°		log ₁₀ P _{mm} = $\frac{-709.6}{T} + 1.75$ log ₁₀ T + 0.0039 T + 1.025 ³ (0.6 to 760mm) (T = t°C + 273.1)
C=C-C	> -187 ⁷ -185.2 ⁹ -184.9 ⁸	-47.64 ⁶ @ 764mm -47.8 ^{2,3} -47.7 ⁵ -47.0 ⁹ -47.67 ¹ @ 759.1mm -47.91 ⁶ -47.8 ¹⁰ @ 750mm -48.2 ⁸ @ 749mm -50.2 ⁷ @ 749mm -48.7 ^{2,3} @ 730mm -49.6 ^{2,3} @ 700mm -51.1 ^{2,3} @ 650mm -52.8 ^{2,3} @ 600mm -56.3 ^{2,3} @ 500mm -60.6 ^{2,3} @ 400mm -65.7 ^{2,3} @ 300mm -73.2 ^{2,3} @ 200mm -78.0 ^{2,3} @ 150mm -84.4 ^{2,3} @ 100mm -94.2 ^{2,3} @ 50mm -101.4 ^{2,3} @ 30mm -110.4 ^{2,3} @ 15mm	0.5183 ⁹ @ 19° 0.5473 ⁹ @ 0° 0.5691 ⁹ @ -15.65° 0.5854 ⁹ @ -27.85° 0.5937 ⁹ @ -34.4° 0.5973 ⁹ @ -37.45° 0.6095 ⁹ @ -47.0° 0.6109 ⁹ @ -48.5° 0.6247 ⁹ @ -58.5° 0.6486 ⁹ @ -78.2° 0.647 ¹⁰ @ -79°	1.3625 ⁴ @ -47.8° 1.3713 ⁴ @ -60° 1.3857 ⁴ @ -80°	$\frac{dD}{dt} = -0.001411$ (1 + 0.0009653t)/°C. (-80° to 20°) $\frac{dn}{dt} = -0.0007204/°C.$ (-80° to -48°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Propene—(Continued)		• –120.3 ^{2,3} @ 6mm –127.4 ^{2,3} @ 3mm –138.1 ^{2,3} @ 1.07mm –143.1 ^{2,3} @ 0.59mm			

- (1) A. A. Ashdown, L. Harris, and R. T. Armstrong, J. Am. Chem. Soc. **58**, 850, 1936.
- (2) G. A. Burrell and I. W. Robertson, J. Am. Chem. Soc. **37**, 2188, 1915.
- (3) G. A. Burrell and I. W. Robertson, U. S. Bureau Mines, Tech. Paper **142**, 1916.
- (4) A. v. Grosse and C. Linn, unpublished data.
- (5) H. M. Huffman, G. S. Parks, and M. Barmore, J. Am. Chem. Soc. **53**, 3876, 1931.
- (6) G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, J. Am. Chem. Soc. **57**, 876, 1935.
- (7) A. Ladenburg and C. Krügel, Ber. **32**, 1818, 1899.
- (8) A. Ladenburg and C. Krügel, Ber. **33**, 637, 1900.
- (9) O. Maass and C. H. Wright, J. Am. Chem. Soc. **43**, 1098, 1921.
- (10) M. Trautz and K. Winkler, J. prakt. Chem. [2] **104**, 44, 1922.
- (11) I. Wanin, J. Russ. Phys. Chem. Soc. **47**, 1094-1101, 1915.

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Butene-1		-6.47	0.6255, @ -6.47°		$\frac{dD}{dt} = -0.001153 \cdot$ $(1+0.001986t)/^{\circ}\text{C}.$ (-40° to +10°)
C=C-C-C	> -195 ¹⁶ > -190 ⁵	-3.7 ⁵ @ 833.7mm -4.4 ⁵ @ 811.4mm -5.9 ⁹ @ 775mm -6.1 ^{5,7} -6.6 to -6.4 ¹³ -6.7 ⁸ -6.7 to -6.5 ¹³ -5 ^{3,10,19} -2 ¹⁵ @ 758mm -6.8 to -6.5 @ 748mm ¹² -6.7 to -6.5 @ 748mm ¹² -6.7 ⁵ @ 740.2mm -8.5 ⁵ @ 691.3mm -11.3 ⁵ @ 621.7mm -14.3 ⁵ @ 549.6mm -17.0 ⁵ @ 491.3mm -19.4 ⁵ @ 445.1mm -23.1 ⁵ @ 377.7mm -25.6 ⁵ @ 338.0mm -28.6 ⁵ @ 302.9mm -29.9 ⁵ @ 276.9mm	0.6067 ⁵ @ 9.8° 0.6077 ⁵ @ 8.9° 0.6088 ⁵ @ 8.1° 0.6105 ⁵ @ 6.6° 0.6109 ⁵ @ 6.1° 0.6127 ⁵ @ 4.7° 0.6142 ⁵ @ 3.6° 0.6158 ⁵ @ 1.9° 0.6170 ⁵ @ -0.5° 0.6189 ⁵ @ -1.4° 0.6209 ⁵ @ -2.5° 0.6229 ⁵ @ -4.1° 0.6241 ⁵ @ -5.2° 0.6261 ⁵ @ -6.9° 0.6277 ⁵ @ -8.2° 0.6298 ⁵ @ -10.3° 0.6314 ⁵ @ -11.8° 0.6334 ⁵ @ -13.4° 0.6359 ⁵ @ -15.4° 0.6385 ⁵ @ -17.9°	1.3803 ⁷ @ -25.0°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Butene-1—(Continued)		–32.6 ° @ 242.2mm	0.6409 ° @ –20.0°		
		–33.7 ° @ 230.0mm	0.6426 ° @ –21.5°		
		–44.6 ° @ 130.8mm	0.6450 ° @ –24.0°		
		–52.3 ° @ 83.3mm	0.6466 ° @ –25.7°		
		–57.1 ° @ 62.0mm	0.6489 ° @ –27.6°		
		–60.1 ° @ 50.5mm	0.6507 ° @ –29.0°		
		–77.5 ° @ 23.5mm	0.6528 ° @ –30.9°		
			0.6547 ° @ –33.0°		
			0.6571 ° @ –35.0°		
			0.6606 ° @ –38.2°		
			0.6651 ° @ –42.4°		
			0.6655 ° @ –43.0°		
			0.6690 ° @ –46.0°		
cis Butene-2	–139.3	3.73			log ₁₀ P _{mm} = $\frac{-2379.264}{T}$
C–C=C–C	–139.3	3.73 ° 2.0 to 2.7 ¹⁸ @ 754mm 3.0 ¹ @ 746mm 2.95 to 3.05 ²⁰ @ 746mm 2.5 to 2.7 ²¹ @ 740mm			–15.4405 log ₁₀ T +0.0097519 T +46.48442 ° (–80° to +30°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
trans Butene-2	-105.8				log ₁₀ P _{mm} = $\frac{-2505.74}{T}$
C-C=C-C	-105.8 ^{9,16}	0.30 to 0.40 ²⁰ @ 744mm 0.3 ¹ @ 744mm			-18.78681 log ₁₀ T +0.012991 T +34.25987 ⁹ (-80° to +30°)
Butene-2					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)	-127 ⁵	20.4 ⁵ @ 1550mm 18.3 ⁵ @ 1450mm 16.2 ⁵ @ 1320mm 2.9 ⁵ @ 814mm 3.0 ¹⁴ 1.9 to 2.2 ¹⁷ 1.0 ⁵ 0 to 3 ⁵ -0.1 to +0.9 ¹⁷ +1.0 ¹¹ @ 741.4mm -1.0 ⁵ @ 707.4mm -3.3 ⁵ @ 644.6mm -4.7 ⁵ @ 609.8mm -7.1 ⁵ @ 555.2mm -9.7 ⁵ @ 499.7mm -14.9 ⁵ @ 402.7mm -16.0 ⁵ @ 383.2mm	0.6105 ⁵ @ 17.8° 0.6146 ⁵ @ 14.3° 0.6169 ⁵ @ 12.3° 0.6210 ⁵ @ 8.6° 0.6216 ⁵ @ 5.9° 0.6267 ⁵ @ 3.8° 0.6289 ⁵ @ 1.7° 0.6303 ⁵ @ 0.9° 0.6315 ⁵ @ -0.3° 0.6345 ⁵ @ -2.8° 0.6355 ⁵ @ -4.2° 0.6387 ⁵ @ -6.6° 0.6416 ⁵ @ -9.4° 0.6439 ⁵ @ -11.5° 0.6454 ⁵ @ -13.0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylpropene	-140.7	-6.6	0.6266, @ -6.6°		$\frac{dD}{dt} = -0.001143 \cdot$ $(1 + 0.001409t)/^{\circ}\text{C.}$ (-50° to +12°)
$\begin{array}{c} \text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-146.8 5, 6	22.1 ° @ 2017mm	0.6058 ° @ 11.5°	1.3814 ⁷ @ -25.0°	
	-140.7 9, 16	20.6 ° @ 1965mm	0.6087 ° @ 9.1°		
		17.4 ° @ 1780mm	0.6095 ° @ 7.3°		
		14.7 ° @ 1624mm	0.6135 ° @ 5.0°		
		13.0 ° @ 1535mm	0.6179 ° @ 2.3°		
		11.4 ° @ 1454mm	0.6180 ° @ 1.0°		
		8.8 ° @ 1340mm	0.6190 ° @ 0.1°		
		5.9 ° @ 1213mm	0.6234 ° @ -3.7°		
		3.5 ° @ 1114mm	0.6267 ° @ -6.5°		
		1.8 ° @ 1044mm	0.6268 ° @ -6.6°		
		-2.2 ° @ 903mm	0.6299 ° @ -9.5°		
		-4.6 ° @ 826mm	0.6324 ° @ -11.7°		
		-6.0 ° @ 778.7mm	0.6343 ° @ -13.5°		
		-6.67 ° @ 770mm	0.6391 ° @ -17.4°		
		-6.6 °, ⁷	0.6408 °		
		-6.3 ¹⁰	@ -19.1°		
		-6 °	0.6428 °		
		-4 °	@ -21.0°		
		-8.8 °	0.6444 °		
		@ 695.8mm	@ -22.5°		
		-12.0 °	0.6468 °		
		@ 610.6mm	@ -24.8°		
		-16.4 °	0.6520 °		
		@ 510.9mm	@ -29.7°		
		-20.0 °	0.6546 °		
		@ 437.5mm	@ -31.7°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_{4}^{20}	n_D^{20}	Additional Data
2-Methylpropene (Continued)		-22.6 °	0.6581 °		
		@ 390.9mm	@ -34.8°		
		-25.5 °	0.6604 °		
		@ 345.3mm	@ -37.2°		
		-29.0 °	0.6632 °		
		@ 293.9mm	@ -40.4°		
		-30.7 °	0.6658 °		
		@ 265.1mm	(<i>n</i>) -42.1°		
		-35.3 °	0.6680 °		
		@ 216.0mm	@ -44.1°		
		-38.3 °	0.6710 °		
		@ 185.3mm	@ -46.9°		
		-41.0 °	0.6738 °		
		@ 161.6mm	(<i>n</i>) -48.9°		
		-43.5 °			
		@ 139.2mm			
		-46.0 °			
		@ 121.1mm			
		-48.9 °			
		@ 101.9mm			
		-52.5 °			
		@ 82.7mm			
		-55.7 °			
		@ 66.9mm			
		-59.3 °			
		@ 53.5mm			
		-79.1 °			
		@ 12.5mm			

- (1) L. O. Brockway and P. C. Cross, J. Am. Chem. Soc. **58**, 2407, 1936.
- (2) R. F. Brunel, J. Am. Chem. Soc. **39**, 1978, 1917.
- (3) R. F. Brunel and E. G. Probeck, Am. Chem. J. **44**, 431, 1910.
- (4) A. Butlerov, Z. Chem. **13**, 236, 1870.
- (5) C. C. Coffin and O. Maass, J. Am. Chem. Soc. **50**, 1427, 1928.
- (6) C. C. Coffin and O. Maass, Trans. Roy. Soc. Can. [3] **21**, Sec. 3, 33, 1927.
- (7) A. v. Grosse, J. Am. Chem. Soc. **59**, 2739, 1937.
- (8) C. D. Hurd and A. R. Goldsby, J. Am. Chem. Soc. **56**, 1812-5, 1934.
- (9) G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, J. Am. Chem. Soc. **57**, 876, 1935.
- (10) V. Komarewski, W. Johnston, and P. Yoder, J. Am. Chem. Soc. **56**, 2705, 1934.
- (11) A. Lieben, Ann. **150**, 87, 1869.
- (12) H. J. Lucas and R. I. Dillon, J. Am. Chem. Soc. **50**, 1460, 1928.
- (13) H. J. Lucas, R. I. Dillon, and W. G. Young, J. Am. Chem. Soc. **52**, 1949, 1930.
- (14) V. de Luynes, Ann. **129**, 200, 1864; Ann. chim. phys. [4] **2**, 385, 1864.
- (15) G. Mignonac and R. Vanier de Saint-Aunay, Compt. rend. **189**, 106, 1929.
- (16) S. S. Todd and G. S. Parks, J. Am. Chem. Soc. **58**, 134, 1936.
- (17) S. Winstein and H. J. Lucas, J. Am. Chem. Soc. **60**, 836, 1938.
- (18) J. Wislicenus, H. P. Talbot, and M. Henze, Ann. **313**, 228, 1900.
- (19) A. Wurtz, Ann. **152**, 21, 1869.
- (20) W. G. Young, R. T. Dillon, and H. J. Lucas, J. Am. Chem. Soc. **51**, 2528, 1929.
- (21) K. Ziegler, F. Häffner, and H. Grimm, Ann. **528**, 101, 1937.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Pentene-1		30.1	0.6429	1.3714	$\frac{dn}{dt} = -0.0006186/^\circ\text{C.}$ (-30° to +30°)
C=C-C-C-C		30.5 to 31 ³³ @ 767mm	0.641 ³³ @ 21°	1.3658 ²⁵ @ 30°	
		30.4 ⁴³ @ 766mm	0.6410 ^{72,74} 0.6414 ⁸⁴	1.3714 ³³ @ 21°	
		39 to 41 ⁵⁶	0.6419 ⁸⁸	1.3718 ²⁷ @ 21°	
		39 to 40 ^{6,7}	0.64199 ⁶³	1.371 ⁴	
		32.5 ⁴	0.6420 ⁷²	1.3710 ^{43,72,74}	
		30.4 to 30.6 ⁸⁶	0.644 ⁴	1.3711 ^{44,68,72}	
		30.5 to 31.0 ⁶⁸	0.64512 ⁴⁴	1.3712 ⁶³	
		30.2 ⁷²	0.6465 ¹⁶ D_{20}^{20}	1.3719 ²⁸	
		30.1 to 30.3 ⁸⁴	0.6483 ⁴⁶	1.3731 ²⁷	
		30.1 ⁷²	0.637 ³³ @ 18°	1.3736 ⁸⁴	
		30.10 ⁷⁴		1.3734 ⁴⁶ @ 19.5°	
		30.0 to 30.1 ⁵⁰		1.3719 ³³ @ 18°	
		30 to 31 ³³		1.4024 ²⁵ @ -30°	
		30.0 ²⁷		1.36956 ⁴⁴ $n_{H\alpha}^{20}$	
		29.9 to 30.1 ⁷⁷		1.37769 ⁴⁴ $n_{H\beta}^{20}$	
		30.5 to 31 ⁶³ @ 754mm			
		29 to 29.5 ⁴⁶ @ 751mm			
		29.8 to 30.0 ⁴⁴ @ 750mm			
		29.5 to 31 ¹⁶ @ 747.8mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
cis Pentene-2		37	0.6503	1.38130	$\frac{dD}{dt} = -0.0009989 \cdot$ $(1 + 0.002356t)/^{\circ}\text{C.}$ (-70° to +50°)
C-C=C-C-C	-180 to	37.8 ⁷¹	0.5824 ⁶⁷	1.37960 ¹³	
	-178 ⁴²	37.0 ⁷⁰	@ 80°	1.37965 ⁷³	
	-144 ¹³	36.5 ³	0.5982 ⁶⁷	1.3817 ⁴³	
		36 to 40 ⁷³	@ 70°	1.3822 ^{70,71}	
		36.2 ⁴²	0.6112 ⁶⁷		
		35.5 to 36 ¹³	@ 60°		
		35.4 ⁴²	0.6181 ⁶⁷		
		@ 740mm	@ 50°		
			0.6288 ⁶⁷		
			@ 40°		
			0.6392 ⁶⁷		
			@ 30°		
			0.6503 ^{67,73}		
			0.6562 ⁷⁰		
			0.6586 ⁷¹		
			0.6608 ⁶⁷		
			@ 10°		
			0.6710 ⁶⁷		
			@ 0°		
			0.6811 ⁶⁷		
			@ -10°		
			0.6903 ⁶⁷		
			@ -20°		
			0.6995 ⁶⁷		
			@ -30°		
			0.7085 ⁶⁷		
			@ -40°		
			0.7172 ⁶⁷		
			@ -50°		
			0.7269 ⁶⁷		
			@ -60°		
			0.7350 ⁶⁷		
			@ -70°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
trans Pentene-2		35.85	0.64821	1.3792	$\frac{dD}{dt} = -0.0009780 \cdot$ $(1 + 0.0025143t)/^{\circ}\text{C.}$ (-70° to +80°)
C-C=C-C-C	-149.3 ⁶⁷	37 to 38 ²⁰	0.5814 ⁶⁷	1.37845 ¹³	
	-149 ¹³	37 ²⁰	@ 80°	1.37849 ⁶⁹	
	-147 ^{61,62}	36.40 ^{61,62}	0.5938 ⁶⁷	1.3790 ⁷¹	
	-136 to	36.25 ⁷¹	@ 70°	1.3795 ³⁵	
	-135 ⁴²	36.2 ⁴²	0.6053 ⁶⁷	1.3797 ³⁵	
		35.85 ⁶⁹	@ 60°	1.3799 ⁴³	
		35.8 ¹³	0.6163 ⁶⁷	1.38169 ⁶¹	
		@ 755mm	@ 50°	@ 17.2°	
		35.9 to 36.0 ³⁵	0.6275 ⁶⁷	1.38568 ⁶¹	
		@ 744mm	@ 40°	@ 11°	
		35.7 to 35.9 ³⁵	0.6381 ⁶⁷		
		@ 743mm	@ 30°		
		35.4 ⁴²	0.6481 ^{67,69}		
		@ 740mm	0.6486 ⁷¹		
		35.65 to 35.70	0.6535 ^{61,62}		
		@ 737mm ³⁵	@ 17.2°		
			0.6595 ^{61,76}		
			@ 11°		
			0.6580 ⁶⁷		
			@ 10°		
			0.6675 ⁶⁷		
			@ 0°		
			0.6770 ⁶⁷		
			@ -10°		
			0.6866 ⁶⁷		
			@ -20°		
			0.6960 ⁶⁷		
			@ -30°		
			0.7052 ⁶⁷		
			@ -40°		
			0.7140 ⁶⁷		
			@ -50°		
			0.7227 ⁶⁷		
			@ -60°		
			0.7314 ⁶⁷		
			@ -70°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentene-2					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)	-147.0 ⁷⁸	34.5 ⁴	0.64021 ⁸⁷	1.3780 ²⁵	
	-138 ⁸⁷	35 to 36 ⁷	@ 30°	1.3782 ²⁵	
		35 to 37 ⁴¹	0.64537 ⁸⁷	1.3784 ²⁶	
		35.5 to 35.8 ²⁵	@ 25°	1.3786 ¹²	
		35.5 to 37.5 ²⁷	0.6485 ⁵⁹	1.37889 ⁶³	
		36 ⁸⁷	0.6499 ⁶³	1.3790 ²⁶	
		36.0 to 36.2 ⁸⁸	0.6503 ^{88, 70, 74}	1.3793 ^{12, 88}	
		36 to 37 ²	0.6504 ¹²	1.37935 ⁶⁸	
		36.2 to 36.4 ⁷⁷	0.6505 ⁷³	1.3796 ²⁴	
		36.2 to 36.5 ⁸⁴	0.65054 ⁸⁷	1.37965 ^{88, 74}	
		36.25 ⁷⁰	0.6506 ¹²	1.3797 ⁷³	
		36.3 ⁶⁸	0.6520 ⁶⁴	1.3798 ^{12, 74}	
		36.3 to 36.5 ¹²	0.6523 ⁷⁰	1.3807 ⁷⁰	
		36.39 ⁸⁷	0.6527 ⁷⁰	1.3808 ⁸⁷	
		36.4 ^{69, 78}	0.653 ²	1.3810 ^{84, 70}	
		36.55 ⁷⁰	0.6540 ⁷⁴	1.3812 ²	
		36.55 to 36.6 ¹²	0.647 ⁴	1.375 ⁴	
		36.59 to 36.64 ⁶⁴	@ 19°	@ 19°	
		37 to 39 ⁹	0.65551 ⁸⁷	1.3814 ⁵⁹	
		36.5 to 36.8 ⁶⁸	@ 15°	@ 17.5°	
		@ 754mm	0.6576 ²	1.3839 ⁸⁷	
		36 ⁸⁰	@ 14.5°	@ 15°	
		@ 740.8mm		1.3840 ²⁷	
		36.0 to 36.2 @ 740mm ⁶³		@ 15°	
				1.38354 ²	
				@ 14.7°	
				1.3868 ⁸⁷	
				@ 10°	
				1.3899 ⁸⁷	
				@ 5.3°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
2-Methylbutene-1 $\begin{array}{c} C=C-C-C \\ \\ C \end{array}$		31 31.21 to 31.24 @ 762mm ³⁴ 28.8 to 31.8 ¹⁹ 30 to 31 ⁴⁷ 30.9 ⁴⁸ 31 to 32 ³⁸ 31 to 33 ^{20, 56} 31.05 ⁷⁴ 31.1 ²⁷ 31.2 ²⁸ 31.3 to 32.6 ¹⁴ 33 to 35 ⁸ 32 ⁴⁵ @ 757.6mm	0.6504 0.6504 ⁷⁴ 0.6645 ⁴⁷ D_{20}^{17} 0.6668 ²⁰ D_0^0 0.670 ³⁸ @ 0°	1.3785 1.3776 ⁴⁸ 1.3777 ³⁴ 1.3783 ⁷⁴ 1.3803 ¹⁴ 1.3952 ⁴⁷ @ 17° 1.378 ²⁰ @ 16° 1.3800 ²⁷ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_{4}^{20}	n_D^{20}	Additional Data
3-Methylbutene-1		20.1	0.6340 @ 15°	1.3677 @ 15°	
<chem>C=C-C-C</chem> C		21.1 to 21.3 ⁸⁶ @ 780.2mm	0.63197 ⁵⁷ @ 15°	1.3897 ⁴⁷ @ 18°	
		20.5 to 20.7 ⁴⁵ @ 771.20mm	0.6323 ⁸³ @ 15°	1.3728 ⁸³ @ 18°	
		19.8 to 20.4 ³⁹ @ 761.5mm	0.6338 ³⁹ @ 15°	1.3682 ²⁷ @ 15°	
		25 ²²	0.6373 ⁵¹ @ 15°	1.3680 ⁷² @ 15°	
		21.25 ²⁸	0.645 ⁴⁷ D_{20}^{15}	1.3676 ⁸³ @ 15°	
		21 to 24 ²⁹	0.648 ²¹ @ 0°	1.3675 ^{15, 57} @ 15°	
		20.5 to 21.5 ^{27, 56}		1.3674 ³⁹ @ 15°	
		20.18 to 20.21 ^{16, 83}		1.3707 ⁵⁷ @ 10°	
		20.10 ⁴⁷		1.3762 ⁵⁷ @ 0°	
		20 to 20.5 ¹⁴		1.36487 ³⁹ ¹⁵ $n_{H\alpha}$	
		19 to 20 ⁴⁷		1.37283 ³⁹ ^{15.1} $n_{H\beta}$	
		21 to 23 ⁵¹ @ 755mm		1.37763 ³⁹ ^{15.1} $n_{H\gamma}$	
		19.2 to 20.0 ⁷² @ 754mm			
		20.2 ²¹ @ 749mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylbutene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		38.6	0.6596₆	1.3876	$\frac{dD}{dt} = -0.0009799 \cdot$ $(1+0.00588t)/^{\circ}\text{C.}$ $(-70^{\circ} \text{ to } +80^{\circ})$ $\frac{dn}{dt} = -0.0006166/^{\circ}\text{C.}$ $(10^{\circ} \text{ to } 35^{\circ})$
	-146.1 ⁸⁷	38.2 to 38.7 ¹⁰	0.5853 ⁸⁷	1.3781 ⁸⁷	
	-134.3 ⁷⁹	@ 766mm	@ 80°	@ 35°	
	-133.6 ⁸⁴	37.8 to 38.3 ⁴⁵	0.5950 ⁸⁷	1.3814 ⁸⁷	
	-123 ⁸⁷	@ 764.25mm	@ 70°	@ 30°	
		38.68 ⁸⁴	0.6065 ⁸⁷	1.3890 ⁵³	
		@ 762mm	@ 60°	@ 21°	
		30 to 40 ⁸³	0.6237 ⁸⁷	1.3878	
		33 to 40 ⁸⁷	@ 50°	14, 57, 74	
		34 to 39 ⁸⁷	0.6352 ⁸⁷	1.3877 ^{1, 80}	
		@ 40°		1.3869 ^{84, 75}	
		34 to 40 ⁸⁷	0.6468 ⁸⁷	1.3856 ⁸²	
		35 ¹¹	@ 30°	1.3855 to	
		35 to 37 ⁸⁰	0.65694 ⁸⁷	1.3860 ³⁵	
		35 to 38.5 ⁸⁴	@ 25°	@ 19°	
		35 to 39 ²⁶	0.65730 ¹⁰	1.3870 ⁵	
		35 to 39 ⁸⁴	@ 25°	@ 19°	
		35 to 40 ⁸⁷	0.6578 ⁸⁷	1.3875 ⁴⁹	
		36 ^{80, 86}	0.66277 ³²	@ 19°	
		36 to 37 ⁴⁵	0.6627 ⁴⁹	1.3900 ⁵⁴	
		36.0 to 37.3 ¹⁴	0.6625 ⁸⁰	@ 18°	
		36 to 38 ³⁸	0.66250 ¹	1.3905 ⁵⁴	
		36 to 40 ^{82, 87}	0.6620 ⁷⁴	@ 18°	
		36.7 ⁸²	0.6627 to	1.3883 ³²	
		36.8 to 38.4 ⁸²	0.6630 ³⁶	@ 16.4°	
		37 to 38 ¹⁸	@ 19°	1.3898 ²⁷	
		37 to 40 ⁵³	0.6634 ⁵³	@ 15°	
		37.2 ^{85, 79}	@ 19°	1.3908 ⁸⁷	
		37.2 to 38.2 ⁸	0.66470 ³²	@ 15°	
		37.5 to 39 ²⁷	@ 18.1°	1.3939 ⁸⁷	
		37.7 ¹⁷	0.665 ⁸⁴	@ 10°	
		38 ^{82, 45, 86}	@ 17°		
		38.0 to 38.3 ³¹	0.66641 ³²		
		@ 16.5°			
		38 to 40 ⁸⁷	0.663 ⁸⁵		
		38.2 to	@ 16°		
		38.4 ^{1, 80}	0.66708 ⁸⁷	@ 15°	
			0.6663 ⁸⁴	@ 15°	
			0.66888 ³²	@ 14°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylbutene-2 (Continued)		38.4 to 38.5 ⁴⁹	0.664 ⁵⁵		
		38.42 ^{57,74}	@ 14°		
		38.5 to 38.6 ⁸⁶	0.6678 ¹⁷		
		38.6 ²⁸	@ 13.1°		
		39 ³	0.665 ⁵⁵		
		36.3 to 37.3 ¹⁹	@ 13°		
		@ 747mm	0.670 ⁵⁵		
		36 to 37 ⁴⁵	@ 11°		
		@ 746.3mm	0.6672 ⁶⁷		
			@ 10°		
			0.6860 ⁶⁷		
			@ 0°		
			0.68313 ³²		
			@ 0°		
			0.6783 ³⁸		
			@ 0°		
			0.6860 ⁶⁷		
			@ -10°		
			0.6948 ⁶⁷		
			@ -0°		
			0.7034 ⁶⁷		
			@ -30°		
			0.7132 ⁶⁷		
			@ -40°		
			0.7216 ⁶⁷		
			@ -50°		
			0.7302 ⁶⁷		
			@ -60°		
			0.7384 ⁶⁷		
			@ -70°		

- (1) M. Adams, Thesis, Mount Holyoke College, 1935.
- (2) K. v. Auwers, *Ann.* **415**, 142, 1916.
- (3) von Balard, *Ann.* **52**, 311, 1844.
- (4) M. Bourguet, *Bull. soc. chim.* [4] **41**, 1475, 1927.
- (5) M. Bourguet and L. Piaux, *Bull. soc. chim.* [4] **51**, 1041, 1932.
- (6) J. v. Braun, *Ann.* **382**, 1, 1911.
- (7) A. Brochet, *Bull. soc. chim.* [3] **7**, 566, 1892.
- (8) B. T. Brooks and I. Humphrey, *J. Am. Chem. Soc.* **40**, 822, 1918.
- (9) R. F. Brunel and E. G. Probeck, *Am. Chem. J.* **44**, 431, 1910.
- (10) E. Burkey, Thesis, Mount Holyoke College, 1934.
- (11) E. Chalblay, *Ann. chim.* **1**, 469, 1914.
- (12) S. E. Chase, Master's Thesis, Mount Holyoke College, 1933.
- (13) R. H. Clarke and E. G. Hallonquist, *Trans. Roy. Soc. Can.* [3] **24**, Sec. 3, 115, 1930.
- (14) J. M. Church, F. C. Whitmore, and P. V. McGrew, *J. Am. Chem. Soc.* **56**, 176, 1934.
- (15) M. A. Dolliver, T. L. Gresham, G. B. Kistiakowsky, and W. E. Vaughan, *J. Am. Chem. Soc.*, **59**, 831, 1937.
- (16) H. B. Dykstra, J. F. Lewis, and C. E. Boord, *J. Am. Chem. Soc.* **52**, 3396, 1930.
- (17) J. F. Eijkman, *Chem. Weekblad.* **3**, 701, 1906.
- (18) A. Eltekow, *Ber.* **16**, 395, 1883.
- (19) W. F. Faragher, W. A. Gruse, and F. H. Garner, *Ind. Eng. Chem.* **13**, 1044, 1921.
- (20) R. Fittig, *Ann.* **200**, 21, 1880.
- (21) F. Flavitzky, *Ber.* **6**, 562, 1873.
- (22) F. Flavitzky, *Ber.* **11**, 992, 1878.
- (23) B. Gredy, *Bull. soc. chim.* [5] **2**, 1029, 1935.
- (24) B. Gredy, *Bull. soc. chim.* [5] **2**, 1951, 1935.
- (25) A. v. Grosse and C. Linn, unpublished data.
- (26) H. Hibbert, *J. Am. Chem. Soc.* **37**, 1748, 1915.
- (27) J. Hyman and C. R. Wagner, *J. Am. Chem. Soc.* **52**, 4345, 1930.
- (28) V. N. Ipatieff, H. Pines, and L. Schmerling, *J. Am. Chem. Soc.* **60**, 353, 1938.
- (29) V. N. Ipatieff *Ber.* **36**, 1990, 1903.
- (30) V. N. Ipatieff and W. Huhn, *Ber.* **36**, 2016, 1903.
- (31) Jackson, Master's Thesis, Mount Holyoke College, 1929.
- (32) C. A. F. Kahlbaum, German Patent 66,866.
- (33) A. Kerrmann, *Bull. soc. chim.* [4] **39**, 988, 1926.
- (34) G. B. Kistiakowsky, S. S. Todd, and C. H. Schomate, *J. Am. Chem. Soc.* **58**, 2505, 1936.
- (35) S. Krapivin, *Bull. soc. naturalistes Moscow*, [2] **22**, 1, 1908.
- (36) W. M. Lauer and F. H. Stodola, *J. Am. Chem. Soc.* **56**, 1215, 1934.
- (37) H. Landolt and H. Jahn, *Z. physik. Chem.* **10**, 289, 1892.
- (38) J. A. Lebel, *Bull. soc. chim.* [2] **25**, 545, 1876.
- (39) J. J. Leendertse, A. J. Tulleners, and H. I. Waterman, *Rec. trav. chim.* **52**, 515, 1933.
- (40) W. Louguinine and G. Dupont, *Compt. rend.* **150**, 1346, 1910.
- (41) H. J. Lucas and H. W. Mayse, *J. Am. Chem. Soc.* **47**, 1459, 1925.
- (42) H. J. Lucas and A. N. Prater, *J. Am. Chem. Soc.* **59**, 1682, 1937.
- (43) E. C. Mago, Thesis, Mount Holyoke College, 1932.
- (44) K. E. Mayer, Master's Thesis, Mount Holyoke College, 1931.
- (45) A. Michael and F. Zeidler, *Ann.* **385**, 227, 1911.
- (46) M. Michailov and J. A. Arbuzov, *Compt. rend. U. R. S. S.* **3**, 423, 1936.
- (47) T. Midgley, Jr. and A. L. Henne, *J. Am. Chem. Soc.* **51**, 1215, 1929.
- (48) C. O. Monod, Master's Thesis, Mount Holyoke College, 1935.
- (49) Mount Holyoke College, unpublished data, 1938.
- (50) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
- (51) S. S. Nametkin and L. N. Abakumovskaya, *J. Gen. Chem. (U. S. S. R.)* **6**, 1166, 1936.
- (52) I. N. Nasarov, *Ann. Leningrad State Bounboff Univ. Chem. Ser.* **1**, 123, 1935.

- (53) I. N. Nasarov, Ber. **69B**, 21, 1936.
- (54) I. N. Nasarov, Ber. **70B**, 606, 1937.
- (55) I. N. Nasarov, Ber. **70B**, 617, 1937.
- (56) J. F. Norris and J. M. Joubert, J. Am. Chem. Soc. **49**, 873, 1927.
- (57) J. F. Norris and R. Reuter, J. Am. Chem. Soc. **49**, 2624, 1927.
- (58) B. Otto, Master's Thesis, Mount Holyoke College, 1928.
- (59) L. W. Pickett, Master's Thesis, Mount Holyoke College, 1927.
- (60) H. v. Risseghem, Compt. rend. **158**, 1694, 1914.
- (61) H. v. Risseghem, Bull. soc. chim. Belg. **28**, 187, 1914.
- (62) Rodgers, Master's Thesis, Mount Holyoke College, 1929.
- (63) N. A. Rosanov, J. Russ. Phys. Chem. Soc. **48**, 168, 1915.
- (64) C. A. Sanders, Thesis, Mount Holyoke College, 1936.
- (65) J. B. Senderens, Compt. rend. **154**, 777, 1913.
- (66) W. F. Seyer, J. Am. Chem. Soc. **53**, 3588, 1931.
- (67) M. L. Sherrill, J. Am. Chem. Soc. **52**, 3396, 1936.
- (68) M. L. Sherrill, C. Baldwin, and D. Haas, J. Am. Chem. Soc. **51**, 3034, 1929.
- (69) M. L. Sherrill and E. H. Launspach, J. Am. Chem. Soc. **60**, 2562, 1938.
- (70) M. L. Sherrill and E. S. Matlock, J. Am. Chem. Soc. **59**, 1682, 1937.
- (71) M. L. Sherrill, K. E. Mayer, and G. F. Walter, J. Am. Chem. Soc. **56**, 926, 1934.
- (72) M. L. Sherrill, B. Otto, and L. W. Pickett, J. Am. Chem. Soc. **51**, 3023, 1929.
- (73) M. L. Sherrill and G. F. Walter, J. Am. Chem. Soc. **58**, 742, 1936.
- (74) M. Slemmons, Thesis, Mount Holyoke College, 1929.
- (75) M. E. Smith, Master's Thesis, Mount Holyoke College, 1931.
- (76) T. D. Stewart, K. Dod, and G. Stenmark, J. Am. Chem. Soc. **59**, 1765, 1937.
- (77) T. D. Stewart and B. Weidenbaum, J. Am. Chem. Soc. **58**, 98, 1936.
- (78) J. Timmermans, Bull. soc. chim. Belg. **27**, 334, 1913.
- (79) D. D. Thompson and M. L. Sherrill, J. Am. Chem. Soc. **58**, 745, 1936.
- (80) G. Wagner and A. Saytzeff, Ann. **175**, 351, 1875.
- (81) J. K. Walker and N. Wood, J. Chem. Soc. **105**, 1131, 1922.
- (82) G. F. Walter, unpublished data mentioned by Sanders, Mount Holyoke College, 1936.
- (83) H. I. Waterman, P. van't Spijker, and H. A. v. Westen, Rec. trav. chim. **48**, 612, 1929.
- (84) R. Wilkinson, J. Chem. Soc. **1931**, 3057.
- (85) S. Winstein and H. J. Lucas, J. Am. Chem. Soc. **60**, 836, 1938.
- (86) R. L. Wakeman, Thesis, Mass. Inst. Tech., 1930.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexene-1	-138	63.5	0.6747	1.3886	$\frac{dD}{dt} = -0.000831/^{\circ}\text{C.}$ (0° to 20°)
C=C-C-C-C-C	-140 ⁴⁶	63.8 to 64 ⁶² @ 774mm	0.6726 ⁸⁶ 0.6732 ⁸⁸	1.3852 ⁹⁹ @ 30°	$\frac{dn}{dt} = -0.0006070/^{\circ}\text{C.}$ (-30° to +30°)
	-139 ^{46, 47, 67}	67.7 to 68.1 ²⁶ @ 761mm	0.6746 ²² 0.6750 ^{21, 82}	1.3870 ⁸⁵ @ 25°	
	-138 ⁶²	70 ⁵⁰	0.6766 ⁶⁸	1.38767 ⁶² @ 25°	$\log_{10} P_{mm} = 7.527 - \frac{1578.4}{T}$ ⁸⁶ (0° to 65°)
	-98.6 to	67 ¹⁰	0.6779 ²¹	1.3870 ⁸⁶ @ 21°	
	-100 ²⁸	65.9 to 67.6 ⁹⁵	0.6784 ⁶³ D ₂₀ ²⁰	1.3870	
	-98.5 ²⁷	64.5 to 65 ⁴⁸	0.6686 ²⁶ D ₂₀ ²⁰	1.38319 ²⁸ @ 15.5°	
		63.6 to 64.1 ⁷³	0.6830 ³⁷ D ₂₀ ²⁰	1.3821 ³⁷ @ 15.5°	
		63.5 to 63.7 ⁴⁶	0.6734 ³⁴ D ₂₀ ²⁰	1.393 ⁴⁸ @ 14°	
		63.45 to 63.55 ⁶⁷	0.684 ⁴⁵ @ 18°	1.407 ¹⁰ @ 10°	
		63.4 to 63.7 ⁵⁸	0.6782 ⁴⁶ @ 15°	1.4021 ⁹⁹ @ 0°	
		63.35 ^{46, 47}	0.67875 ⁴⁷ @ 15°	1.4190 ⁹⁹ @ -30°	
		63.2 to 63.7 ⁹⁰	0.6789 ^{22, 47, 67}		
		62 ⁴⁵	@ 15°		
		61 to 64 ⁵³	0.684 ⁴⁸ @ 14°		
		64 ³⁴ @ 756mm	0.7148 ¹⁰ @ 10°		
		60.5 to 61.5 ³⁷ @ 756mm	0.6831 ²⁸ @ 0°		
		62 to 63 ²¹ @ 751mm	0.6920 ⁴⁶ @ 0°		
		63 to 64 ⁸⁶ @ 745mm	0.6925 ⁴⁷ @ 0°		
		62 to 64 ²² @ 745mm	0.7241 ¹⁰ @ 0°		
		63 to 64 ²¹ @ 742mm			
		61 to 65 ²² @ 742mm			
		62 to 63 ²⁶ @ 740mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
cis Hexene-2					
C-C=C-C-C-C		68.5 to 69.5 ⁷⁴	0.683 ⁷⁴ @ 25°	1.3960 ⁷⁴ @ 25°	
trans Hexene-2					
C-C=C-C-C-C	-152 ⁴⁶ -148.7 ⁴⁶	68.0 to 68.2 ⁴⁶	0.6863 ⁴⁶ @ 15° 0.6871 ⁴⁶ @ 15° 0.7000 ⁴⁶ @ 0°	1.3980 ⁴⁶ @ 15° 1.3981 ⁴⁶ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexene-2					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)	-144.6 ⁶⁷	65 to 67 ¹⁷	0.6792 ¹²	1.39446 ¹²	
		67 ^{9,39}	@ 23.3°	@ 23.3°	
		67 to 70 ¹⁴	0.68376 ⁹	1.3958 ³⁹	
C-C=C-C-C-C		67.5 ⁹	@ 20.4°	1.3928 ⁵⁸	
		67.8 to 67.9 ⁵⁴	0.6825 ¹²	1.39439 ³³	
		67.9 to 68.1 ⁵⁸	0.6813 ⁵⁸	@ 19.5°	
		68.0 to 68.2 ^{54, 62}	0.68414 ⁹	1.3974 ⁵⁴	
			@ 19.75°	@ 15°	
		68 to 68.2 ⁶⁷	0.68592 ⁹	1.3995 ⁹	
			@ 18.1°	@ 15°	
		68 to 69 ³⁸	0.68767 ⁹		
		68 to 70 ²	@ 16.2°		
		68.2 to 68.35 ⁶⁷	0.6849 ¹⁸		
			@ 16°		
		69 ¹	0.6671 ¹		
		68 to 68.5 ¹²	@ 16°		
		@ 747mm	0.6849 ⁵⁴		
		67 ⁴	@ 15°		
		@ 737.9mm	0.6852 ⁶⁷		
		65 to 66 ⁴	@ 15°		
		@ 706mm	0.6855 ⁵⁴		
			@ 15°		
			0.6862 ⁶⁷		
			@ 15°		
			0.68952 ⁹		
			@ 14.2°		
			0.6937 ²		
			@ 0°		
			0.6986 ^{2,54}		
			@ 0°		
			0.6988 ⁵⁴		
			@ 0°		
			0.6997 ^{4,39}		
			@ 0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
cis Hexene-3					
C-C-C=C-C-C		66.85 to 66.95 ¹⁰³	0.6775 ¹⁰³ 0.6784 ¹⁰³	1.3926 ¹⁰³ 1.3939 ¹⁰³	
		66.85 to 67.15 ¹⁰³	0.6797 ¹⁰³ 0.6802 ¹⁰³	1.3946 ¹⁰³	
		66.90 to 67.05 ¹⁰³			
		67.05 to 67.50 ¹⁰³			
trans Hexene-3					
C-C-C=C-C-C		66.4 to 66.7 ¹⁰²	0.6784 ¹⁰²	1.3943 ¹⁰²	
Hexene-3					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)		66.28 to 66.35 ⁹⁸	0.6779 ⁹⁸ 0.6784 ⁹⁸	1.3942 ⁹⁸	
C-C-C=C-C-C		66.46 to 66.59 ⁸⁷	0.6785 ^{79,83,85,87}	1.3947 ^{83,85,86}	
		66.58 to 66.72 ⁹⁸	0.6792 ⁹⁸ 0.6807 ⁸²	1.394 ⁸⁸ @ 19°	
		66.58 to 66.93 ⁹⁸	@ 19° 0.6816 ⁸⁸		
		66.6 to 67.0 ⁸⁸	@ 19° 0.6962 ⁹⁸		
		66.70 ^{78,83,86}	@ 0°		
		64 ⁸² @ 753mm	0.6967 ⁹⁸ @ 0°		
		66.05 to 66.18 @ 748mm ⁸⁷	0.6975 ⁹⁸ @ 0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		63 61.5 to 62.0 ^{87,88} 64 to 66 ³⁷	0.6824 0.6817 ⁵⁸ 0.6831 ⁸⁷	1.3921 ^{87,88}	
3-Methylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		53.6 51 to 55 ⁸⁴ 53.6 to 54.0 ⁸⁸	0.6700 ⁵⁸ 0.6826 ⁸⁴ @ 15°	1.3835 ⁵⁸	
4-Methylpentene-1 $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		53.8 52.5 to 54 ⁸⁶ 52.5 to 54.5 ^{83, 63} 53 to 59 ⁸³ 53.6 to 53.9 ⁵⁸ 53.8 to 54.2 ⁶¹ 53.9 to 54.1 ⁸⁶ 54.0 to 54.1 ⁷³ 55.0 to 55.5 ⁷³	0.6647₆ 0.6638 ⁸⁶ 0.6646 ⁵⁸ 0.6718 ⁵³ D ₂₀ ²⁰ 0.6692 ⁶¹ @ 15° 0.6700 ^{61,86} @ 15° 0.6828 ⁶¹ @ 0°	1.3825 ⁵⁸ 1.3839 ⁸⁶ @ 19.5°	$\frac{dD}{dt} = -0.0009164/^{\circ}\text{C.}$ (0° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-134.75 ^{44,67}	66 64 to 65 ²³ 64 to 68 ^{88,90} 64 to 69 ^{80,90} 65 to 67 ⁷ 66 to 70 ⁵⁵ 66.7 to 67.1 ⁴⁴ 66.7 to 67.2 ⁸⁷ 66.8 to 67.6 ⁴¹ 67 to 68 ¹³ 67.1 ¹⁰¹ 67.2 to 67.5 ⁸⁸	0.693 0.6965 ¹⁰¹ 0.6904 ⁸⁸ 0.686 ⁸⁹ @ 19° 0.687 ⁷ D ₁₀ ¹⁹ 0.684 ⁹⁰ @ 16° 0.685 ⁹⁰ @ 15° 0.69145 ⁴⁴ @ 15° 0.6925 ⁸¹ @ 15° 0.7051 ⁷ @ 0° 0.702 ⁴⁴ D ₀ ⁰	1.3984 1.3967 ⁹⁰ 1.3970 ⁹⁰ 1.3997 ¹⁰¹ 1.4005 ⁵⁸ 1.4000 ⁸⁹ @ 18° 1.4028 ⁴⁴ @ 15°	
cis 3-Methylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		66 65.1 to 65.7 ⁴³ 65.7 to 66.2 ^{88,89} 68.8 to 69.4 ⁸⁷	0.6940 0.6940 ^{88,89} 0.7220 ⁴³ @ 15°	1.3994 1.3994 ^{88,89} 1.3997 ⁴³ @ 15°	
trans 3-Methylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		69 67.6 to 68.2 ^{88,89} 69.9 to 70.2 ⁴³ 70.2 to 70.5 ^{87,100}	0.6956 0.6956 ^{88,89} 0.7021 ¹⁰⁰ @ 15°	1.4002 1.4002 ^{88,89} 1.4072 ⁴³ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_{40}^{20}	n_D^{20}	Additional Data
3-Methylpentene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$					$\frac{dD}{dt} = -0.000678/^{\circ}\text{C.}$ (15° to 25°)
		67 to 68 ³⁸ @ 771mm	0.694 ⁸¹ D_{20}^{20}	1.4002 ⁷¹ 1.4012 ⁹⁴	
		62 to 65 ⁸¹	0.6934 ³⁸	1.402 ⁴¹	
		64 to 69 ⁹⁰	D_{20}^{20}	1.4022 ⁹⁰	
		64 to 70 ⁹⁰	0.698 ⁷	@ 18°	
		65 to 69 ⁹⁰	D_{19}^{19}	1.4023 ⁷⁹	
		65 to 70 ⁹⁰	0.697 ⁹⁰	@ 18°	
		65 to 71 ⁷²	@ 16°	1.4034 ⁷⁹	
		67.6 to 68.2 ⁷¹	0.693 ⁹⁰	@ 18°	
		69 ⁴¹	@ 15°	1.404 ⁸¹	
		69 to 71 ⁷⁹	0.696 ⁹⁰	@ 18°	
		69 to 71.5 ⁴⁰	@ 15°	1.4040 ⁹⁰	
		69.2 to 69.6 ⁷⁹	0.6984 ⁷²	@ 16°	
		69.3 to 69.7 ⁹⁴	@ 15°	1.4060 ⁷⁹	
		69.3 to 69.8 ⁷⁹	0.7005 ⁷⁹	@ 15°	
		69.5 to 71 ⁷	@ 15°	1.4072 ⁷⁹	
		67 to 69 ⁴⁰	0.7008 ^{70,72}	@ 15°	
		@ 753mm	@ 15°		
		68.5 to 69.4 ⁷⁹	0.7010 ⁹⁴		
		@ 751mm	@ 15°		
		68.5 to 68.9 ⁷⁹	0.7022 ⁷⁹		
		@ 740mm	@ 15°		
		66 to 68 ⁸⁸	0.7055 ⁴⁰		
		@ 735mm	@ 15°		
			0.7158 ⁴¹		
			@ 0°		
			0.7110 ⁴¹		
			D_0^0		
			0.712 ⁴¹		
			D_0^0		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
cis 4-Methylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		58 57.7 to 58.5 ⁶⁸ 58.0 to 58.6 ⁷⁷ 58.2 to 58.6 ^{61,67}	0.6704 0.663 ⁷⁷ @ 24° 0.6709 ⁶⁸ 0.6735 ⁶¹ @ 15°	1.3858 ⁷⁷ @ 24° 1.3885 ⁶⁸ 1.3892 ⁶¹ n _{H_a} ¹⁵ 1.3977 ⁶¹ n _{H_β} ¹⁵ 1.4029 ⁶¹ n _{H_γ} ¹⁵ 1.3916 ⁶¹ n _{H_δ} ¹⁵ yellow 1.3964 ⁶¹ n _{H_ε} ¹⁵ green	
trans 4-Methylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		54.2 to 55.2 ⁶⁸	0.6702 ⁶⁸	1.3881 ⁶⁸	

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylpentene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		57 to 58.5 ²⁴ 57.6 to 57.8 ^{61,67} 58 to 59 ²⁸ 58.15 to 59.15 ⁴⁰ 58.6 to 59.0 ⁷³ 57 to 59 ²⁴ @ 740mm	0.6685 ⁷³ @ 25° 0.6695 ²⁸ D ₀ ²⁰ 0.6703 ²⁴ 0.6706 ²⁴ 0.6734 ⁶¹ @ 15° 0.6874 ²⁸ D ₀ ⁰	1.3869 ⁷³ @ 25.3° 1.3883 ²⁴ 1.3884 ²⁴ 1.3888 ⁶¹ n _{Hα} ¹⁶ 1.3973 ⁶¹ n _{Hβ} ¹⁶ 1.4024 ⁶¹ n _{Hγ} ¹⁶ 1.3914 ⁶¹ n _{He yellow} ¹⁶ 1.3961 ⁶¹ n _{He green} ¹⁶	
2-Ethylbutene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		66 64.9 to 65.1 ⁷⁹ 66.2 to 66.7 ^{67,68} 66.7 to 67.0 ⁸⁸ 67 to 68 ⁴² 63.9 to 64.1 ⁷⁹ @ 735mm	0.6916 0.69403 ⁴² @ 20.5° 0.6899 ⁷⁹ 0.6914 ⁶⁸ 0.6938 ⁶⁷ 0.6948 ⁷⁹ @ 15°	1.3991 1.40276 ⁴² @ 20.5° 1.3970 ⁷⁹ 1.3990 ^{67,68} 1.4000 ⁷⁹ @ 15° 1.4021 ⁸⁸ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,3-Dimethylbutene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-114.7 ⁹⁷	41.2 56 to 68 ¹¹ 42 ¹⁶ 41.2 ³² 41.18 ⁹³ 41.0 to 41.2 ⁶⁰ 40.9 to 42.3 ¹⁹ 40 to 50 ⁸² 40.2 to 40.4 ⁶⁰ @ 747mm 40.2 to 40.25 @ 741mm ⁶⁰ 40 to 43.5 ⁶⁵ @ 740mm 38 to 43 ⁶⁴ @ 740mm	0.6519_s 0.6510 ⁶⁰ 0.65295 ⁷⁵ 0.6549 ³² @ 18° 0.67015 ⁷⁵ D ₄ ⁰ 0.6795 ¹¹ @ 0°	1.3766_s 1.3709 ⁹⁹ @ 30° 1.3759 ⁶⁰ 1.3760 ⁶⁰ 1.37630 ⁷⁵ 1.3765 ⁹³ 1.3768 ⁹⁹ 1.37667 ³² @ 18° 1.3775 ⁶⁴ @ 18° 1.3850 ⁸² @ 18° 1.3887 ⁹⁹ @ 0° 1.4065 ⁹⁹ @ -30°	$\frac{dD}{dt} = -0.0009077/^{\circ}\text{C.}$ (0° to 20°) $\frac{dn}{dt} = -0.0005980/^{\circ}\text{C.}$ (-30° to +30°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3-Dimethylbutene-2	-74.2	73.3	0.7054	1.4116 @ 18°	$\frac{dD}{dt} = -0.000580/^\circ\text{C.}$ (0° to 20°)
$\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-76.4 ⁶⁰	72 to 73 ²⁰	0.7120 ¹⁵	1.4100 ⁸⁹	
	-74.6 ⁸⁰	@ 767mm	0.7075 ³⁷	@ 18°	
	-74.2 ⁸¹	73.39 ⁸¹	D ₃₀ ²⁰	1.41153 ⁸⁰	
		@ 762mm	0.7081 ⁶⁰	@ 18°	
		73.2 to 73.5 ⁸⁴	D ₂₀ ²⁰	1.41198 ⁸⁴	
		73 to 74 ^{15,37}	@ 18°	@ 18°	
		73 ^{6,8,40}	0.6984 ⁴¹	1.4121 ^{64,69}	
			D ₀ ²⁰	@ 18°	
		72.9 to 73.2 ⁴⁰	0.7007 ³⁵	1.4124 ⁸¹	
		72 to 75 ¹¹	D ₀ ²⁰	@ 18°	
		72 to 74 ⁵	0.70608 ⁸²	1.4072 ⁹⁰	
		72 to 73.5 ⁶⁷	D ₀ ²⁰	@ 17°	
		72 ⁷⁵	0.698 ⁸⁹	1.4086 ⁸²	
		71 to 72 ²⁹	@ 18°	@ 17°	
		70 to 73 ¹⁹	0.695 ⁹⁰	1.4100 ⁸⁹	
		70 ³	@ 15°	@ 15°	
		69 to 73 ⁸²	0.715 ⁸⁹		
		69 to 71 ⁷⁶	@ 13°		
		68 to 74 ⁸⁹	0.7168 ³¹		
		68 to 70 ³⁵	D ₀ ⁰		
		67 to 72 ⁹⁰	0.7190 ³⁵		
		65 to 73 ⁸⁹	D ₀ ⁰		
		72.9 to 73.2 ⁹¹	0.7280 ¹⁵		
		@ 758mm	@ 0°		
		70 to 71 ³¹			
		@ 757mm			
		70 to 71 ³⁵			
		@ 754mm			
		72.3 to 72.6 ⁶⁰			
		@ 747mm			
		69.5 to 72 ⁶⁵			
		@ 740mm			
		69 to 72 ⁶⁴			
		@ 740mm			
		71 to 73 ³⁰			
		@ 735mm			
		71.9 ⁶⁹			
		@ 732mm			

- (1) E. Erlenmeyer and J. A. Wanklyn, *Jahresber. Fortschr. Chem.* **1861**, 732; **1862**, 480; *Ann.* **135**, 129, **1865**.
- (2) A. Wurtz, *Ann.* **132**, 306, **1864**.
- (3) C. Friedel and R. D. Silva, *Compt. rend.* **76**, 226, **1873**; *Jahresber. Fortschr. Chem.* **1873**, 338.
- (4) O. Hecht and J. Strauss, *Ann.* **172**, 62, **1874**.
- (5) M. Kaschirsky, *Ber.* **11**, 984, **1878**.
- (6) D. Pawlow, *Ann.* **196**, 122, **1879**.
- (7) L. Jawein, *Ann.* **195**, 253, **1879**.
- (8) A. Eltekow, *Ber.* **16**, 395, **1883**.
- (9) H. Landolt and H. Jahn, *Z. physik. Chem.* **10**, 289, **1892**.
- (10) A. Brochet, *Bull. soc. chim.* [3] **2**, 566, **1892**.
- (11) F. Couturier, *Ann. chim. phys.* [6] **26**, 459, **1892**.
- (12) J. W. Brühl, *J. prakt. Chem.* [2] **49**, 201, **1894**.
- (13) V. N. Ipatieff, *J. prakt. Chem.* [2] **54**, 257, **1896**.
- (14) I. Welt, *Ber.* **30**, 1493, **1897**.
- (15) I. Kondakow, *J. prakt. Chem.* [2] **62**, 166, **1900**.
- (16) M. Delacre, *Mémoire Acad. Roy. Belg.*, July 2, 1904, 296 pp.
- (17) P. Sabatier and J. B. Senderens, *Ann. chim. phys.* [8] **4**, 319, **1905**.
- (18) J. F. Eijkman, *Chemisch Weekblad* **3**, 701, **1906**.
- (19) M. Delacre, *Bull. Acad. Roy. med. Belg.* **1906**, 7.
- (20) L. Henry, *Compt. rend.* **144**, 552, **1907**.
- (21) N. D. Zelinsky and E. C. Przewalsky, *J. Russ. Phys.-Chem. Soc.* **39**, 1168, **1907**.
- (22) N. D. Zelinsky and E. C. Przewalsky, *J. Russ. Phys.-Chem. Soc.* **40**, 1105, **1908**.
- (23) W. Louguinine and G. Dupont, *Compt. rend.* **150**, 1346, **1910**.
- (24) A. Gorski, *J. Russ. Phys.-Chem. Soc.* **42**, 1356, **1910**.
- (25) J. v. Braun, *Ann.* **382**, 1, **1911**.
- (26) H. van Beresteyn, *Bull. soc. chim. Belg.* **25**, 293, **1911**.
- (27) J. Timmermans, *Bull. soc. chim. Belg.* **25**, 300, **1911**.
- (28) A. Umnowa, *J. Russ. Phys.-Chem. Soc.* **42**, 1530, **1911**.
- (29) F. Couturier, *Bull. soc. chim.* [4] **9**, 898, **1911**.
- (30) J. Lindner, *Monatsh.* **32**, 421, **1911**.
- (31) N. Kishner, *J. Russ. Phys.-Chem. Soc.* **44**, 165, **1912**.
- (32) W. Fomin and N. Sochanski, *Ber.* **46**, 244, **1913**.
- (33) R. Meyer and A. Tanzen, *Ber.* **46**, 3183, **1913**.
- (34) N. Kishner, *J. Russ. Phys.-Chem. Soc.* **45**, 973, **1913**.
- (35) N. Kishner and G. Chonin, *J. Russ. Phys.-Chem. Soc.* **45**, 1770, **1913**.
- (36) E. Chablay, *Ann. chim.* **1**, 469, **1914**.
- (37) B. T. Brooks and I. Humphrey, *J. Am. Chem. Soc.* **40**, 822, **1918**.
- (38) A. Faworski, *J. Russ. Phys.-Chem. Soc.* **50**, 43, **1918**.
- (39) J. Tausz and M. Peter, *Zentr. Bakt. Parasitenk. Infekt.*, II, **49**, 497, **1919**.
- (40) H. van Risseghem, *Bull. soc. chim. Belg.* **30**, 8, **1921**.
- (41) Pariselle and I. Simon, *Compt. rend.* **173**, 86, **1921**.
- (42) G. A. R. Kon, *J. Chem. Soc.* **119**, 810, **1921**.
- (43) H. van Risseghem, *Bull. soc. chim. Belg.* **31**, 213, **1922**.
- (44) H. van Risseghem, *Bull. soc. chim. Belg.* **32**, 144, **1923**.
- (45) A. Kirmann, *Bull. soc. chim.* [4] **39**, 988, **1926**.
- (46) H. van Risseghem, *Bull. soc. chim. Belg.* **35**, 328, **1926**.
- (47) H. van Risseghem, *Bull. soc. chim. Belg.* **35**, 387, **1926**.
- (48) M. Bourguet, *Bull. soc. chim.* [4] **41**, 1475, **1927**.
- (49) S. V. Lebedev and I. A. Vinogradov-Volzynski, *J. Russ. Phys.-Chem. Soc.* **60**, 441, **1928**.
- (50) G. Mignonac and R. Vanier de Saint-Aunay, *Compt. rend.* **189**, 106, **1926**.

- (51) T. Midgley, Jr. and A. L. Henne, *J. Am. Chem. Soc.* **51**, 1215, 1929.
(52) R. Lespieau and H. Wiemann, *Bull. soc. chem.* [4] **45**, 627, 1929.
(53) H. B. Dykstra, J. T. Lewis, and C. E. Boord, *J. Am. Chem. Soc.* **52**, 3396, 1930.
(54) H. van Risseghem, *Bull. soc. chem. Belg.* **39**, 349, 1930.
(55) M. Montagne, *Ann. chim. phys.* [10] **13**, 40, 1930.
(56) R. Wilkinson, *J. Chem. Soc.* **1931**, 3057.
(57) C. G. Schmitt and C. E. Boord, *J. Am. Chem. Soc.* **53**, 2427, 1931.
(58) C. G. Schmitt and C. E. Boord, *J. Am. Chem. Soc.* **54**, 751, 1932.
(59) P. J. Flory, unpublished work mentioned by C. G. Schmitt and C. E. Boord, *J. Am. Chem. Soc.* **54**, 751, 1932.
(60) I. Schurman and C. E. Boord, *J. Am. Chem. Soc.* **55**, 4930, 1933.
(61) H. van Risseghem, *Bull. soc. chim. Belg.* **42**, 219, 1933.
(62) H. I. Waterman and W. J. C. De Kok, *Rec. trav. chim.* **52**, 251, 1933.
(63) C. D. Hurd and H. T. Bollman, *J. Am. Chem. Soc.* **55**, 699, 1933.
(64) F. C. Whitmore and P. L. Meunier, *J. Am. Chem. Soc.* **55**, 3721, 1933.
(65) F. C. Whitmore and H. S. Rothrock, *J. Am. Chem. Soc.* **55**, 1106, 1933.
(66) H. van Risseghem, *Bull. soc. chim. Belg.* **42**, 229, 1933.
(67) H. van Risseghem, B. Gredy, and L. Piaux, *Compt. rend.* **196**, 938, 1933.
(68) J. M. Church, F. C. Whitmore, and P. V. McGrew, *J. Am. Chem. Soc.* **56**, 176, 1934.
(69) K. C. Laughlin, C. W. Nash, and F. C. Whitmore, *J. Am. Chem. Soc.* **56**, 1395, 1934.
(70) I. N. Nasarov, *Compt. rend. acad. sci. U. R. S. S.* **3**, 609-15, 1934.
(71) A. D. Petrov, *Uspekhi Khim.* **3**, 1050, 1934.
(72) I. N. Nasarov, *Ann. Leningrad State Roubnoff. Univ. Chem. Ser.* **1**, 123, 1935.
(73) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
(74) B. Gredy, *Bull. soc. chim.* [5] **2**, 1029, 1935.
(75) S. V. Lebedev and N. A. Kudrjawzew, *J. Gen. Chem. (U. S. S. R.)* **5**, (67) 1859, 1935.
(76) W. J. Hickinbottom, *J. Chem. Soc.* **1935**, 1279.
(77) B. Gredy, *Bull. soc. chim.* [5] **2**, 1951, 1935.
(78) K. B. Nisbet, Master's Thesis, Mount Holyoke College, 1935.
(79) C. M. Hull and C. E. Boord, *Ohio State Univ. Abs. Doctors' Dissertation*, No. 18, 191, 1936.
(80) G. S. Parks, S. S. Todd, and C. H. Shomate, *J. Am. Chem. Soc.* **58**, 2505, 1936.
(81) G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, *J. Am. Chem. Soc.* **58**, 137, 1936.
(82) I. N. Nasarov, *Ber.* **69B**, 18, 1936.
(83) M. L. Sherrill and P. Mollet, *J. chim. phys.* **33**, 701, 1936.
(84) E. P. Carr and M. K. Walker, *J. Chem. Phys.* **4**, 751, 1936.
(85) E. P. Carr and G. F. Walter, *J. Chem. Phys.* **4**, 756, 1936.
(86) M. Michailov and J. A. Arbuzov, *Compt. rend. acad. sci. U. R. S. S.* **3**, 423, 1936.
(87) E. A. Helm, Thesis, Mount Holyoke College, 1936.
(88) Armstrong, Master's Thesis, Mount Holyoke College, 1936.
(89) I. N. Nasarov, *Ber.* **70B**, 606, 1937.
(90) I. N. Nasarov, *Ber.* **70B**, 617, 1937.
(91) H. Brunner and E. H. Farmer, *J. Chem. Soc.* **1937**, 1039.
(92) T. D. Stewart, K. Dod, and G. Stenmark, *J. Am. Chem. Soc.* **59**, 1765, 1937.
(93) M. A. Dolliver, T. C. Gresham, G. B. Kistiakowsky, and W. E. Vaughan, *J. Am. Chem. Soc.* **59**, 831, 1937.
(94) A. G. Horney and C. E. Boord, *Ohio State Univ. Abs. Doctors' Dissertations*, No. 23, 101, 1937.
(95) L. Maess and L. von Müffling, *Angew. Chem.* **50**, 759, 1937.
(96) S. Winstein and H. J. Lucas, *J. Am. Chem. Soc.* **60**, 836, 1938.
(97) W. D. Kennedy, C. H. Shomate, and G. S. Parks, *J. Am. Chem. Soc.* **60**, 1507, 1938.
(98) H. van Risseghem, *Bull. soc. chim. Belg.* **47**, 221, 1938.
(99) A. v. Grosse and C. Linn, unpublished work.

- (100) H. van Risseghem, Bull. soc. chim. Belg. **47**, 47, 1938.
- (101) H. W. Rudel, Thesis—Ohio State Univ., Sept. 1938.
- (102) D. J. Gibson, Thesis—Ohio State Univ., Sept. 1938.
- (103) H. van Risseghem, Bull. soc. chim. Belg. **47**, 261, 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Heptene-1	-119.1	93.1	0.6976	1.3999	
C=C-C-C-C-C-C	-119.7 ¹	93.7 to 93.8 ³	0.6960 ³⁸	1.3965 ⁴	
	-119.1 ²	@ 771mm	0.6970 ^{5,6}	@ 25°	
	-115 ³	100 to 105 ⁴⁹	0.6972 ⁶	1.3976 ³⁹	
		97 to 99 ⁵⁸	0.6973 ³	1.3991 ⁵	
		95 to 100 ⁷³	0.6977 ³⁹	1.3992 ^{6,38}	
		95 to 95.2 ¹³	0.6983 ⁸	1.3996 ³	
		95 ^{71,72}	0.6992 ⁷	1.3997 ²	
		94.9 ¹¹	0.6993 ^{11,42}	1.3999 ^{5,11}	
		94.3 ⁴¹	0.700 ⁴³	1.3999 ^{37,42}	
		94 to 95 ¹⁰	@ 19°	1.4000 ⁶	
		94 to 94.5 ⁴⁰	0.705 ⁴⁰	1.4000 ⁴³	
		94 to 94.4 ⁹	@ 19°	@ 19°	
		93.85 to 93.9 ⁸	0.739 ⁵⁸	1.4027 ⁷	
		93.6 to 93.65 ⁵	D ₀ ^a	@ 19°	
		93.55 ⁶		1.4029 ⁷³	
		93.5 to 95.5 ⁷		@ 19°	
		93.5 to 94.5 ³⁹		1.404 ⁴⁰	
		93.45 ^{5,6}		@ 19°	
		93.0 ²		1.3972 ³	
		92 to 93 ⁴³		n _{Hα} ²⁰	
		93.4 to 93.7 ³⁸		1.4054 ³	
		@ 758mm		n _{Hβ} ²⁰	
		93.06 ²		1.4101 ³	
		@ 757mm		n _{Hγ} ²⁰	
		93.0 ⁵⁷			
		@ 750mm			
		94.3 ⁴²			
		@ 745mm			
cis Heptene-2					
C-C=C-C-C-C-C		98.5 to 99.5 ¹²	0.705 ¹²	1.4052 ¹²	
			@ 25°	@ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
trans Heptene-2					
C-C=C-C-C-C-C		97.5 to 99 ¹²	0.700 ¹² @ 26°	1.4056 ¹² @ 24°	
Heptene-2					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)		97.6 ⁴	0.7034 ^{11,14}	1.4021 ⁴ @ 25°	
		97.6 to 98 ¹⁴		1.4010 ¹⁴	
C-C=C-C-C-C-C		98.1 to 98.4 ¹¹		1.4041 ¹¹	
		98.5 ⁷⁴			
		98.6 to 99.6° ⁸			
trans Heptene-3 (?)					$\frac{dn}{dt} = -0.0003233/^\circ\text{C.}$ (20° to 40°)
C-C-C=C-C-C-C		95.8 ⁴⁴ @ 768mm	0.7016 ⁴⁴	1.39758 ⁴⁴ @ 40° 1.39934 ⁴⁴ @ 35° 1.40112 ⁴⁴ @ 28° 1.40419 ⁴⁴ @ 20°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Heptene-3					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)		93 to 95 ⁶⁰	0.7010 ^{45, 46}	1.4029 ¹⁵	
		94 ^{45, 46}	@ 22°	@ 24°	
		95 to 96 ¹³	0.7015 ¹⁸	1.4041 ¹⁶	
C-C-C=C-C-C-C		95.5 to 95.7 ¹⁵	@ 22°	@ 24°	
		95.7 to 96.0 ¹⁷	0.7000 ¹⁷	1.4046 ¹⁸	
		95.7 to 95.8 ¹⁶	0.7001 ¹⁶	@ 24°	
		95.8 ¹⁸	0.7005 ⁶¹	1.4049 ¹⁷	
		95.8 to 96.1 ¹¹	0.7020 ⁶⁰	@ 24°	
		95.8 to 96.3 ⁹	D ₂₀ ²⁰	1.4062 ¹³	
		97 to 98 ⁶²	0.7043 ¹¹	@ 24°	
		95.6 ⁶¹	D ₂₀ ²⁰	1.4090 ¹¹	
		@ 746mm		@ 24°	
				1.4017 ^{45, 46}	
				@ 22°	
2-Methylhexene-1		91	0.7036	1.4040	
		90 to 92 ¹⁵	0.7000 ¹¹	1.4068 ¹⁶	
		91.1 to 91.5 ¹¹	0.7033 ⁶⁴	@ 21°	
		92.8 to 93.5 ¹³	0.7041 ⁶³	1.4072 ¹³	
		94.5 to 95.5 ⁶⁴	0.7049 ¹³	@ 21°	
		@ 757mm	0.7077 ⁶⁴	1.4040 ¹¹	
		91.5 to 93 ⁶⁴	@ 15°		
		@ 753mm	0.7080 ⁶³		
		91 to 92 ⁶³	@ 15°		
		@ 750mm	0.7083 ⁶⁴		
		93 to 94 ⁶³	@ 15°		
		@ 749mm	0.7124 ⁶⁴		
			@ 15°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Methylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		84.0 86 to 87 ¹⁹ @ 763mm 83.8 to 84.0 ¹¹ 84.0 to 84.1 ¹¹	0.6945 ¹¹ 0.6953 ¹¹	1.3970 ¹¹	
4-Methylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		87.3 86.8 to 87.3 ⁹ 87.2 to 87.5 ¹¹	0.6969 0 7110 ⁹ @ 25° 0.6969 ¹¹	1.3985 1.3940 ⁹ @ 24.9° 1.3985 ¹¹	
5-Methylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		85 84 to 85 ⁸⁵ @ 762mm 80 to 85 ⁴⁷ 84 to 86 ⁴¹ 84.7 ¹¹ 85 to 86 ⁶⁰ 85.5 to 86.0 ⁹	0.6925 0.6895 ⁹ @ 25° 0.6936 ¹¹ 0.6956 ⁴⁸ D ₂₀ ²⁰ 0.7160 ⁶⁰ D ₁₅ ¹⁵ 0.7087 ⁶⁵ @ 0°	1.3954 1.3940 ⁹ @ 24 9° 1.3954 ¹¹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylhexene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		94.5 92 to 95 ⁴⁹ 94.4 to 94.6 ¹¹ 94.5 to 96 ⁶⁰ 95.1 ²⁰	0.7083 0.7078 ²⁰ 0.7089 ¹¹	1.4075 1.4040 ⁴⁹ @ 20.5° 1.4075 ¹¹ 1.4100 ²⁰ 1.4049 ⁴⁹ @ 17.5°	
3-Methylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		85 to 90 ⁶⁸ 90 to 94 ²¹ 93 to 97 ⁶¹ 93.1 to 93.3 ¹¹ 93.5 to 95.3 ⁶¹ 95.5 to 97.0 ⁶¹ 93.5 to 94.7 ²² @ 740mm	0.7301 ⁶⁸ @ 25° 0.7117 ⁶¹ @ 23° 0.71379 ⁶¹ @ 22.5° 0.71229 ⁶¹ @ 22.5° 0.7120 ²¹ 0.714 ²¹ @ 16° 0.712 ²¹ @ 16°	1.41319 ⁶⁸ @ 25° 1.40804 ⁶¹ @ 22.8° 1.4099 ⁶¹ @ 22.8° 1.4100 ²¹ @ 22.8° 1.4105 ²¹ @ 22.8° 1.41070 ⁶¹ @ 22.8° 1.4122 ²² @ 22.8°	
4-Methylhexene-2 (High boiling geometrical isomer) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		87.1 to 87.6 ¹¹	0.7007 ¹¹	1.3980 ¹¹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylhexene-2 (Low boiling geometrical isomer) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		85.1 to 85.6 ¹¹	0.6981 ¹¹	1.4000 ¹¹	
5-Methylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		91.1 to 91.6 ¹¹	0.6990 ¹¹	1.3990 ¹¹	
2-Methylhexene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		85.6 to 86.1 ¹¹ 86.4 to 86.9 ¹¹	0.6942 ¹¹ 0.7020 ¹¹	1.3991 ¹¹ 1.3995 ¹¹	
3-Methylhexene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		88.5 to 88.9 ²³ 91 ⁷⁶ 93 to 96 ⁶⁰ 93.8 to 94.2 ⁵² @ 755mm	0.6991 ²³ 0.7060 ⁷⁶ @ 16°	1.4050 ²³	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
2-Ethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		93.9 to 94.3 ¹¹	0.7079 ¹¹	1.4050 ¹¹	
3-Ethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		83.6 83.4 to 83.6 ²³ 85 ⁴⁵	0.6948 ⁴⁵ @ 22° 0.6956 ²³	1.3966 ⁴⁵ @ 22° 1.3998 ²³	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Ethylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		95.2	0.7217	1.4139	$\log_{10} P_{mm}$ $= 7.890 - \frac{1849.4}{T}$ (740 to 760mm)
		96 ⁵⁴	0.7190 ⁵³	1.4128 ⁵³	
		@ 764mm	D ₂₅ ²⁵	@ 25°	
		97 to 98 ^{60,76}	0.7191 ⁵⁴	1.4136 ²⁷	
		@ 24.45°	@ 25°	@ 25°	
		96 to 100 ²⁶	0.7172 ¹¹	1.4139 ⁵⁴	
		96 to 97 ²⁹	0.720 ²¹	@ 25°	
		96.1 ¹⁸	@ 15°	1.4140 ^{27,28}	
		95.7 to 96.2 ¹⁶	0.7213 ^{25,26}	@ 25°	
		95 to 98 ^{21,25}	@ 15°	1.4120 ¹¹	
		95 to 97 ⁵⁰	0.7222 ^{18,28}	1.4140 ¹¹	
		95.3 to 95.5 ¹¹	@ 15°	@ 18°	
		95.2 ²⁸	0.7223 ²⁷	1.4142 ^{24,27}	
		94 to 98 ²¹	@ 15°	@ 18°	
		95.16 ²⁷	0.7228 ²⁷	1.4143 ¹⁵	
		95.13 ²⁷	@ 15°	@ 18°	
		95.08 ²⁷	0.72544 ²⁷	1.40777	
		94.8 to 94.9 ¹¹	@ 15°	@ 17° ^{25,26}	
		95 to 95.5 ³³	0.718 ²¹	1.4145 ¹¹	
		@ 745mm	@ 13°	@ 16°	
		94.5 to 94.7 ¹¹		1.4149 ¹⁸	
		@ 743.5mm		@ 16°	
		93.9 to 94.0 ¹¹			
		@ 740.7mm			
		96 to 97 ²⁴			
		@ 737mm			
		94 to 95 ²⁴			
		@ 730mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3-Dimethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		84 84.1 to 84.4 ¹¹ 84.1 to 84.3 ¹¹ 84.0 to 84.4 ¹¹ 83 to 87.5 ⁴⁰ 80 to 86 ³⁰ 83.6 to 84.0 ¹¹ @ 750mm 83.4 to 83.6 ¹¹ @ 744mm 83.2 to 83.5 ¹¹ @ 740mm	0.7054 ¹¹ 0.722 ³⁰	1.4022 ¹¹ 1.4130 ³⁰ @ 18° 1.4160 ³⁰ @ 18°	
2,4-Dimethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		80.9 to 81.3 ¹¹ 80.4 to 80.8 ¹¹ @ 748mm	0.6937 ¹¹	1.3970 ¹¹	
3,3-Dimethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		77 77.1 ²⁰ 76.9 ³⁴ 76.6 ²⁰ @ 747mm	0.6965 0.6961 ³⁴ 0.6969 ²⁰	1.3985 1.3980 ²⁰ 1.3991 ³⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
4,4-Dimethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-136.5 ³¹	71.8 72.63 ³¹ @ 765mm 72.35 ³³ 71.4 to 71.8 ²³ 71.2 to 72.4 ⁹ 70.7 to 71.1 ³³ @ 724mm	0.6883 ⁹ @ 25° 0.6824 ²³ 0.6827 ³³ 0.6828 ³³ 0.7007 ³³ D_4^0	1.3922 1.3909 ⁹ @ 25.2° 1.3911 ³³ 1.3918 ³³ 1.3919 ³¹ 1.3930 ²³ 1.3932 ²³	
2,3-Dimethylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		92 90 to 92 ⁵⁶ 90 to 95 ³⁰ 91 to 93 ²³ 91 to 94 ³⁰ 91 to 95 ³⁰ 91.8 ²³ 92 to 95 ^{50,78} 93 to 95 ^{32,55} 92 to 95 ⁷⁷ @ 757mm	0.7197 0.7188 ⁷⁷ @ 21° 0.7190 ²³ 0.72 ⁵⁷ @ 22° 0.7203 ²³ 0.7363 ⁵⁵ D_4^{20} 0.7242 ³⁰ @ 15° 0.725 ³⁰ @ 1° 0.7355 ⁷⁷ @ 0° 0.7553 ⁵⁶ D_4^0	1.4146 1.413 ⁵⁶ @ 22° 1.4142 ²³ 1.4150 ²³ 1.4180 ³⁰ @ 18° 1.4195 ³⁰ @ 18° 1.4200 ³⁰ @ 18°	$\frac{dD}{dt} = -0.000817/^\circ\text{C.}$ (0° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,4-Dimethylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		83 81 to 82 ⁵⁰ 82 to 84 ^{62,67} 82 to 83 ⁶⁸ 82.4 to 82.8 ²³ 82.4 to 83.0 ²³ 82.5 to 83.5 ⁷⁰ 82.6 ⁶⁷ 82.9 to 83.4 ⁹ 84 to 85.5 ⁶⁹ 85 ⁸⁰	0.6955 0.6958 ⁶⁸ @ 22° 0.6947 ⁶⁷ 0.6954 ²³ 0.6958 ²³ 0.6978 ⁶⁹ 0.6985 ⁸⁰ @ 15° 0.6990 ⁶⁷ @ 15° 0.7059 ⁶⁹ @ 0° 0.7139 ⁶⁸ @ 0°	1.4015 1.40165 ⁶⁸ @ 22° 1.4013 ²³ 1.4014 ²³ 1.4020 ⁶⁷ 1.3995 ⁶⁷ n _{Ha} ²⁰ 1.4082 ⁶⁷ n _{Hβ} ²⁰ @ 15° 1.4134 ⁶⁷ n _{Hγ} ²⁰ 1.4022 ⁶⁷ n _{Hδ} ²⁰ @ 0°	$\frac{dD}{dt} = -0.0007715/^{\circ}\text{C.}$ (0° to 25°)
3,4-Dimethylpentene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		85 to 89 ²¹ 86.2 to 86.4 ¹¹ 88.7 to 89.1 ²³	0.7126 ¹¹ 0.715 ²¹ @ 15° 0.7186 ²³ @ 15°	1.4052 ¹¹ 1.4100 ²¹ @ 17° 1.4120 ²³	
4,4-Dimethylpentene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		84 to 86 ^{32,55} 76.0 to 76.1 ³⁴ 75.0 to 75.1 ³⁴ @ 739mm	0.6881 ³⁴ 0.7220 ⁵⁵ D ₄ ²⁰ 0.7414 ⁵⁵ D ₄ ⁰	1.3986 ³⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
3-Methyl-2-ethylbutene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C} \end{array}$		88.4 to 88.8 ¹¹ 88.7 to 89.1 ¹¹ 87.9 to 88.3 ¹¹ @ 748mm 88.2 to 88.5 ¹¹ @ 747mm	0.7186 ¹¹	1.4120 ¹¹	•
2,3,3-Trimethylbutene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		78 76 to 78 ⁵⁰ 77 to 79.5 ³⁵ 77.8 to 78.2 ²³ 77.9 to 78.1 ²³ 78 to 80 ^{70,81}	0.7029 0.7023 ²³ 0.7073 ⁷⁰ D_4^{20} 0.7075 ³⁵ @ 15° 0.7101 ²³ @ 15° 0.7243 ⁷⁰ D_4^{20}	1.4023 ²³ 1.4023 ³⁵ @ 15° 1.4059 ²³ @ 15°	$\frac{dD}{dt} = -0.00116/^\circ\text{C.}$ (0° to 20°)

- (1) G. S. Parks, S. S. Todd, and C. H. Shomate, *J. Am. Chem. Soc.* **58**, 2505, 1936.
- (2) G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, *J. Am. Chem. Soc.* **58**, 137, 1936.
- (3) H. I. Waterman and W. J. C. De Kok, *Rec. trav. chim.* **52**, 298, 1933.
- (4) T. D. Stewart, K. Dod, and G. Stenmark, *J. Am. Chem. Soc.* **59**, 1765, 1937.
- (5) G. F. Walter, "Synthesis of 1-Heptene," Mt. Holyoke College, 1932-33.
- (6) M. L. Sherrill, K. E. Mayer, and G. F. Walter, *J. Am. Chem. Soc.* **56**, 926, 1934.
- (7) F. Jostes and W. Bartels, *Oel, Kohle, Erdoel, Teer* **13**, No. 44, 1166, 1937.
- (8) Ho, "Synthesis of 1-Heptene," Mt. Holyoke College, 1932-33.
- (9) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
- (10) R. Ya. Levina, D. A. Petrov, and D. M. Trakhtenberg, *J. Gen. Chem. (U. S. S. R.)* **6**, 1496, 1936.
- (11) F. J. Soday and C. E. Boord, *J. Am. Chem. Soc.* **55**, 3293, 1933.
- (12) B. Gredy, *Bull. soc. chim. [5]* **2**, 1029, 1935.
- (13) J. Boeseken, *Rec. trav. chim.* **54**, 657, 1935.
- (14) C. E. Boord, private communication mentioned by M. N. Gormly, Thesis, Mount Holyoke College, 1936.
- (15) L. Maess and L. von Müffling, *Angew. Chem.* **50**, 759, 1937.
- (16) E. P. Carr and M. K. Walker, *J. Chem. Phys.* **4**, 751, 1936.
- (17) Wadmond, "Preparation of 3-Heptene from 4-Heptanol," Mount Holyoke College, 1933.
- (18) M. L. Sherrill and P. Mollet, *J. chim. phys.* **33**, 701, 1936.
- (19) P. G. Stevens, *J. Am. Chem. Soc.* **57**, 1112, 1935.
- (20) H. W. Rudel, Thesis, Ohio State Univ., Sept. 1938.
- (21) I. N. Nasarov, *Ber.* **70B**, 617, 1937.
- (22) A. G. Horney and C. E. Boord, Ohio State Univ. Abs. Doctors' Dissertations, No. 23, 101, 1937.
- (23) C. E. Boord, "Non Cyclic Hydrocarbons," 1936 Tabulation
- (24) J. M. Church, F. C. Whitmore, and P. V. McGrew, *J. Am. Chem. Soc.* **56**, 176, 1934.
- (25) I. N. Nasarov, *Compt. rend. acad. sci. (U. R. S. S.)* **3**, 609, 1934.
- (26) I. N. Nasarov, Ann. Leningrad State Boubnoff Univ. Chem. Ser. **1**, 123, 1935.
- (27) C. O. Monod, Master's Thesis, Mount Holyoke College, 1935.
- (28) E. P. Carr and G. F. Walter, *J. Chem. Phys.* **4**, 756, 1936.
- (29) W. J. Hickinbottom, *J. Chem. Soc.* 1935, 1279.
- (30) I. N. Nasarov, *Ber.* **70B**, 606, 1937.
- (31) M. A. Dolliver, T. C. Gresham, G. B. Kistiakowsky, and W. E. Vaughan, *J. Am. Chem. Soc.* **59**, 831, 1937.
- (32) S. W. Lebedew and N. A. Kudijawzew, *J. Gen. Chem. (U. S. S. R.)* **5**, (67), 1859, 1935.
- (33) F. C. Whitmore and A. H. Homeyer, *J. Am. Chem. Soc.* **55**, 4555, 1933.
- (34) I. Schurman and C. E. Boord, *J. Am. Chem. Soc.* **55**, 4930, 1933.
- (35) I. N. Nasarov, *Ber.* **69B**, 21, 1936; *Compt. rend. acad. sci. U. R. S. S.* **1**, 329, 1936.
- (36) F. Jostes and W. Bartels, *Oel, Kohle, Erdoel, Teer* **13**, No. 44, 1166, 1937.
- (37) K. E. Mayer, Master's Thesis, Mount Holyoke College, 1931.
- (38) D. D. Thompson, Master's Thesis, Mount Holyoke College, 1932.
- (39) R. Wilkinson, *J. Chem. Soc.* 1931, 3057.
- (40) M. Bourguel, *Bull. soc. chim. [4]* **41**, 1475, 1927.
- (41) F. J. Soday, unpublished work mentioned by B. H. Shoemaker and C. E. Boord, *J. Am. Chem. Soc.* **53**, 1505, 1931.
- (42) C. E. Boord, private communication 1931 mentioned by M. N. Gormly, Thesis, Mount Holyoke College, 1936.
- (43) A. Kirrmann, *Bull. soc. chim. [4]* **39**, 988, 1926.
- (44) L. Mathus and F. Gibon, *Bull. soc. chim. Belg.* **34**, 303, 1925.
- (45) C. Prévost, *Compt. rend.* **187**, 946, 1928.
- (46) C. Prévost and J. Daujat, *Bull. soc. chim. [4]* **47**, 590, 1930.

- (47) L. C. Swallen and C. E. Boord, J. Am. Chem. Soc. **52**, 651, 1930.
- (48) H. B. Dykstra, J. F. Lewis, and C. E. Boord, J. Am. Chem. Soc. **52**, 3396, 1930.
- (49) C. D. Hurd and C. W. Bennett, J. Am. Chem. Soc. **51**, 3675, 1929.
- (50) G. Edgar, G. Calingaert, and R. E. Marker, J. Am. Chem. Soc. **51**, 1483, 1929.
- (51) M. Montagne, Ann. chim. phys. [10] **13**, 40, 1930.
- (52) A. Favorski and J. Zalessky-Kibardine, Bull. soc. chim. [4] **37**, 1227, 1925.
- (53) H. J. Lucas, J. Am. Chem. Soc. **51**, 248, 1929.
- (54) J. Boeseken and Wilschut, Rec. trav. chim. **51**, 168, 1932.
- (55) A. Favorski and Alexejewa, J. Russ. Phys. Chem. Soc. **50**, 561, 1920.
- (56) Pariselle and L. J. Simon, Compt. rend. **173**, 86, 1921.
- (57) H. De Graef, Bull. soc. chim. Belg. **40**, 315, 1931.
- (58) P. Sabatier and J. B. Senderens, Compt. rend. **135**, 87, 1902; Ann. chim. phys. [8] **4**, 319, 1905.
- (59) J. v. Braun, Ann. **382**, 1, 1911.
- (60) B. T. Brooks and I. Humphrey, J. Am. Chem. Soc. **40**, 822, 1918.
- (61) S. Krapiw, Bull. soc. naturalistes Moscow [2] **22**, 1, 1908.
- (62) A. Mailhe, Bull. soc. chim. [4] **15**, 327, 1914.
- (63) N. D. Zelinsky and E. C. Przewalsky, J. Russ. Phys. Chem. Soc. **39**, 1168, 1907.
- (64) N. D. Zelinsky and E. C. Przewalsky, J. Russ. Phys. Chem. Soc. **40**, 1105, 1908.
- (65) E. Andre, Ann. chim. phys. [8] **29**, 540, 1913.
- (66) E. Bjelouss, Ber. **45**, 625, 1912.
- (67) A. Favorski and A. Umnova, J. Russ. Phys. Chem. Soc. **44**, 1349, 1912; J. prakt. Chem. [2] **88**, 646, 1913.
- (68) B. Mereshkowski, J. Russ. Phys. Chem. Soc. **45**, 1940, 1913.
- (69) W. Jegorowa, J. Russ. Phys. Chem. Soc. **46**, 1319, 1914.
- (70) A. Favorski, J. Russ. Phys. Chem. Soc. **50**, 43, 1918.
- (71) H. Limpricht, Ann. **103**, 80, 1857.
- (72) I. Welt, Ber. **30**, 1493, 1897.
- (73) R. Fittig, Ann. **117**, 68, 1861.
- (74) C. Schorlemmer and T. E. Thorpe, Ann. **217**, 149, 1883.
- (75) C. Friedel and R. D. Silva, Compt. rend. **76**, 226, 1873; Jahresber. Fortschr. Chem. **1873**, 338.
- (76) M. Saizew, Jr., J. prakt. Chem. [2] **57**, 38, 1898.
- (77) M. Kaschirsky, J. Russ. Phys. Chem. Soc. **13**, 90, 1881.
- (78) M. Kaschirsky, Ber. **11**, 984, 1878.
- (79) S. Reformatsky, Ber. **28**, 2842, 1895.
- (80) W. Markownikow, Zeitschr. Chem. **1870**, 518; **1871**, 268.
- (81) A. Eltekow, Ber. **16**, 395, 1883.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octene-1 C=C-C-C-C-C-C-C	- 104 ⁴⁰	122.5 121.85 to 122.15 ⁴⁰ @ 765mm 122.0 to 122.4 ³⁰ @ 760.2mm 121.6 to 123.6 ³⁰ @ 760.2mm 125.1 to 126.1 ⁴⁷ 123 to 124 ¹² 122 to 125 ¹³ 122 to 124 ^{9,21} 122 to 123 ^{10,44} 122 to 122.1 ^{2,3} 122 ¹⁷ 121.5 to 122.5 ²⁷ 121 to 122 ^{22,67} 120.9 to 121.2 ²⁹ 120.8 to 121.2 ²⁹ 120.2 to 120.7 ⁴² 119.2 to 119.7 ⁴² @ 747mm 120.1 to 120.4 ²⁹ @ 743mm 119.9 to 120.3 ²⁹ @ 741mm 120 to 121 ²⁹ @ 741mm 119 to 119.5 ³⁹ @ 739mm	0.7159 0.7147 ⁴² 0.7149 ²⁹ 0.715 ³⁹ 0.7151 ²⁹ 0.7155 ⁴⁰ 0.7158 ²⁷ 0.7165 ⁵⁷ 0.7177 ⁵⁴ 0.718 ³⁰ 0.7181 ³⁰ 0.716 ²² @ 19° 0.718 ²³ @ 18° @ 19° 0.7207 ¹² @ 18° 0.7217 ² @ 17°	1.4103 1.4082 ²⁷ 1.4087 ³⁹ 1.40880 ⁴⁰ 1.4090 ²⁹ 1.4092 ⁴² 1.4102 ⁵⁴ 1.4128 ⁵⁷ 1.4131 ³⁰ 1.4132 ³⁰ 1.408 ²³ @ 19° 1.4133 ¹² @ 18° 1.4145 ⁴⁴ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
cis Octene-2		123			
C-C=C-C-C-C-C-C		121 to 122 ⁵⁶ 125 to 126 ⁴⁸	0.9257 ⁴⁸ @ 24°	1.4119 ⁴⁸ @ 24°	
Octene-2					
Caprylene		125 to 126 ²³	0.6687 ¹⁰	1.4119 ⁴⁸	
(Mixtures of <i>cis</i> and <i>trans</i> isomers)		125.0 to 125.3 ²⁹	@ 78.8° 0.7127 ⁴⁴	@ 24° 1.4155 ⁴⁴	
C-C=C-C-C-C-C-C		125 ¹ 124.8 to 125.4 ²⁹	@ 30° 0.7193 ⁴² 0.7197 ⁵⁵	@ 21.5° 1.41366 ⁴⁵ 1.4147 ⁴²	
		124.6 to 124.9 ⁴²	0.7214 ⁵⁵ 0.7220 ²⁹	1.4148 ²⁹ 1.4149 ^{29, 56}	
		124.2 ⁵⁶ 123 to 123.5 ⁴⁴	0.7223 ²⁹ 0.7248 ⁴⁵ 0.725 ²³	1.415 ²³	
		123 to 124 ⁴⁸ 124.1 to 124.7 ²⁹			
		@ 745mm 123.8 to 124.1 ⁴²			
		@ 743mm 124.0 to 124.3 ²⁹			
		@ 740mm 23.5 ⁴⁸ @ 5.6mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) C-C-C=C-C-C-C-C		122.7 to 122.9 ²⁹ 121.9 to 122.1 ²⁹ @ 744mm 121.7 to 121.9 ²⁹ @ 741mm	0.7181 ²⁹ 0.7185 ²⁹	1.4138 ²⁹ 1.4139 ²⁹	
<i>cis</i> Octene-4 C-C-C=C-C-C-C-C	- 115 ⁶¹	61.9 ⁶¹ @ 97.4mm	0.7186 ⁶¹	1.4111 ⁶¹ @ 24.2°	
<i>trans</i> Octene-4 C-C-C=C-C-C-C-C	- 105 ⁶¹	120.7 ⁶⁶	0.7166 0.7165 ⁶¹ 0.7167 ⁶⁶	1.4110 ⁶¹ @ 24.2° 1.4131 ⁶⁶	
Octene-4 (Mixtures of <i>cis</i> and <i>trans</i> isomers) C-C-C=C-C-C-C-C		121.9 to 122.3 ²⁹ 122.0 to 122.3 ²⁹ 121.1 to 121.4 ²⁹ @ 742mm 120.9 to 121.3 ²⁹ @ 740mm	0.7184 ²⁹	1.4140 ²⁹	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
2-Methylheptene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		119.2 to 119.5 ²⁹ 118.3 to 118.6 ²⁹ @ 743mm	0.7203 ²⁹	1.4122 ²⁹	
3-Methylheptene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		112 111.0 ⁶⁶ 112.6 to 113.0 ⁵⁵	0.7109 ⁶⁶ 0.7185 ⁵⁵	1.408 1.4063 ⁶⁶ 1.4099 ⁵⁵	
4-Methylheptene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		112.6 to 113.0 ⁴² 111.7 to 112.1 ⁴² @ 740mm	0.7183 ⁴²	1.4099 ⁴²	
5-Methylheptene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		113.1 to 113.4 ⁴² 112.4 to 112.7 ⁴² @ 744mm	0.7164 ⁴²	1.4094 ⁴²	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Methylheptene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		114 113.5 to 113.9 ⁴² 113.3 to 113.6 ⁴² 113 to 115 ²⁰ 111 to 112 ²¹ 110 ⁸ @ 750mm 112.7 to 113.0 ⁴² @ 747mm 112.6 to 113.0 ⁴² @ 739mm	0.7133 0.7125 ²¹ 0.7135 ⁴² 0.71845 ⁸ @ 14.5° 0.7294 ⁸ @ 0°	1.407 1.3986 ²¹ 1.4083 ⁴² 1.4085 ⁴²	$\frac{dD}{dt} = -0.000815/^{\circ}\text{C.}$ (0° to 20°)
2-Methylheptene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		122.5 to 122.7 ⁵¹ 122.3 to 122.7 ⁵⁵ 121.7 ⁶⁴ 121 to 122 ⁶⁰ 120 to 121 ²⁸ 122.4 ¹⁸ @ 756mm 123 to 125 ¹¹ @ 755mm 121 ⁶⁴ @ 746mm 121.5 to 121.7 ⁵¹ @ 736mm	0.7248 0.728 ²⁸ @ 22° 0.7245 ⁶⁴ 0.7249 ⁵¹ 0.816 ¹¹ 0.7256 ¹⁸ D ₄ ²⁰	1.4172 1.4169 ¹⁸ 1.4170 ⁵¹ 1.4175 ⁶⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
3-Methylheptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		121 to 122 ⁶⁰ 122.2 to 122.8 ⁶¹ 121 ³⁶ @ 750mm 121.4 to 122.0 ⁶¹ @ 742mm	0.7304 ⁶¹ 0.7308 ⁶⁶ 0.7296 ⁶⁶ D_{20}^{20}	1.4183 ⁶⁶ 1.4190 ⁶⁰ 1.4197 ⁶¹	
4-Methylheptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		113.2 to 113.4 ⁴² 113.8 to 114.1 ⁴⁷ 112.1 to 112.5 ⁴² @ 740mm	0.7188 ⁴⁷ @ 25° 0.7145 ⁴²	1.4100 ⁴⁷ @ 25° 1.4110 ⁴²	
5-Methylheptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		117.2 to 117.6 ⁶⁶	0.7202 ⁶⁶	1.4120 ⁶⁶	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Methylheptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		116.3 to 117.3 ⁴² 117.4 to 117.8 ⁵⁵ 115.4 to 116.4 ⁴² @ 739mm	0.7179 ⁵⁵ 0.7188 ⁴²	1.4120 ⁴² 1.4122 ⁵⁵	
2-Methylheptene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		111.7 to 112.2 ²⁹ 120.4 ¹⁵ 110.8 to 111.3 ²⁹ @ 741mm	0.7059 ²⁹ 0.7314 ¹⁵	1.4070 ²⁹	
3-Methylheptene-3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		121.1 ⁵⁵	0.7280 ⁵⁵	1.4180 ⁵⁵	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylheptene-3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		115 to 120 ¹⁴ 120.4 ⁴ 122.4 ⁶⁵	0.71746 ⁴ D ₀ ³⁵ 0.72287 ⁴ D ₀ ³⁰ 0.7411 ¹⁴ @ 25° 0.7255 ⁶⁵ 0.73138 ⁴ D ₀ ³⁰ 0.73246 ⁴ D ₃₀ ²⁰	1.4169 ⁶⁵ 1.41712 ¹⁴ @ 25°	
5-Methylheptene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		111.7 to 112.3 ²⁹ 110.4 to 111.0 ²⁹ @ 732mm	0.7118 ²⁹	1.4097 ²⁹	
6-Methylheptene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		111.5 to 112.5 ⁵ 114.2 to 114.7 ²⁹ 113.1 to 113.6 ²⁹ @ 737mm	0.7121 ²⁹	1.4103 ²⁹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Ethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		120 116 to 118 ⁴¹ 120.5 ²⁹ 121.1 119.6 to 120.2 ²⁹ @ 742mm	0.7274 ²⁹ 0.7283 ²⁹ @ 16°	1.4207 1.4158 ⁶² @ 30° 1.4207 ⁶² 1.4161 ²⁹ 1.4180 ⁴¹ @ 12° 1.4305 ⁶² @ 0° 1.4452 ⁶² @ -30°	$\frac{dn}{dt} = -0.00049/^\circ\text{C.}$ (-30° to 30°)
3-Ethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		107.7 to 111.7 ²⁹ 110.0 to 111.0 ²⁹ 109.1 to 110.1 ²⁹ @ 741mm 106.6 to 110.6 ²⁹ @ 737mm	0.7134 ²⁹ 0.7140 ²⁹	1.4068 ²⁹ 1.4072 ²⁹	
4-Ethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		110 to 111 ⁵⁵	0.7134 ⁵⁵	1.4068 ⁵⁵	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Ethylhexene-2 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		119.6 to 120.5 ¹⁶ @ 769mm 120.1 to 121.1 ⁶¹ 119.4 ³ 119.2 to 120.1 ¹⁶ 119 to 122 ²⁶ 119 to 120 ⁷ 119.5 to 120.5 ⁶¹ @ 745mm	0.72074 ³ D ₀ ²⁰ 0.72598 ³ D ₀ ²⁰ 0.73657 ³ 0.7367 ⁶¹ 0.73754 ³ D ₂₀ ²⁰	1.4246 ⁶¹	
4-Ethylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		112.4 to 112.6 ⁴² 112.0 to 112.2 ⁴² @ 750mm	0.7138 ⁴²	1.4108 ⁴²	
3-Ethylhexene-3 $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		112.5 to 113.0 ⁶⁶ @ 751mm	0.7144 ⁶⁶	1.4149 ⁶⁶	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3-Dimethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		110.5 110.3 to 110.8 ⁶⁵ 110.6 to 110.8 ⁶⁰ 110.8 ⁵⁰ 110.0 ⁵⁰ @ 743mm 109.6 to 109.8 ⁵⁰ @ 738mm	0.723 0.7222 ⁵⁰ 0.7250 ⁶⁵	1.412 1.4104 ⁵⁰ 1.4117 ⁵⁰ 1.4153 ⁶⁵	
2,4-Dimethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		111.0 to 111.3 ⁵⁰ 110.2 to 110.5 ⁵⁰ @ 743mm	0.7191 ⁵⁰	1.4107 ⁵⁰	
2,5-Dimethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		111.6 ⁵⁰ 111.6 to 112.6 ⁵⁰ 111.1 ⁵⁰ @ 748mm 111.0 to 112.0 ⁵⁰ @ 746mm	0.7172 ⁵⁰ 0.7194 ⁵⁰	1.4106 ⁵⁰ 1.4117 ⁵⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,3-Dimethylhexene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		104.0 ⁶⁴ 105.8 ⁶⁵	0.7143 ^{64,65}	1.4067 1.4065 ⁶⁵ 1.4070 ⁶⁴	
3,4-Dimethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		113.0 to 113.5 ⁴² 112.2 to 112.7 ⁴² @ 742mm	0.7240 ⁴²	1.4145 ⁴²	
3,5-Dimethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		105.0 to 105.8 ⁴² 104.4 to 105.2 ⁴² @ 746mm	0.7087 ⁴²	1.4050 ⁴²	
4,4-Dimethylhexene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		107.0 to 107.5 ⁴² 106.2 to 106.7 ⁴² @ 742mm	0.7198 ⁴²	1.4102 ⁴²	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,5-Dimethylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \\ \quad \quad \text{C} \quad \text{C} \end{array}$		107.8 to 108.8 ⁶⁵	0.7382 ⁶⁵	1.4152 ⁶⁵	
5,5-Dimethylhexene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \quad \quad \text{C} \end{array}$		101.8 ⁶⁵	0.7132 ⁶⁵	1.4055 ⁶⁵	
2,3-Dimethylhexene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \quad \text{C} \quad \text{C} \end{array}$		119 114 to 118 ⁵⁸ 114 to 119 ⁵⁸ 119 to 119.5 ⁶⁰ 120.2 ⁶⁵	0.7392 0.7392 ⁶⁵ 0.7364 ⁵⁸ @ 16° 0.736 ⁵⁸ @ 15°	1.4271 1.4270 ⁵⁸ 1.4272 ⁵⁸ 1.4238 ⁶⁵ @ 18° 1.4225 ⁶⁰ @ 18°	
2,4-Dimethylhexene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \\ \quad \text{C} \quad \quad \text{C} \end{array}$		110 108.9 to 109.0 ⁶⁰ 110.1 to 110.5 ⁶⁵	0.727 0.7223 ⁶⁰ 0.7322 ⁶⁵	1.3990 ⁶⁵ 1.4144 ⁶⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,5-Dimethylhexene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		112 112.0 to 112.2 ⁵¹ 112.3 ⁶⁴ 111.3 to 111.5 ⁵¹ @ 744mm 111 ³⁶ @ 739mm	0.7209 0.7190 ⁶⁴ 0.7202 ⁵¹ 0.7265 ³⁶ D ₂₀ ²⁰	1.4143 1.4135 ³⁶ 1.4144 ⁶⁴ 1.4146 ⁵¹	
3,4-Dimethylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		115.3 to 115.6 ⁶⁰ 115 to 116 ⁴⁶ @ 756mm	0.7294 ⁶⁰ 0.7315 ⁶⁰ 0.7438 ⁶⁰ 0.7521 ⁴⁶ @ 0°	1.4152 to 1.4156 ⁴⁹ @ 25° 1.4139 ⁶⁰ 1.4175 ⁶⁰ 1.4192 ⁴⁶	
3,5-Dimethylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		108 to 111 ⁶⁰ 109.1 ⁵⁵ 112.5 to 113 ⁵¹ 109 ³⁶ @ 737mm 111.4 to 111.9 ⁵¹ @ 735mm	0.7313 ⁵⁵ 0.7242 ⁵¹ 0.7313 ³⁶ D ₂₀ ²⁰	1.4148 ⁶⁰ 1.4160 ^{36,55} 1.4162 ⁵¹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,4-Dimethylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		105.4 to 106.0 ³⁷ 103.5 to 104.1 ³⁷ @ 739mm	0.7202 ³⁷	1.4120 ³⁷	
4,5-Dimethylhexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		109.5 to 110.0 ⁴² 108.6 to 109.1 ⁴² @ 740mm	0.7200 ⁴²	1.4132 ⁴²	
2,2-Dimethylhexene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		100.1 ³⁷ 99.0 ³⁷ @ 750.5mm	0.7048 ³⁷	1.4068 ³⁷	
2,5-Dimethylhexene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		102.0 to 102.1 ⁴⁵	0.7124 ⁴⁵	1.4030 ⁴⁵	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4-Dimethylhexene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		113.5 ²⁴			
2-Propylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		117.7 ⁵⁰ 117.3 ⁵⁰ @ 751mm	0.7240 ⁵⁰	1.4136 ⁵⁰	
2-Isopropylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		111.7 to 112.0 ⁵⁰ 110.8 to 111.1 ⁵⁰ @ 741mm	0.7212 ⁵⁰	1.4117 ⁵⁰	
2-Methyl-3-ethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$		109.0 to 110.0 ⁵⁰ 107.9 to 108.9 ⁵⁰ @ 737mm	0.7262 ⁵⁰	1.4140 ⁵⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Methyl-2-ethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C} \end{array}$		112.5 112.5 to 112.7 ⁵⁰ 111.4 to 113 ⁶³ 111.8 to 112.0 ⁵⁰ @ 745mm	0.7294 0.7288 ⁵⁰ 0.7300 ⁶³	1.4142 ^{50,63}	
3-Methyl-3-ethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \end{array}$		110.3 to 111.7 ⁶³	0.7197 ⁶³	1.4120 ⁶³	
4-Methyl-2-ethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		111 110.2 to 110.4 ⁵⁰ 110.4 to 111.7 ³² 109.6 to 110.9 ³² @ 744mm 109.3 to 109.5 ⁵⁰ @ 741mm	0.7195 0.7192 ⁵⁰ 0.7197 ²⁹	1.4111 1.4102 ⁵⁰ 1.4120 ²⁹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyl-3-ethylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$		117 113 to 116.5 ⁵⁸ 116.8 to 117.3 ⁶⁵ 114.5 to 116.5 ⁶ @ 741mm	0.7390 0.7390 ⁶⁵ 0.7385 ⁶ D ₃₀ ²⁰ 0.7388 ⁵⁸ @ 16° 0.7535 ⁶ D ₀ ⁰	1.4246 1.4246 ⁶⁵ 1.4215 ⁵⁸ @ 17°	
4-Methyl-3-ethylpentene-2 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \\ \text{C} \end{array}$		114.5 to 116.5 ⁵⁸ @ 741mm			
2,3,3-Trimethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		108 107.8 to 108.4 ⁵⁰ 108.2 ³⁸ 111.4 to 112.4 ⁶⁵ 107.2 to 107.8 ⁵⁰ @ 747mm 106 to 106.7 ³⁴ @ 742mm	0.734 0.7305 ⁶⁵ 0.7363 ³⁸ 0.739 ⁵⁰	1.4184 1.4178 ³⁸ 1.4179 ³⁴ 1.4180 ⁶⁵ 1.4200 ⁶⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3,4-Trimethylpentene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \end{array}$		106.7 to 107.7 ⁵⁰ 106.0 to 107.0 ⁵⁰ @ 744mm	0.726 ⁵⁰	1.4146 ⁵⁰	
2,4,4-Trimethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-93.7	101.5	0.7164	1.4089	
	-94.2 ⁵²	101.56 to	0.710 ²⁸	1.408 ²⁸	
	-93.6 ³⁷	101.58 ⁵⁹ @ 765mm	0.7151 ³¹	1.4082 ^{31,32}	
		102 ⁴³ @ 765mm	0.7167 ⁴³	1.4084 ³⁵	
		101 to 102 @ 765mm ⁴³	0.7179 ⁴³	1.4089 ⁵⁰	
		101.2 ^{31,32}		1.4100 ⁴³	
		101.2 to 101.3 ²⁸		1.4103 ⁴³	
		101.5 ³⁵ @ 738mm			
		100.1 ³⁷ @ 737mm			
		100.1 to 100.2 ²⁸ @ 736mm			
3,3,4-Trimethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		105.4 ⁶⁴	0.7287 ⁶⁴	1.4140 ⁶⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4,4-Trimethylpentene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	.	104.9 to 105.6 ⁴² 104.2 to 104.9 ⁴² @ 743mm	0.7185 ⁴²	1.4128 ⁴²	
2,3,4-Trimethylpentene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \end{array}$		115 110 to 115 ⁵⁸ 113.8 to 114.5 ⁶⁶ 114.3 ³³ @ 739mm	0.7325 ⁶⁵ 0.742 ⁵⁸ @ 13°	1.423 1.4199 ⁶⁸ 1.4263 ³³ 1.4268 ⁵⁸ @ 15°	
2,4,4-Trimethylpentene-2 $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-107 -108.3 ³¹ -107.1 ⁵² -106.5 ³¹	104.5 104.84 ⁶⁹ @ 765mm 104 to 105 ⁴³ 104.1 to 104.5 ²⁸ 104.5 ³¹ 104.8 to 105.0 ⁶⁰ 103.4 ³¹ @ 737mm 103.0 to 103.4 ²⁸ @ 736mm	0.722 0.715 ²⁸ 0.7211 ³¹ 0.7293 ⁶⁰	1.4159 1.415 ²⁸ 1.4158 ³¹ 1.4159 ⁶⁰ 1.4160 ⁶⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4,4-Trimethylpentene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array} $		108 to 113 ⁵³ 111.2 to 111.5 ⁶⁰ 111.9 ³³ 109 ³⁴ @ 740mm	0.7395 ³³ 0.7401 ⁶⁰ 0.7473 ⁵³ @ 15°	1.4190 ⁶⁰ 1.4232 ^{34,35} 1.4277 ⁵³ @ 15°	
3-Methyl-2-Isopropylbutene-1 $ \begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C} \\ \\ \text{C} \end{array} $		103 103.3 ⁵⁰ 101.9 ³³ @ 741mm 102.4 to 102.5 ⁵⁰ @ 741mm	0.7172 ⁵⁰	1.4081 1.4079 ⁵⁰ 1.4083 ³³	
3,3-Dimethyl-2-ethylbutene-1 $ \begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \\ \text{C} \end{array} $		110.4 to 110.8 ¹⁴			

- (1) J. Bouis, *Ann. chim. phys.* [3] **44**, 77, 1855; *Ann.* **92**, 396, 1854.
- (2) W. Möslinger, *Ann.* **185**, 49, 1877.
- (3) E. Sokoloff, *J. prakt. Chem.* [2] **39**, 440, 1889.
- (4) E. Sokoloff, *J. prakt. Chem.* [2] **39**, 444, 1889.
- (5) R. Fittig and F. Feist, *Ann.* **255**, 108, 1889.
- (6) P. Grigorowitsch and D. Pawlow, *J. Russ. Phys. Chem. Soc.* **23**, 172, 1891.
- (7) H. Masson, *Compt. rend.* **132**, 483, 1901.
- (8) P. Barbier and V. Grignard, *Bull. soc. chim.* [3] **31**, 840, 1904.
- (9) P. Sabatier and J. B. Senderens, *Ann. chim. phys.* [8] **4**, 319, 1905.
- (10) J. F. Eijkman, *Chem. Weekblad* **3**, 701, 1906.
- (11) J. Muset, *Bull. Acad. roy. Belg.* **1906**, 775.
- (12) S. Krapiwins, *Bull. soc. naturalistes Moscow* [2] **22**, 1, 1908.
- (13) J. v. Braun, *Ann.* **382**, 1, 1911.
- (14) E. Bjelouss, *Ber.* **45**, 625, 1912.
- (15) L. Clarke and E. R. Reigel, *J. Am. Chem. Soc.* **34**, 674, 1912.
- (16) L. Clarke and W. N. Jones, *J. Am. Chem. Soc.* **34**, 170, 1912.
- (17) J. B. Senderens, *Compt. rend.* **154**, 777, 1913.
- (18) N. Kishner, *J. Russ. Phys. Chem. Soc.* **45**, 973, 1913.
- (19) E. Chablay, *Ann. chim.* **1**, 469, 1914.
- (20) B. de Ressayguier, *Bull. soc. chim.* [4] **15**, 183, 1914.
- (21) B. T. Brooks and I. Humphrey, *J. Am. Chem. Soc.* **40**, 822, 1918.
- (22) A. Kirrmann, *Bull. soc. chim.* [4] **39**, 988, 1926.
- (23) M. Bourguet, *Bull. soc. chim.* [4] **41**, 1475, 1927.
- (24) J. Tausz, *Beilstein's Handbuch Org. Chem.* [4] **1**, 94, 1928.
- (25) J. Doeuvre, *Bull. soc. chim.* [4] **45**, 403, 1929.
- (26) M. Montagne, *Ann. chim. phys.* [10] **13**, 40, 1930.
- (27) R. Wilkinson, *J. Chem. Soc.* **1931**, 3057.
- (28) F. C. Whitmore and S. N. Wrenn, *J. Am. Chem. Soc.* **53**, 3136, 1931.
- (29) J. M. Mavity and C. E. Boord, *Ohio State Univ. Abs. Doctors' Dissertations*, No. 7, 197, 1931.
- (30) H. I. Waterman and T. W. te Nuyl, *Rec. trav. chim.* **51**, 533, 1932.
- (31) C. O. Tongberg, J. D. Pickers, M. R. Fenske, and F. C. Whitmore, *J. Am. Chem. Soc.* **54**, 3706, 1932.
- (32) F. C. Whitmore and J. M. Church, *J. Am. Chem. Soc.* **54**, 3710, 1932.
- (33) F. C. Whitmore and K. C. Laughlin, *J. Am. Chem. Soc.* **54**, 4392, 1932.
- (34) F. C. Whitmore and K. C. Laughlin, *J. Am. Chem. Soc.* **54**, 4011, 1932.
- (35) F. C. Whitmore and A. L. Houk, *J. Am. Chem. Soc.* **54**, 3714, 1932.
- (36) M. Tuot, *Compt. rend.* **197**, 1434, 1933.
- (37) I. Schurman and C. E. Boord, *J. Am. Chem. Soc.* **55**, 4930, 1933.
- (38) K. C. Laughlin and F. C. Whitmore, *J. Am. Chem. Soc.* **55**, 2607, 1933.
- (39) F. C. Whitmore and J. M. Herndon, *J. Am. Chem. Soc.* **55**, 3428, 1933.
- (40) H. I. Waterman and W. J. C. de Kok, *Rec. trav. chim.* **53**, 725, 1934.
- (41) J. v. Braun and G. Marz, *Ber.* **67B**, 1696, 1934.
- (42) M. A. Dietrich and C. E. Boord, *Ohio State Univ. Abs. Doctors' Dissertations*, No. 14, 12, 1934.
- (43) H. I. Waterman, J. J. Leendertse, and A. J. de Kok, *Rec. trav. chim.* **53**, 1151, 1934.
- (44) A. Krassilchik, *Ann. combustibles liquides* **10**, 923, 1935.
- (45) A. Maman, *Pub. sci. tech. ministère air (France)* No. **66**, 1, 1935.
- (46) S. V. Lebedev and S. M. Orlov, *J. Gen. Chem. (U. S. S. R.)* **5**, 1589, 1935.
- (47) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
- (48) B. Gredy, *Bull. soc. chim.* [5] **2**, 1029, 1935.
- (49) N. L. Drake and F. P. Veitch, Jr., *J. Am. Chem. Soc.* **57**, 2623, 1935.

- (50) S. B. Kuykendall and C. E. Boord, Ohio State Univ. Abs. Doctors' Dissertations, No. 17, 241-53, 1935.
- (51) C. M. Hull and C. E. Boord, Ohio State Univ. Abs. Doctors' Dissertations No. 18, 191, 1936.
- (52) G. S. Parks, S. S. Todd, and C. H. Shomate, J. Am. Chem. Soc. **58**, 2505, 1936.
- (53) I. N. Nasarov, Ber. **69B**, 21, 1936; Compt. rend. acad. sci. U. R. S. S. **1**, 329, 1936.
- (54) S. S. Nametkin and L. N. Abakumovskaya, J. Gen. Chem. (U. S. S. R.) **6**, 1166, 1936.
- (55) C. E. Boord, "Non Cyclic Hydrocarbons" 1936 Tabulation.
- (56) G. Dupont, Bull. soc. chim. [5] **3**, 1030, 1936.
- (57) F. Jostes and W. Bartels, Oel, Kohle, Erdoel, Teer **13**, No. 44, 1166, 1937.
- (58) I. N. Nasarov, Ber. **70 B**, 606, 1937.
- (59) M. A. Dolliver, T. C. Gresham, G. B. Kistiakowsky, and W. E. Vaughan, J. Am. Chem. Soc. **59**, 831, 1937.
- (60) A. G. Horney and C. E. Boord, Ohio State Univ. Abs. Doctors' Dissertations, No. 23, 101, 1937.
- (61) W. G. Young, Z. Jasaitis, and L. Levanas, J. Am. Chem. Soc. **59**, 403, 1937.
- (62) A. v. Grosse and C. Linn, unpublished work.
- (63) J. M. Mavity, unpublished data.
- (64) H. W. Rudel, Thesis—Ohio State Univ., Sept., 1938.
- (65) R. J. Reid, Thesis—Ohio State Univ., June, 1938.
- (66) D. J. Gibson, Thesis—Ohio State Univ., Sept., 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Nonene-1 <chem>C=C-C-C-C-C-C-C-C</chem>		146 145.0 to 145.6 ¹⁷ 145.3 to 145.8 ²⁵ 146 ¹³ 39.5 ²⁴ @ 3mm	0.7308 0.730 ¹³ @ 21° 0.7302 ²⁴ 0.7315 ¹⁷	1.4161 1.414 ¹³ @ 21° 1.41600 ²⁴ 1.4163 ¹⁷	
cis Nonene-2 <chem>C-C-C-C-C-C-C-C-C</chem>		148.5 ²⁵	0.738 ¹³ @ 21°	1.420 ¹³ @ 21°	
Nonene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) <chem>C-C=C-C-C-C-C-C-C</chem>		147 to 148 ^{3,4} 153 to 154 ⁵ @ 768mm	0.8371 ⁵		
Nonene-4 (Mixtures of <i>cis</i> and <i>trans</i> isomers) <chem>C-C-C-C=C-C-C-C-C</chem>		143 to 145 ¹¹ 147 to 148 ³⁵ 147.5 to 148.1 ²⁵ 44 to 46 ¹⁵ @ 12mm	0.7287 ¹⁵ @ 22° 0.7394 ¹¹ 0.732 ³⁵ @ 18°	1.4185 ¹⁵ @ 22° 1.421 ³⁵ @ 18°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyloctene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		143 140 to 144 ² 141.5 to 143 ² 143.1 ³³	0.7346 ³³ 0.7318 ² D ₁₁ ¹¹	1.4190 ³³	
3-Methyloctene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		136.3 ³⁴	0.7249 ³⁴	1.4130 ³⁴	
7-Methyloctene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		138.1 ³³	0.7252 ³³	1.4133 ³³	
2-Methyloctene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		146 145 to 146 ²⁶ 146.2 ³¹	0.7385 ³¹	1.4240 ²⁶ @ 21° 1.4240 ³¹	
3-Methyloctene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		143 to 145 ²⁰ @ 734mm 64.5 to 65 ²⁶ @ 14mm	0.7409 ²⁰ @ 25° 0.759 ²⁶ @ 23°	1.4268 ²⁶ @ 23° 1.4247 ²⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methyloctene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		137.3 to 137.9 ²⁵	0.7286 ²⁵ @ 25°	1.4158 ²⁵ @ 24.8°	
4-Methyloctene-4 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		133 to 138 ⁶ 136 to 144 ¹⁰	0.7388 ⁶ @ 25° 0.7495 ¹⁰ D ₂₀ ²⁰	1.41781 ⁶ @ 25° 1.4228 ¹⁰	
3-Ethylheptene-3 $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		140 to 141 ¹² @ 759mm	0.7477 ¹²	1.42765 ¹²	
4-Ethylheptene-3 (?) (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		138 to 145 ²⁸			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
1-2,4-Dimethylheptene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		134 to 136 ¹⁸			
d-2,5-Dimethylheptene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		138 ¹⁹			$[\alpha]_D^{25} = +2.39^\circ$ ¹⁹ $[M]_D^{25} = +3.02^\circ$ ¹⁹
2,6-Dimethylheptene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		139 138.9 ³¹ 142 to 143 ¹⁴	0.7336 ³¹ 0.768 ¹⁴ @ 14°	1.4224 ³¹ 1.4321 ¹⁴ @ 14°	
4,5-Dimethylheptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		135.0 to 136.1 ²⁸	0.7431 ²⁸ @ 25°	1.4220 ²⁸ @ 24.8°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (n 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
4,6-Dimethylheptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \\ & & & & \text{C} & & \text{C} & & & & \end{array}$		129.5 to 130.1 ²⁵	0.7239 ²⁵ @ 25°	1.4135 ²⁵ @ 25°	
2,3-Dimethylheptene-3 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \\ & & \text{C} & & & & & & & & \end{array}$		138.4 to 138.8 ²² @ 740.5mm	0.747 ²²	1.4250 ²²	
2,6-Dimethylheptene-3 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \\ & & \text{C} & & & & \text{C} & & & & \end{array}$		132 to 134 ¹⁰			
3,6-Dimethylheptene-3 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \\ & & & & \text{C} & & \text{C} & & & & \end{array}$		137 ²¹ @ 747mm	0.7382 ²¹ D ₁₀ ²⁰	1.4217 ²¹	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
4,6-Dimethylheptene-3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \quad \\ \quad \quad \text{C} \quad \quad \text{C} \end{array}$		131 ²¹ @ 749mm	0.7358 ²¹ D ₂₀ ²⁰	1.4198 ²¹	
2-Propylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \quad \text{C}-\text{C}-\text{C} \end{array}$		142 to 144 ⁷ @ 768mm			
3-Propylhexene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \quad \text{C}-\text{C}-\text{C} \end{array}$		138 to 142 ²⁹	0.747 ²⁹ @ 13°	1.4300 ²⁹ @ 18°	
4-Methyl-4-ethylhexene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \quad \text{C}-\text{C} \end{array}$		135.0 to 136.5 ³²	0.7467 ³²	1.4230 ³²	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,5,5-Trimethyl- hexene-2 $ \begin{array}{c} & & & & \text{C} \\ & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & \\ & & & & \text{C} \end{array} $		126.7 ³¹	0.7335 ³¹	1.4210 ³¹	
4,5,5-Trimethyl- hexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers)		128.7 to 129.5 ²⁸	0.7382 ²⁸ @ 25°	1.4198 ²⁸ @ 24.9°	
$ \begin{array}{c} & & & & \text{C} \\ & & & & \\ \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & \\ & & & & \text{C} \end{array} $					
2,2,3-Trimethyl- hexene-3 (Mixtures of geometrical isomers)		130 to 132 ²⁷	0.7493 ²⁷ @ 15°	1.4312 ²⁷ @ 15°	
$ \begin{array}{c} & & & & \text{C} \\ & & & & \\ \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & \\ & & & & \text{C} \end{array} $					
4-Methyl- 2-propylpentene-1 $ \begin{array}{c} & & & & \text{C} \\ & & & & \\ \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & \\ & & & & \text{C} \end{array} $		132 to 133 ¹⁸⁷			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,4-Dimethyl-3-ethylpentene-2 (Mixtures of geometrical isomers) $ \begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C} \end{array} $		124 to 132 ²⁷	0.7533 ²⁷ @ 15°	1.4300 ²⁷ @ 15°	
2,3,3,4-Tetramethylpentene-1 $ \begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \end{array} $		132.6 ²³ @ 743mm	0.761 ²³	1.4305 ²³	
3,3-Dimethyl-2-isopropylbutene-1 $ \begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ / \quad \backslash \\ \text{C} \quad \text{C} \end{array} $		121.6 ²³ 122 to 133 ²⁷	0.737 ²³ 0.7545 ²⁷ @ 13°	1.4175 ²³ 1.4260 ²⁷ @ 17°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Ethylheptene-3 (?) or 3-Propylhexene-2 (?) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		139.5 ¹	0.72990 ¹ D ₀ ¹⁸ 0.73449 ¹ D ₀ ³⁰ 0.74333 ¹ D ₀ ²⁰ 0.74443 ¹ D ₂₀ ²⁰		

- (1) E. Sokoloff, J. prakt. Chem. [2] **39**, 444, 1889.
- (2) M. Freund and F. Schönfeld, Ber. **24**, 3350, 1891.
- (3) C. Mannich, Ber. **35**, 2144, 1902.
- (4) H. Thoms and C. Mannich, Ber. **36**, 2544, 1903.
- (5) J. Van Gysegem, Bull. Acad. roy. Belg. **1906**, 692.
- (6) E. Bjelouss, Ber. **45**, 625, 1912.
- (7) L. Clarke, J. Am. Chem. Soc. **34**, 380, 1912.
- (8) L. Clarke and S. A. Beggs, J. Am. Chem. Soc. **34**, 54, 1912.
- (9) L. Clarke and S. A. Beggs, J. Am. Chem. Soc. **34**, 60, 1912.
- (10) A. Mailhe, Bull. soc. chim. [4] **15**, 327, 1914.
- (11) M. V. Cox, Bull. soc. chim. [4] **37**, 1549, 1925.
- (12) M. Theunis, Acad. roy. Belg., Classe sci., Mém [5] **12**, 785, 1926.
- (13) M. Bourguet, Bull. soc. chim. [4] **41**, 1475, 1927.
- (14) J. Doeuvre, Bull. soc. chim. [4] **45**, 403, 1929.
- (15) A. Kirmann and J. Grard, Compt. rend. **190**, 876, 1930.
- (16) T. Midgley, Jr. and A. L. Henne, J. Am. Chem. Soc. **52**, 2075, 1930.
- (17) P. Wilkinson, J. Chem. Soc. **1931**, 3057.
- (18) P. A. Levene and R. E. Marker, J. Biol. Chem. **92**, 455, 1931.
- (19) P. A. Levene and R. E. Marker, J. Biol. Chem. **95**, 1, 1932.
- (20) F. C. Whitmore and F. E. Williams, J. Am. Chem. Soc. **55**, 406, 1933.
- (21) M. Tuot, Compt. rend. **197**, 1434, 1933.
- (22) F. C. Whitmore and W. L. Evers, J. Am. Chem. Soc. **55**, 812, 1933.
- (23) F. C. Whitmore and K. C. Laughlin, J. Am. Chem. Soc. **55**, 3732, 1933.
- (24) A. Maman, Pub. sci. tech. ministère air France No. 66, 1, 1935.
- (25) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, J. Am. Chem. Soc. **57**, 1605, 1935.
- (26) B. Gredy, Bull. soc. chim. [5] **2**, 1038, 1935.
- (27) I. N. Nasarov, Ber. **69** B, 21, 1936; Compt. rend. acad. sci. U. R. S. S. **1**, 329, 1936.
- (28) M. Montagne and Y. Isambert, Compt. rend. **203**, 331, 1936.
- (29) I. N. Nasarov, Ber. **70** B, 617, 1937.
- (30) A. G. Horney and C. E. Boord, Ohio State Univ. Abs. Doctors' Dissertations, No. 23, 101, 1937.
- (31) H. W. Rudel, Thesis—Ohio State Univ., Sept., 1938.
- (32) R. J. Reid, Thesis—Ohio State Univ., June, 1938.
- (33) C. E. Frank, Thesis—Ohio State Univ., June, 1938.
- (34) D. J. Gibson, Thesis—Ohio State Univ., Sept., 1938.
- (35) A. Kirmann, Compt. rend., **182**, 1629, 1926.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Decene-1 <chem>C=CCCCCCCCC</chem>		171 170.4 to 170.8 ³⁷ 172 ^{4,9} 106 to 107 ⁴ @ 100mm 87 to 88 ⁴ @ 50mm 61.5 ⁴ @ 15mm 60 to 61 ⁹ @ 12mm 53.5 ³⁸ @ 3mm	0.743, 0.7398 ⁴ @ 30° 0.7421 ³⁶ 0.7512 ⁴ @ 15° 0.7630 ⁴ @ 0°	1.42170 ³⁶	$\log_{10} P_{mm} = \frac{-2272.08555}{T} + 7.98547^4$ (15 to 760mm) $\frac{dD}{dt} = -0.000875/^{\circ}\text{C.}$ (0° to 30°)
Decene-3 (?) (Mixtures of <i>cis</i> and <i>trans</i> isomers) <chem>CC=CCCCCCCC</chem>		160 ²			
Decene-5 (Mixtures of <i>cis</i> and <i>trans</i> isomers) <chem>CCC=CCCCC</chem>		149.3 ⁴⁴	0.7331 ⁴⁴	1.4212 ⁴⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylnonene (3 or 4) (Mixtures of geometrical isomers are possible in either case) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		161 to 164 ²⁰ 161 to 163.5 ²⁸ @ 734mm 58 to 59 ²⁸ @ 15mm	0.7483 ²⁸ @ 25°	1.4293 ²⁸	
2-Ethyloctene-1 (?) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		60 @ 15mm ⁹			
3-Ethyloctene-2 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		57 to 59 ²⁸ @ 15mm	0.7545 ²⁸ @ 25°	1.4303 ²⁸	
d-2,6-Dimethyloctene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		162 ¹⁴ @ 743mm	0.7558 ¹⁴	1.4303 ¹⁴	[α] _D ²⁰ = +9.06° ¹⁴

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
1-3,7-Dimethyloctene-1 $\begin{array}{ccccccc} \text{C} & = & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$		154 ²³ 45 to 46 ²³ @ 13mm	0.7321 ²³	1.4176 ²³	[α] _D ²⁰ = -12.38° ²³
3,7-Dimethyloctene-1 $\begin{array}{ccccccc} \text{C} & = & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$		152 to 155 ¹³ 154 ²⁴ @ 738mm	0.7396 ²⁴ 0.744 ¹³ @ 19°	1.4212 ²⁴ 1.4213 ¹³ @ 19°	
2,3-Dimethyloctene-2 $\begin{array}{ccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & \text{C} & & \end{array}$		158.4 to 158.8 ³⁰ @ 733mm		1.4280 ⁴⁰	
1-2,4-Dimethyloctene-2 $\begin{array}{ccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & \text{C} & & \end{array}$		62 @ 30mm ²⁶			[M] _D ²⁴ = -5.04° ²⁶
d-2,5-Dimethyloctene-2 $\begin{array}{ccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & \text{C} & & \end{array}$		162 ²⁷			[α] _D ²⁴ = +1.31° ²⁷ [M] _D ²⁴ = +1.83° ²⁷

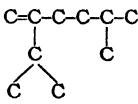
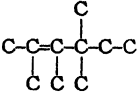
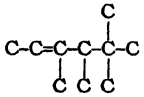
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
d-2,6-Dimethyloctene-2 $\begin{array}{ccccccc} & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & \\ & \text{C} & & & & & & & & & & & & \text{C} \end{array}$		164 to 165 ¹⁸ @ 782mm 163.5 to 164 ¹⁰ 164.5 ¹⁰ @ 756mm	0.7522 0.7515 ¹⁰ D ₀ ²⁰ 0.7521 ¹⁸ D ₀ ²⁰ 0.7533 ¹⁰ D ₀ ²⁰	1.4293 ¹⁰ 1.4304 ¹⁰	$[\alpha]_D^{20} = +9.28^\circ$ ¹⁰ $[\alpha]_D^{20} = +4.39^\circ$ ¹⁰
2,6-Dimethyloctene-2 $\begin{array}{ccccccc} & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & \\ & \text{C} & & & & & & & & & & & & \text{C} \end{array}$		162 to 163 ⁴⁰ 163 to 164 ¹⁸ @ 757mm 65 to 66 ⁴¹ @ 17mm	0.746 ⁴¹ @ 22° 0.7527 ¹⁸ D ₀ ²⁰	1.425 ⁴¹ @ 22° 1.4286 ¹⁸	
2,7-Dimethyloctene-2 $\begin{array}{ccccccc} & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & \\ & \text{C} & & & & & & & & & & & & \text{C} \end{array}$		163.7 ³ @ 744mm 159 to 162 ⁷ @ 650mm	0.7387 ¹ D ₂₀ ²⁰ 0.7475 ⁷ D ₀ ²⁰		

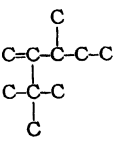
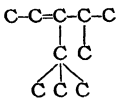
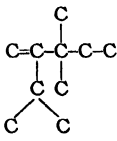
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,7-Dimethyloctene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} \\ & & & & & & \\ & & & & \text{C} & & \text{C} \end{array}$		163 ¹⁹ 162 to 163 ^{19,20} 162 ¹⁷ 161 to 162 ²⁴ @ 753mm 161 ²² @ 744mm	0.7458 ²² @ 25° 0.7470 ¹⁹ @ 25° 0.7475 ¹⁹ @ 21° 0.7490 ¹⁹ 0.7508 ²⁰ 0.7473 ²⁴	1.4259 ²² @ 25° 1.4272 ²⁴	
2,3-Dimethyloctene-3 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$		161.2 to 161.4 @ 739mm ²⁰		1.4290 ²⁰	
2,4-Dimethyloctene-4 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} \\ & & & & & & \\ & & \text{C} & & \text{C} & & \text{C} \end{array}$		154 ²⁹ @ 752mm	0.7497 ²⁹ D ₂₀ ²⁰	1.4256 ²⁹	

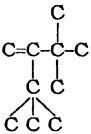
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,5-Dimethyloctene-4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		152 to 157 ¹²	0.7460 ¹² @ 25°	1.41889 ¹² @ 25°	
2-Propylheptene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		53 to 54 ²¹ @ 11mm			
4-Propylheptene-3 $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array}$		160 to 162 ³² @ 734mm 65 to 96 ³² @ 15mm		1.4386 ³²	
2-Methyl-3-ethylheptene (2 or 3) (Mixtures of geometrical isomers are possible if compound is 2-Methyl-3-ethylheptene-3) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C} \end{array}$		155 to 157 ¹⁸	0.7570 ¹⁸	1.4302 ¹⁸	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Methyl-3-ethylheptene-2 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C}-\text{C} \quad \text{C} \end{array}$		157 to 158 ° @ 750mm	0.7520 ° @ 11.4° 0.7609 ° @ 0°	1.42708 ° @ 11.4°	
2,5,6-Trimethylheptene (1 or 2) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \\ \text{C} \quad \quad \text{C} \quad \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \\ \text{C} \quad \quad \text{C} \quad \text{C} \end{array}$		159.5 to 161 ° ¹¹	0.7575 ° ¹¹ @ 19°	1.4315 ° ¹¹ @ 19°	
3,3,6-Trimethylheptene-1 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		155 °	0.7705 ° @ 0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,5,5-Trimethyl- heptene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $ \begin{array}{c} & & & \text{C} & & & \\ & & & & & & \\ \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \\ & & & \text{C} & & & \text{C} & & & & \end{array} $		116.8 ³⁸ @ 215mm		1.4375 ³⁸ @ 25°	
2,4,6-Trimethyl- heptene-3 (Mixtures of geometrical isomers) $ \begin{array}{c} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & \\ & & \text{C} & & & & \text{C} & & & & \text{C} & & \end{array} $		142 ²⁹ @ 740mm	0.7355 ²⁹ D ₂₀ ²⁰	1.4208 ²⁹	
3,5,5-Trimethyl- heptene-3 (Mixtures of geometrical isomers) $ \begin{array}{c} & & & \text{C} & & & \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \\ & & & \text{C} & & & \text{C} & & & & \end{array} $		157 to 157.5 ⁵ @ 759mm	0.7729 ⁵ D ₂₁ ²¹ 0.7878 ⁵ D ₀ ⁰		$\frac{dD}{dt} = -0.000776/^{\circ}\text{C.}$ (0 to 20° C.)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
5-Methyl-2-isopropyl-hexene-1 		150 ³³	0.7387 ³³ @ 24°	1.4202 ³³ @ 24°	
2,3,4,4-Tetramethyl-hexene-2 		45 to 50 ⁴⁶ @ 15mm	0.76970 ³ @ 20.1° 0.77135 ³ @ 18.1° 0.77263 ³ @ 16.4° 0.77414 ³ @ 14.3°	1.4385 ³ @ 17°	$\frac{dD}{dt} = -0.000764/^{\circ}\text{C.}$ (14° to 20°)
3,4,5,5-Tetramethyl-hexene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) 		110.8 ³⁵ @ 215mm		1.4340 ³⁵ @ 25°	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
3-Methyl-2-tert-butylpentene-1 		146 to 150 ⁴³	0.767 ⁴³ @ 11°	1.4306 ⁴³ @ 17°	
4-Methyl-3-tert-butylpentene-2 (Mixtures of geometrical isomers) 		153 to 158 ³⁹	0.7791 ³⁹	1.4370 ³⁹	
3,3-Dimethyl-2-isopropylpentene-1 		152 to 156 ⁴³	0.772 ⁴³ @ 16°	1.4370 ⁴³ @ 17°	

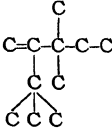
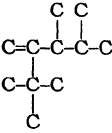
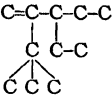
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,3-Dimethyl-2-<i>tert</i>-butylbutene-1 		150 147 to 155 ^{38, 42} 149.5 ³¹	0.770 0.770 ³¹ 0.7820 ³⁸ @ 19° 0.7824 ⁴² @ 19°	1.4364 1.4364 ³¹ 1.4374 ^{38, 42}	

- (1) B. Lachowicz, *Ann.* **220**, 168, 1883.
- (2) R. Fittig and R. Riechelmann, *Ann.* **255**, 126, 1889.
- (3) H. Landolt and H. Jahn, *Z. physik. Chem.* **10**, 289, 1892.
- (4) L. Grosjean, *Ber.* **25**, 478, 1892.
- (5) I. Kondakow, *J. Russ. Phys. Chem. Soc.* **28**, 789, 1896; *J. prakt. Chem.* [2] **54**, 442, 1896.
- (6) M. Guerbert, *Compt. rend.* **128**, 1003, 1899; *Ann. chim. phys.* [7] **27**, 67, 1902.
- (7) N. Kishner, *J. Russ. Phys. Chem. Soc.* **32**, 381, 1900.
- (8) V. Grignard, *Bull. soc. chim.* [3] **31**, 753, 1904.
- (9) P. Bagard, *Bull. soc. chim.* [4] **1**, 346, 1907.
- (10) N. Kishner, *J. Russ. Phys. Chem. Soc.* **43**, 951, 1911.
- (11) O. Wallach and F. Challenger, *Ann.* **381**, 81, 1911.
- (12) E. Bjelouss, *Ber.* **45**, 625, 1912.
- (13) O. Wallach and M. Behnke, *Ann.* **389**, 194, 1912.
- (14) L. Wolff and E. Thielepape, *Ann.* **394**, 103, 1912.
- (15) N. Kishner, *J. Russ. Phys. Chem. Soc.* **45**, 973, 1913.
- (16) N. Kishner, *J. Russ. Phys. Chem. Soc.* **45**, 1779, 1913.
- (17) P. Barbier and R. Locquin, *Compt. rend.* **158**, 1554, 1914; *Ann. chim. phys.* [9] **2**, 396, 1914.
- (18) O. Wallach and H. Gröppel, *Ann.* **408**, 200, 1915.
- (19) O. Wallach, P. Schulze, and H. Gröppel, *Ann.* **408**, 186, 1915.
- (20) W. Longuinof, *Bull. inst. reactifs, Moscow*, **1**, 150, 1922.
- (21) P. Karrer, F. Canal, K. Zohner, and R. Widmer, *Helv. Chim. Acta* **11**, 1062, 1928.
- (22) N. D. Zelinski and R. Levina, *Ber.* **62**, B, 1861, 1929.
- (23) J. v. Braun and W. Teuffert, *Ber.* **62**, B, 235, 1929.
- (24) W. Longuinof and E. Margoliss, *Bull. soc. chim.* [4] **45**, 156, 1929.
- (25) M. Montagne, *Ann. chim. phys.* [10] **13**, 40, 1930.
- (26) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **92**, 455, 1931.
- (27) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **95**, 1, 1932.
- (28) F. C. Whitmore and F. E. Williams, *J. Am. Chem. Soc.* **55**, 406, 1933.
- (29) M. Tuot, *Compt. rend.* **197**, 1434, 1933.
- (30) F. C. Whitmore and W. L. Evers, *J. Am. Chem. Soc.* **55**, 812, 1933.
- (31) F. C. Whitmore and K. C. Laughlin, *J. Am. Chem. Soc.* **55**, 3732, 1933.
- (32) J. M. Church, F. C. Whitmore, and P. V. McGrew, *J. Am. Chem. Soc.* **56**, 176, 1934.
- (33) J. v. Braun and G. Marz, *Ber.* **67** B, 1696, 1934.
- (34) H. I. Waterman, J. J. Leendertse, and A. J. de Kok, *Rec. trav. chim.* **53**, 1151, 1934.
- (35) C. M. Kline and N. L. Drake, *J. Research Nat. Bur. Standards* **13**, 705, 1934.
- (36) A. Maman, *Pub. sci. tech. ministère air (France)* No. **66**, 1, 1935.
- (37) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
- (38) I. N. Nasarov, *Ber.* **69** B, 18, 1936.
- (39) I. N. Nasarov, *Ber.* **69** B, 21, 1936; *Compt. rend. acad. sci. U. R. S. S.* **1**, 329, 1936.
- (40) C. Mannich, K. Handke, and K. Roth, *Ber.* **69** B, 2112, 1936.
- (41) G. Dupont and V. Desreux, *Compt. rend.* **203**, 733, 1936.
- (42) I. N. Nasarov, *Compt. rend. acad. sci. U. R. S. S. [N. S.]* **1**, 79, 1936.
- (43) I. N. Nasarov, *Ber.* **70** B, 617, 1937.
- (44) D. J. Gibson, Thesis—Ohio State Univ., Sept., 1938.
- (45) J. F. Norris and J. M. Joubert, *J. Am. Chem. Soc.* **49**, 873, 1927.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Undecene-1 $\text{C}=\text{C}-(\text{C})_9-\text{C}$		188 to 190 ° 84 @ 18mm ¹	0.7630 °	1.4284 °	
Undecene-2 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\text{C}-\text{C}=\text{C}-(\text{C})_7-\text{C}$		192 to 193 ° 78.5 ° @ 14mm			
5-Methyldecene-4 (Mixtures of geometrical isomers) $\begin{array}{ccccccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & & & \\ & & & & & & & & & & \text{C} & & & & & & \end{array}$		75 to 76 ° @ 15mm	0.7578 ° @ 25°	1.4333 °	
1-2,4-Dimethylnonene-2 $\begin{array}{ccccccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & \\ & & \text{C} & & & & \text{C} & & & & & & & \end{array}$		79 @ 30mm ⁷			[M] _D ²⁴ = -4.76° ⁷
1-2,5-Dimethylnonene-2 $\begin{array}{ccccccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & \\ & & \text{C} & & & & & & \text{C} & & & & & \end{array}$		113 ° @ 100mm			[α] _D ²⁵ = -0.58° [M] _D ²⁵ = -0.89° ⁸

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
2,8-Dimethylnonene-4 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \text{C} & & & & \\ & & & & & & & & & & & & & & \end{array}$		57 to 63 ¹¹ @ 13mm	0.743 ¹¹	1.4211 ¹¹	
4,8-Dimethylnonene-4 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \text{C} & & & & \\ & & & & & & & & & & & & & & \end{array}$		165 to 165 ⁴	0.75301 ⁴ @ 25°	1.42776 ⁴ @ 25°	
2,4,7-Trimethyloctene-4 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & \text{C} & & \\ & & & & & & & & & & & & \end{array}$		168 ¹⁰ @ 739mm	0.7539 ¹⁰ D ₂₀ ²⁰	1.4280 ¹⁰	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyl-4-propylheptene-3 or 6-Methyl-4-propylheptene-3 (Mixtures of geometrical isomers are possible if compound is 6-methyl-4-propylheptene-3) $ \begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C}-\text{C}-\text{C} \end{array} $ or $ \begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \quad \\ \quad \quad \text{C}-\text{C}-\text{C} \quad \quad \text{C} \end{array} $		180 to 183 ⁵	0.7710 ⁵ @ 15°	1.433 ⁵ @ 15°	
3-Methyl-2-tert-butylhexene-1 $ \begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \\ / \quad \backslash \\ \text{C} \quad \text{C} \end{array} $		169 to 174 ¹³	0.774 ¹³ @ 13°	1.4360 ¹³ @ 15°	
3,3-Dimethyl-2-isopropylhexene-1 $ \begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ / \quad \backslash \\ \text{C} \quad \text{C} \end{array} $		171 to 174 ¹³	0.873 ¹³ @ 9°	1.4380 ¹³ @ 15°	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
3,3-Dimethyl-2-<i>tert</i>-butylpentene-1 		176 to 181 ¹²	0.799 ¹² @ 15°	1.4518 ¹² @ 17°	
3,4-Dimethyl-2-<i>tert</i>-butylpentene-1 		167 to 171 ¹³	0.781 ¹³ @ 16°	1.4415 ¹³ @ 18°	
3-Ethyl-2-<i>tert</i>-butylpentene-1 		168 to 172 ¹³	0.783 ¹³ @ 16°	1.4412 ¹³ @ 17°	

- (1) E. Jeffreys, *Am. Chem. J.* **22**, 14, 1899.
- (2) C. Mannich, *Ber.* **35**, 2144, 1902.
- (3) H. Thoms and C. Mannich, *Ber.* **36**, 2544, 1903.
- (4) E. Bjelouss, *Ber.* **45**, 625, 1912.
- (5) G. Amouroux and M. Murat, *Compt. rend.* **154**, 993, 1912; *J. pharm. chim.* [7] **5**, 473, 1912.
- (6) J. v. Braun, H. Deutsch, and A. Schmatloch, *Ber.* **45**, 1246, 1912.
- (7) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **92**, 455, 1931.
- (8) P. A. Levene and R. E. Marker, *J. Biol. Chem.* **95**, 1, 1932.
- (9) F. C. Whitmore and F. E. Williams, *J. Am. Chem. Soc.* **55**, 406, 1933.
- (10) M. Tuot, *Compt. rend.* **197**, 1434, 1933.
- (11) F. G. Fischer and O. Stoffers, *Ann.* **500**, 253, 1933.
- (12) I. N. Nasarov, *Ber.* **70 B**, 606, 1937.
- (13) I. N. Nasarov, *Ber.* **70 B**, 617, 1937.

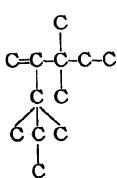
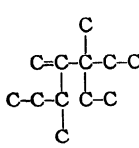
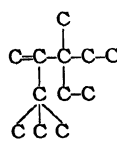
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Dodecene-1 C=C-(C) ₉ -C	-31.5 ° -31 °	213 213 ³⁸ 96 @ 15mm ⁸ 95.5 ³⁸ @ 15mm 90 to 91 ³⁰ @ 13mm 86.5 ³⁷ @ 3mm	0.7600 0.7024 ³⁸ @ 100° 0.7384 ³⁸ @ 50° 0.7511 ⁸ @ 30° 0.7598 ³⁰ 0.7600 ³⁸ 0.7605 ³⁷ 0.7620 ⁸ @ 15° 0.7621 ³⁸ @ 15° 0.7732 ⁸ @ 0° 0.7729 ⁸ @ 0° 0.7744 ³⁸ @ 0° 0.7954 ⁸ @ -31°	1.4327 1.4326 ³⁸ @ 21.5° 1.4338 ³⁸ 1.43040 ³⁷ 1.4319 ³⁰ 1.4360 ³⁸ @ 15°	$\frac{dD}{dt} = -0.0007204/^\circ\text{C.}$ (0° to 100°) $\frac{dn}{dt} = -0.00044/^\circ\text{C.}$ (15° to 25°)
Dodecene-6 (Mixtures of <i>cis</i> and <i>trans</i> isomers) C-(C) ₄ -C=C-(C) ₄ -C		62.5 to 62.6 ³⁷ @ 15mm	0.7423 ³⁷	1.4252 ³⁷	
2-Methylundecene-2 C-C=C-(C) ₇ -C C		210 to 211.5 ¹⁷ @ 752mm	0.7590 ¹⁷	1.4270 ¹⁷	

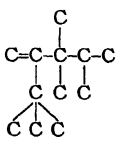
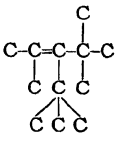
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylundecene- (4 or 5) (Mixtures of <i>cis</i> and <i>trans</i> isomers are possible in either case) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_5-\text{C} \\ \\ \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_4-\text{C} \\ \\ \text{C} \end{array}$		204 to 206 ¹⁸⁹			
6-Methylundecene-5 (Mixtures of geometrical isomers) $\text{C}-(\text{C})_5-\text{C}=\text{C}-(\text{C})_4-\text{C} \\ \\ \text{C}$		90 to 92 ²³ @ 15mm	0.7647 ²³ @ 25°	1.4368 ²³	
2-Ethyldecene-1 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_7-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		91 to 93 ¹⁹ @ 11mm	0.7703 ¹⁹ @ 21°		
d-2,3-Dimethyl- decene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		101 to 105 ²⁴ @ 20mm			[α] _D ²⁵ = +0.33° ²⁴

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
l-2,5-Dimethyldecene-2 		125 ²³ @ 100mm			[α] _D ²³ = -0.35° ²³ [M] _D ²³ = -0.59° ²³
2-Propylnonene-1 		88 to 90 ²⁰ @ 13.5mm	0.7630 ²⁰ @ 22°	1.4311 ²⁰ @ 22°	
4-Propylnonene-3 (Mixtures of geometrical isomers)		84 to 87 ²³ @ 15mm	0.7643 ²³ @ 25°	1.4362 ²³	
2,5,8-Trimethylnonene-4 (Mixtures of geometrical isomers)		74 to 76 ° @ 9mm	0.7678 ° @ 12.3° 0.7768 ° @ 0°	1.43521 ° @ 12.3°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Butyloctene-1					
5-Methyleneundecane		88 to 89 ²⁰ @ 14mm	0.7642 ²⁰ @ 23°	1.4315 ²⁰ @ 20.5°	
$ \begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array} $					
3-Butyloctene-1					
$ \begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array} $		84.8 ²⁷ @ 15mm	0.7591 ²⁷	1.4295 ²⁷	
4-Butyloctene-2					
$ \begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array} $		115.2 to 117.2 @ 55 to 57mm ²⁰	0.7558 ²⁰ @ 25°	1.4287 ²⁰ @ 25°	
7-Methyl-4-propyloctene-3					$ \log_{10} Pmm = \frac{2653.06248}{T} + 8.60733 \text{ (calc.) }^{18} \\ (20-756.5\text{mm.}) \\ (T = ^\circ\text{C.} + 273.1) $
$ \begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C}-\text{C}-\text{C} \qquad \text{C} \end{array} $		190 to 191 ¹² 189 to 191 ¹³ @ 756.5mm 89 to 91 ¹³ @ 20mm	0.7610 ¹³ D ₀ ²⁰ 0.7672 ¹² @ 21° 0.7773 ¹³ D ₀ ⁰ 0.7851 ¹³ @ 0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4,5-Trimethyl-5-ethylheptene-3 (?) (Mixtures of <i>cis</i> and <i>trans</i> isomers) $ \begin{array}{c} & & & \text{C} & & & \\ & & & & & & \\ \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \\ \text{C} \quad \text{C} \quad \text{C}-\text{C} \end{array} $		195 to 197 ⁷ 196 to 199 ²	0.798 ² D ₁₉ ¹⁹ 0.809 ² D ₀ ⁰		
2,2,3,5,6-Pentamethylheptene-3 (?) (Mixtures of geometrical isomers) $ \begin{array}{c} & \text{C} & & & & & \\ & & & & & & \\ \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \end{array} $		54.9 to 56.5 ³⁵ @ 12mm 54.9 to 58.5 ³⁵ @ 10.5mm			
5-Methyl-2-isoamylhexene-1 (?) $ \begin{array}{c} & & & \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ & & & & & & \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} & & & \text{C} \\ \\ \text{C} \end{array} $		189 to 194 ¹¹			

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
3,3-Dimethyl-2-<i>tert</i>-pentylpentene-1 		200 to 204 ³¹	0.8176 ³¹	1.4610 ³¹ @ 18°	
3-Methyl-3-ethyl-2-<i>sec</i>-butylpentene-1 		196 to 199 ³²	0.8064 ³² @ 12°	1.4500 ³² @ 14°	
3-Methyl-3-ethyl-2-<i>tert</i>-butylpentene-1 		198 to 203 ³¹	0.8189 ³¹ @ 16°	1.4570 ³¹ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,3,4-Trimethyl-2-tert-butylpentene-1 		195 to 200 ³¹	0.819 ³¹ @ 8°	1.4560 ³¹ @ 14°	
2,4,4-Trimethyl-3-tert-butylpentene-2 (?) 	< -30° ^{4,5}	178 to 181 ⁸ @ 768mm 173 to 176 ¹ 177 ³ 177 to 179 ³⁶ 177.5 to 178.5 ³ 177.5 to 179 ^{4,5} 178.5 to 179.5 ¹⁸ 179 to 181 ¹⁸ 178 to 180 ¹⁸ @ 752mm 110 to 111 ²¹ @ 100mm 71 to 72 ²⁵ @ 20mm 56 @ 10mm ¹⁸	0.746 ^{4,5} @ 50° 0.7590 ¹⁸ 0.7600 ¹⁸ 0.7613 ²¹ @ 17° 0.773 ³ 0.774 ^{3,4,5} 0.7747 ¹⁸ D ₀ ⁰	1.4311 ³⁸ @ 30° 1.4306 ¹⁸ 1.43060 ¹⁸ 1.4356 ³⁶ 1.43281 ²¹ @ 17° 1.4445 ³⁶ @ 0° 1.4580 ²⁶ @ -30°	log ₁₀ P _{mm} = $\frac{2261.7533}{T}$ + 7.87254 (10 to 760mm) ¹⁸ (T = °C. + 273.1)

- (1) A. Butleroff and B. Gorgainow, Ber. **6**, 561, 1873.
- (2) L. Jawein, Ann. **195**, 253, 1879.
- (3) J. Lermontoff, Ann. **196**, 116, 1879.
- (4) A. Butleroff, Jahresber. Chem. **1879**, 364.
- (5) A. Butleroff, J. Russ. Phys. Chem. Soc., **11**, 198, 1879; Ber. **12**, 1482, 1879.
- (6) F. Krafft, Ber. **16**, 3018, 1883.
- (7) J. Wislicenus, Ann. **219**, 307, 1883.
- (8) H. Malbot and L. Gentil, Compt. rend. **108**, 957, 1889; Ann. chim. phys. [6] **19**, 393, 1890.
- (9) V. Grignard, Annales Université Lyon, Neue Serie, **6**, 1, 1901.
- (10) G. Freylon, Ann. chim. phys. [8] **20**, 58, 1910.
- (11) I. Wanin, J. Russ. Phys. Chem. Soc. **43**, 352, 1911.
- (12) G. Amouroux and M. Murat, Compt. rend. **154**, 993, 1912; J. pharm. chim. [7] **5**, 473, 1912.
- (13) I. Wanin, J. Russ. Phys. Chem. Soc. **45**, 1155, 1913.
- (14) M. Murat and G. Amouroux, Bull. soc. chim. [4] **15**, 159, 1914.
- (15) I. Wanin, J. Russ. Phys. Chem. Soc. **47**, 1094, 1915.
- (16) T. Milobedzki and A. Suchnowski, Chem. Polski **15**, 34, 1917.
- (17) B. T. Brooks and I. Humphrey, J. Am. Chem. Soc. **40**, 822, 1918.
- (18) S. V. Lebedev and G. G. Koblyansky, J. Russ. Phys. Chem. Soc. **61**, 2175, 1929; Ber. **63B** 103, 1930.
- (19) J. v. Braun and W. Teuffet, Ber. **62B**, 235, 1929.
- (20) J. v. Braun and H. Kröper, Ber. **62**, 2880, 1929.
- (21) H. Staudinger and M. Brunner, Helv. Chim. Acta **13**, 1375, 1930.
- (22) P. A. Levene and R. E. Marker, J. Biol. Chem. **95**, 1, 1932.
- (23) F. C. Whitmore and F. E. Williams, J. Am. Chem. Soc. **55**, 361, 1933.
- (24) P. A. Levene and R. E. Marker, J. Biol. Chem. **100**, 769, 1933.
- (25) H. I. Waterman, J. J. Leendertse, and A. J. de Kok, Rec. trav. chim. **53**, 1151, 1934.
- (26) A. Krassilchik, Ann. combustibles liquides **10**, 923, 1935.
- (27) A. Maman, Pub. sci. tech. ministère air (France) No. **66**, 1, 1935.
- (28) I. N. Nasarov, Ann. Leningrad State Boulnoff Univ. Chem. Ser. **1**, 123, 1935.
- (29) S. V. Lebedev and S. M. Orlov, J. Gen. Chem. (U. S. S. R.) **5**, 1589, 1935.
- (30) F. Jostes and W. Bartels, Ocl, Kohle, Erdoel, Teer **13**, No. 44, 1166, 1937.
- (31) I. N. Nasarov, Ber. **70B**, 606, 1937.
- (32) I. N. Nasarov, Ber. **70B**, 617, 1937.
- (33) V. N. Krestinskiĭ and N. I. Summ, J. Gen. Chem. (U. S. S. R.) **7**, 440, 1937.
- (34) S. M. Orlov, J. Gen. Chem. (U. S. S. R.) **7**, 923, 1937.
- (35) H. Brunner and E. H. Farmer, J. Chem. Soc. **1937**, 1039.
- (36) A. v. Grosse and C. Linn, unpublished work.
- (37) D. J. Gibson, Thesis—Ohio State Univ., Sept., 1938.
- (38) E. B. Evans, J. Inst. Petr. Tech., **24**, 321, 1938.
- (39) R. L. Wakeman, Thesis, Mass. Inst. Tech., 1930.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Tridecene-1 C=C-(C) ₁₀ -C	-13 °	102 to 103 ° @ 10mm	0.7670 ° @ 25° 0.7856 ° @ 0°	1.4328 ° @ 25°	$\frac{dD}{dt} = -0.000744/^\circ\text{C.}$ (0° to 25°)
Tridecene-6 C-(C) ₄ -C=C-(C) ₅ -C		80 to 81 ° @ 6mm	0.76447 ° @ 25°	1.4320 ° @ 25°	
n-Tridecene-x		228 to 231 °	0.7977 °	1.4488 °	
3-Methyldodecene-3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_7-\text{C} \\ \\ \text{C} \end{array}$		105 to 107 ° @ 12mm	0.7802 °		

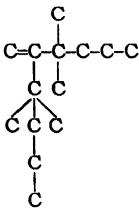
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Ethylundecene-5 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-(\text{C})_4=\text{C}-(\text{C})_2 \\ \\ \text{C}-\text{C} \end{array}$		102 to 105 ° @ 15mm	0.7701 ° @ 25°	1.4401 °	
5-Butylonene-4 $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$		216 215.5 to 216.5 ° 212.5 to 213 ° @ 735mm 108 to 109 ° @ 22mm 98 to 99 ° @ 15mm 90 @ 10mm ° 60 @ 1.2mm °	0.7730 0.7724 ° 0.7745 °	1.4415 1.4375 ° 1.4392 ° 1.4419 ° 1.4421 °	$\log_{10} P_{\text{mm}} = -\frac{2650.92992}{T} + 8.300826 °$ (10 to 760mm) (T = 273.1 + t°C.)
3-Propyl-2-tert-butylhexene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		205 to 207 °	0.791 ° @ 16°	1.4470 ° @ 18°	

- (1) A. Pictet and J. Potok, *Helv. Chim. Acta* **2**, 501, 1919.
- (2) H. Thoms and B. Ambrus, *Arch. Pharm.* **263**, 263, 1925.
- (3) D. Ivanoff, *Bull. soc. chim. [4]* **37**, 287, 1925.
- (4) F. C. Whitmore and F. E. Williams, *J. Am. Chem. Soc.* **55**, 406, 1933.
- (5) F. C. Whitmore and H. M. Woodburn, *J. Am. Chem. Soc.* **55**, 361, 1933.
- (6) J. M. Church, F. C. Whitmore, and P. V. McGrew, *J. Am. Chem. Soc.* **56**, 176, 1934.
- (7) I. N. Nasarov, *Ber.* **70B**, 617, 1937.
- (8) D. Aelony, Thesis—Leland Stanford Univ., 1938.
- (9) A. P. Kozacik and E. Emmet Reid, *J. Am. Chem. Soc.* **60**, 2436, 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
Tetradecene-1 $C=C-(C)_{11}-C$	-12 ¹	124.5 to 125 ⁵ @ 15mm 127 @ 15mm ¹ 114 to 115 ⁶ @ 3mm	0.772 ₈ 0.7638 ¹ @ 30° 0.7737 ⁶ 0.788 ² D ₂₀ ²⁰ 0.7745 ¹ @ 15° 0.7852 ¹ @ 0° 0.7936 ¹ @ -12°	1.4365 1.4381 ⁵ @ 21.1° 1.43647 ⁶	$\frac{dD}{dt} = -0.000655/^{\circ}C.$ (-15° to 30°)
Tetradecene-7 (Mixtures of <i>cis</i> and <i>trans</i> isomers) $C-(C)_5-C=C-(C)_5-C$		126.1 to 126.5 @ 15mm ⁹	0.7728 ⁹	1.4385 ⁹	
4-Methyltridecene-4 (Mixtures of geometrical isomers) $C-C-C-C=C-(C)_7-C$ C		115 to 117 ² @ 10mm	0.788 ²		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,3-Dimethyl- dodecene-3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_7-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		116 to 122 ° @ 13mm	.		
6-Propylundecene-5 or 4-Pentylnonene-3 (Mixtures of geometrical isomers are possible if compound is 6-propyl- undecene-5) $\begin{array}{c} \text{C}-(\text{C})_4=\text{C}-\text{C}-(\text{C})_4 \\ \\ \text{C}-\text{C}-\text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C} \end{array}$		111 to 114 ° @ 15mm	0.7749 ° @ 25°	1.4411 °	
5-Butyldecene- (4 or 5) (Mixtures of geometrical isomers are possible if compound is 5-butyl- decene-4) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$ or $\begin{array}{c} \text{C} \text{ C} \text{ C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$		113 to 115 ° @ 15mm	0.7748 ° @ 25°	1.4414 °	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Pentynonene-1 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_5-\text{C} \\ \\ (\text{C})_4 \\ \\ \text{C} \end{array}$		117 to 118 ° @ 11mm	0.7728 ° @ 22.5°	1.4374 ° @ 22.5°	
3-Pentynonene-1 $\begin{array}{c} \text{C}=\text{C}-\text{C}-(\text{C})_5-\text{C} \\ \\ (\text{C})_4 \\ \\ \text{C} \end{array}$		116.9 ° @ 15mm	0.7705 °	1.4350 °	
2-Hexyloctene-1 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_5-\text{C} \\ \\ (\text{C})_5 \\ \\ \text{C} \end{array}$		100 to 105 ° @ 7mm			
4,5-Dipropyloctene-4 $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C}-\text{C}-\text{C} \quad \text{C}-\text{C}-\text{C} \end{array}$		92 to 95 ° @ 11mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,3-Dimethyl-2-[1,1-dimethylbutyl]-hexene-1 		229 to 233 ⁷	0.8228 ⁷ @ 10°	1.4574 ⁷ @ 18°	

- (1) F. Krafft, Ber. 16, 3018, 1883.
- (2) H. Thoms and B. Ambrus, Arch. Pharm. 263, 263, 1925.
- (3) F. C. Whitmore and F. E. Williams, J. Am. Chem. Soc. 55, 406, 1933.
- (4) J. v. Braun and G. Marz, Ber. 67B, 1696, 1934.
- (5) A. Krassilchik, Ann. combustibles liquides 10, 923, 1935.
- (6) A. Maman, Pub. sci. tech. ministère air (France) No. 66, 1, 1935.
- (7) I. N. Nasarov, Ber. 70B, 606, 1937.
- (8) D. Aelony, Thesis—Leland Stanford Univ., 1938.
- (9) D. J. Gibson, Thesis—Ohio State Univ., Sept., 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentadecene-1 C=C-(C) ₁₃ -C	-3 -2.8 ° -0.50 °	144 to 145 ° @ 15mm 127.5 to 128.5 @ 10mm °	0.778, 0.7751 ° @ 25° 0.7809 ° @ 20° 0.78215 ° @ 12.3° 0.7941 ° @ 0° 0.7921 ° @ 0°	1.4353 ° @ 25° 1.44434 ° @ 12.35°	$\frac{dD}{dt} = -0.000686/°C.$ (0° to 25°)
Pentadecene-6 (?) (Mixtures of <i>cis</i> and <i>trans</i> isomers) C-(C) ₄ -C=C-(C) ₇ -C		120 to 125 ° @ 3mm	0.8200 ° @ 15°	1.4656 ° @ 15°	
3,7,11-Trimethyl- dodecene-(1 or 2) (Mixtures of <i>cis</i> and <i>trans</i> isomers are possible if compound is 3,7,11-tri- methyl-dodecene-2) $\begin{array}{c} \text{C}=\text{C}-\text{C}-(\text{C})_3-\text{C}-(\text{C})_3-\text{C}-\text{C} \\ \qquad \qquad \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \qquad \qquad \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_3-\text{C}-(\text{C})_3-\text{C}-\text{C} \\ \qquad \qquad \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \qquad \qquad \text{C} \end{array}$		290 ° 287 to 288 ° @ 724mm 150 to 152 ° @ 11mm	0.790 ° 0.803 ° @ 0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Butylundecene-5 or 5-Pentyldecene-4 (Mixtures of <i>cis</i> and <i>trans</i> isomers are possible if compound is 6-Butyl- undecene-5) $\begin{array}{c} \text{C}-(\text{C})_8-\text{C}=\text{C}-(\text{C})_4-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_4-\text{C} \\ \\ (\text{C})_4 \\ \\ \text{C} \end{array}$		126 to 129 ° @ 15mm	0.7781 ° @ 25°	1.4436 °	

- (1) R. Willstätter, E. W. Mayer, and E. Huni, Ann. 378, 73, 1911.
 (2) S. Landa and M. Landova, Collection Czechoslov. Chem. Commun. 2, 31, 1930.
 (3) F. C. Whitmore and F. E. Williams, J. Am. Chem. Soc. 55, 406, 1933.
 (4) H. Marcelet, Compt. rend. 202, 1809, 1936.
 (5) A. P. Kozacik and E. Emmet Reid, J. Am. Chem. Soc. 60, 2436, 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexadecene-1, Cetene	4.0		0.7835	1.4417	$\frac{dD}{dt} = -0.0007200/^{\circ}\text{C.}$ (15° to 140°)
C=C-(C) ₁₃ -C	2.2 ¹⁷	275 ¹	0.6996 ⁷	1.4396 ²⁶	$\frac{dn}{dt} = -0.00053/^{\circ}\text{C.}$ (20° to 25°)
	3.4 to	274 ⁴	@ 140.5°	@ 25°	
	4.1 ¹⁶	181.4 to 183.6	0.7394 ¹⁰	1.4422 ²¹	
	3.5 ¹³	@ 44mm ²⁷	@ 79.8°	@ 20.2°	
	4.0 ⁵	163 ¹⁵	0.7686 ⁵	1.4411 ²³	
	4 ^{9,15,25}	@ 21mm	@ 37.1°	1.44110 ²²	
	4.0 to	130 to 150 ¹¹	0.7689 ⁵	1.4418 ²⁸	
	4.1 ⁵	@ 18mm	@ 37.1°	1.4419 ¹⁷	
	4.0 to	157.5 ¹⁷	0.779 ¹⁵	1.4420 ⁹	
	4.1 ²³	@ 15.5mm	@ 25°	@ 19°	
	4 to 5 ²⁷	155 @ 15mm ¹	0.7483 ⁷		
		154.5 to 155 ²³	@ 20.2°		
		@ 15mm	0.7830 ²²		
		154 to 155 ¹	0.7825 ¹⁷		
		@ 15mm	0.8850 ¹¹		
		152 to 154 ¹⁴	D ₂₀ ²⁰		
		@ 13mm	0.78932 ³		
		149.5 to 150 ²¹	@ 15.2°		
		@ 12.5mm	0.7838 ²³		
		149 to 154 ²¹	@ 15°		
		@ 12mm	0.7839 ⁶		
		158 ²⁶	@ 15°		
		@ 11.5mm	0.7868 ¹³		
		125 to 145 ¹³	@ 15°		
		@ 10mm	0.7890 ²¹		
		123 @ 3mm ¹⁵	@ 15°		
			0.7849 ¹⁰		
			@ 14.6°		
			0.7915 ⁵		
			@ 4°		
			0.7917 ⁵		
			@ 4°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
9-Methylpentadecene- (6 or 7) (Mixtures of <i>cis</i> and <i>trans</i> isomers are possible in either case) $\text{C}-(\text{C})_4-\text{C}=\text{C}-\underset{\text{C}}{\text{C}}-(\text{C})_5-\text{C}$ or $\text{C}-(\text{C})_5-\text{C}=\text{C}-\underset{\text{C}}{\text{C}}-(\text{C})_4-\text{C}$		106 to 111 ¹⁹ @ 4mm 142 to 146 ¹⁸ @ 12mm 148 ¹⁸ @ 12mm 210 to 220 ⁶ @ 150mm 250 ² 310 to 320 ⁶	0.7993 ¹⁸ @ 21° 0.7926 ¹⁸ @ 19° 0.8251 ⁶ D ₁₇ ¹⁷ 0.814 ² @ 15° 0.8360 ⁶ D ₉ ⁶	1.4419 ¹⁹ 1.4528 ¹⁸ 1.4535 ¹⁸ @ 19°	
5-Butyldodecene- (4 or 5) (Mixtures of geometrical isomers are possible if compound is 5-butyl- dodecene-4) $\text{C}-\text{C}-\text{C}-\text{C}=\underset{\text{C}-\text{C}-\text{C}-\text{C}}{\text{C}}-(\text{C})_5-\text{C}$ or $\text{C}-\text{C}-\text{C}-\text{C}-\underset{\text{C}-\text{C}-\text{C}-\text{C}}{\text{C}}=\text{C}-(\text{C})_5-\text{C}$		107 to 110 ²⁴ @ 5mm 216 to 263 ²⁴ 265 to 267 ²⁴	0.7855 ²⁴ 0.7864 ²⁴	1.4450 ²⁴ 1.4452 ²⁴	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Pentylundecene-5 $ \begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_4-\text{C} \\ \\ (\text{C})_4 \\ \\ \text{C} \end{array} $		135 to 137 ²⁰ @ 17mm 132 to 124 ²⁰ @ 15mm			
2,8-Dimethyl-5-isoamylnonene-4 $ \begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \qquad \qquad \text{C} \\ \qquad \qquad \qquad \\ \qquad \qquad \qquad \text{C} \\ \qquad \qquad \qquad \\ \qquad \qquad \qquad \text{C} \\ \qquad \qquad \qquad / \ \backslash \\ \qquad \qquad \text{C} \quad \text{C} \end{array} $		114 to 115 ⁸ @ 10mm			

- (1) J. Dumas and E. Péligot, *Ann. chim. phys.* [2] **62**, 5, **1836**; *Ann.* **19**, 290, **1836**.
- (2) J. Bouis, *Ann. chim. phys.* [3] **44**, 77, **1855**; *Ann.* **92**, 396, **1854**.
- (3) D. Mendelejeff, *Jahresber. Fortschr. Chem.* **1860**, 7; *Compt. rend.* **51**, 97, **1860**, *Rép. chim. pure* **3**, 33, **1861**; *Zeitschr. Chem. Pharm.* **1860**, 481.
- (4) Tuttschew, *Jahresber. Fortschr. Chem.* **1860**, 405; *Rép. chim. pure* **2**, 463, **1860**; *Zeitschr. Chem. Pharm.* **1861**, 59.
- (5) F. Krafft, *Ber.* **16**, 3018, **1883**.
- (6) A. Rossolimo, *J. Russ. Phys. Chem. Soc.* **26**, 250, **1894**; *Ber.* **27**, Ref., 626, **1894**.
- (7) J. F. Eykmann, *Rec. trav. chim.* **14**, 183, **1895**.
- (8) V. Grignard, *Compt. rend.* **136**, 815, **1903**.
- (9) A. Klages, *Ber.* **36**, 3584, **1903**.
- (10) J. F. Eijkman, *Chem. Weekblad* **3**, 701, **1906**.
- (11) B. T. Brooks and I. Humphrey, *J. Am. Chem. Soc.* **40**, 822, **1918**.
- (12) W. F. Faragher, W. A. Gruse, and F. H. Garner, *Ind. Eng. Chem.* **13**, 1044, **1921**.
- (13) W. F. Seyer and J. L. Huggert, *Trans. Proc. Roy. Soc. Canada* [3] **18**, 213, **1924**.
- (14) S. Landa, *Bull. soc. chim.* [4] **43**, 1086, **1928**.
- (15) W. E. Messer, *Chem. News* **138**, 292, **1929**.
- (16) S. Skraup and O. Binder, *Ber.* **62**, 1127, **1929**.
- (17) H. I. Waterman, P. van't Spijker, and H. A. van Westen, *Rec. trav. chim.* **48**, 1103, **1929**.
- (18) M. Lerer, *Ann. combustibles liquides* **8**, 681, **1933**.
- (19) F. C. Whitmore and P. A. Krueger, *J. Am. Chem. Soc.* **55**, 1528, **1933**.
- (20) J. M. Church, F. C. Whitmore, and P. V. McGrew, *J. Am. Chem. Soc.* **56**, 176, **1934**.
- (21) A. Krassilechik, *Ann. combustibles liquides* **10**, 923, **1935**.
- (22) A. Maman, *Pub. sci. tech. ministère air (France)* No. **66**, 1, **1935**.
- (23) S. L. Langedijk and P. L. Stedehouder, *Rec. trav. chim.* **56**, 526, **1937**.
- (24) A. D. Petrov and D. N. Andreev, *J. Gen. Chem. (U.S.S.R.)* **7**, 570, **1937**.
- (25) A. R. Ubbelohde, *Trans. Faraday Soc.* **34**, 282, **1938**.
- (26) E. B. Evans, *J. Inst. Petr. Tech.*, **24**, 321, **1938**.
- (27) R. L. Wakeman, Thesis, Massachusetts Institute of Technology, **1930**

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Heptadecene-1 C=C-(C) ₁₄ -C	11.2 °	155.4 to 156.4 ° @ 10mm	0.7859 ° @ 25° 0.7892 ° @ 20°	1.4417° @ 25°	
Heptadecene-8 (Mixtures of <i>cis</i> and <i>trans</i> isomers) C-(C) ₆ -C=C-(C) ₇ -C	C'a. -50 °	173 ° @ 16mm 159.5 to 160 ° @ 9.5mm 136 ° @ 3.5mm	0.795 ° @ 25° 0.7977 ° @ 10° 0.8006 ° @ 6° 0.8042 ° @ 0°		
5,9,13-Trimethyltetra- decene-1 (?) $ \begin{array}{ccccccc} \text{C} & = & (\text{C})_4 & - & \text{C} & - & (\text{C})_4 & - & \text{C} & - & (\text{C})_4 & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & & & \\ & & \text{C} & & & & \text{C} & & & & \text{C} & & & & \end{array} $		288 to 291 ° @ 719mm 153 to 155.5 ° @ 10mm	0.790 °		log ₁₀ P _{mm} = $-\frac{3300.6151}{T}$ + 8.723447 (calc.) (10 to 719mm) (T = 273.1 + t°C.)

(1) J. Mai, Ber. 22, 2133, 1889.

(2) R. Willstätter, O. Schuppli, and E. W. Mayer, Ann. 418, 121, 1919.

(3) W. E. Messer, Chem. News 138, 292, 1929.

(4) A. Krassilchik, Ann. combustibles liquides 10, 923, 1935.

(5) A. P. Kozacik and E. Emmet Reid, J. Am. Chem. Soc. 60, 2436, 1938.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octadecene-1 C=C-(C) ₁₅ -C	18 18 ^{1,4,5,7}	179 to 180 ⁵ @ 18mm 179 ^{1,5,7} @ 15mm 174 ⁴ @ 10mm	0.7823 ⁴ @ 42° 0.7790 ¹ @ 35.6° 0.7863 ⁴ @ 32° 0.7881 ¹ @ 22.1° 0.7884 ⁴ @ 22° 0.7910 ¹ @ 18°	1.4411 ⁴ @ 32° 1.4443 ⁴ @ 22°	$\frac{dD}{dt} = -0.000328/^{\circ}\text{C.}$ (15° to 45°)
Octadecene-9 (High-melting geometrical isomer) C-(C) ₇ -C=C-(C) ₇ -C	2 ²		0.7917 ² @ 19°	1.4478 ² @ 19°	
Octadecene-9 (Low-melting geometrical isomer) C-(C) ₇ -C=C-(C) ₇ -C	< -15 ²	190 ² @ 15mm	0.7968 ²	1.4483 ²	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (at 760mm)	D_4^{20}	n_D^{20}	Additional Data
2-Methylheptadecene-2 $\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_{13}-\text{C} \\ \\ \text{C} \end{array}$	-2.5 °	277 ° @ 100mm 314 °	0.7449 ° @ 100° 0.7953 ° 0.8022 ° @ 10° 0.8089 ° @ 0°		$\log_{10} P_{mm} = \frac{7688.3692}{T} + 13.10125 °$ (100 to 760mm) ($T = 273.1 + t^{\circ}\text{C.}$) $\frac{dD}{dt} = -0.0006892$ (1 - 0.001414t)/°C. (0° to 100°)

(1) H. Gault and Y. Altchidjean, Ann. chim. [10] 2, 209, 1924.

(2) J. Boeseken and A. H. Belinfante, Rec. trav. chim. 45, 914, 1926.

(3) S. Landa and R. Riedl, Collection Czechoslov. Chem. Commun. 2, 520, 1930.

(4) M. V. Dover and W. A. Hensley, Ind. Eng. Chem. 27, 337, 1935.

(5) K. H. Meyer and P. Streuli, Helv. Chim. Acta 20, 1179, 1937.

(6) J. C. Corruthers, Trans. Faraday Soc. 34, 300, 1938.

(7) F. Krafft, Ber. 16, 3032, 1883.

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. (@ 760mm)</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Nonadecene-1 (?)					
Arachidene C=C-(C) ₁₆ -C		180 to 185 ¹ @ 3mm	0.8550 ¹ @ 15°	1.4761 ¹ @ 15°	
Nonadecene-1					
C=C-(C) ₁₆ -C	21.7 ²	177 ² @ 10mm	0.7858 ² @ 35° 0.7889 ² @ 30°		

(1) H. Marcelet, Compt. rend. **202**, 1809, **1936**.(2) A. P. Kozacik and E. Emmet Reid, J. Am. Chem. Soc. **60**, 2436, **1938**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methylnonadecene-1 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_{18}-\text{C} \\ \\ \text{C} \end{array}$	11 to 12 °	146 ° @ 2.2mm 189 ° @ 10mm	0.795 ° @ 22°	1.4504 ° @ 23.5°	
3-Ethylotadecene-2 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_{11}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		119 to 122 ° @ 10mm	0.7517 ° @ 99° 0.7575 ° @ 90° 0.7640 ° @ 80° 0.7710 ° @ 70° 0.7777 ° @ 60° 0.7844 ° @ 50° 0.7906 ° @ 40° 0.7973 ° @ 30° 0.8040 °	1.45585 ° @ 12.4°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Ethyldecene-2 —(Continued)					
5,7,9-Trimethylheptadecene-4 (?) (Mixtures of geometrical isomers) $\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\underset{\text{C}}{\underset{ }{\text{C}}}-\underset{\text{C}}{\underset{ }{\text{C}}}-\underset{\text{C}}{\underset{ }{\text{C}}}-\text{C}(\text{C})-\text{C}$		168 ⁴ @ 10mm	0.8106 ⁴ @ 10° 0.8181 ⁴ @ 0°		
3,7,11,15-Tetramethylhexadecene-2 (?) (Mixtures of <i>cis</i> and <i>trans</i> isomers) $\text{C}-\underset{\text{C}}{\underset{ }{\text{C}}}-\underset{\text{C}}{\underset{ }{\text{C}}}(\text{C})-\underset{\text{C}}{\underset{ }{\text{C}}}-\underset{\text{C}}{\underset{ }{\text{C}}}(\text{C})-\underset{\text{C}}{\underset{ }{\text{C}}}-\underset{\text{C}}{\underset{ }{\text{C}}}(\text{C})-\underset{\text{C}}{\underset{ }{\text{C}}}-\underset{\text{C}}{\underset{ }{\text{C}}}$		177 to 178 ² @ 10.5mm 167 to 168 ¹ @ 7.5mm 106.5 to 108 ¹ @ 0.04 to 0.05mm	0.817 ¹ @ 0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
C₂₁H₄₂ Heneicosenes					
Heneicosene-9					
(Mixtures of <i>cis</i> and <i>trans</i> isomers)	3 ⁴	201 to 202 ⁴ @ 12mm	0.7981 ³⁰ @ 25°		
C-(C) ₇ -C=C-(C) ₁₀ -C		201 to 202 ³ @ 11mm	0.8015 ³⁰ 0.8048 ³⁰ @ 15°		
C₂₂H₄₄ Docosenes					
Docosene-1					
C=C-(C) ₁₉ -C	41 ⁷	174 to 178 ⁷ @ 0.6mm			
4-Propylnonadecene-3					
(Mixtures of geometrical isomers)		204 to 206 ¹¹ @ 10mm	0.7525 ¹¹ @ 99°	1.45568 ¹¹ @ 13.1°	
$ \begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_{14}-\text{C} \\ \\ \text{C}-\text{C}-\text{C} \end{array} $			0.7588 ¹¹ @ 90°		
			0.7652 ¹¹ @ 80°		
			0.7710 ¹¹ @ 70°		
			0.7793 ¹¹ @ 60°		
			0.7858 ¹¹ @ 50°		
			0.7920 ¹¹ @ 40°		
			0.7982 ¹¹ @ 30°		
			0.8044 ¹¹		
			0.8116 ¹¹ @ 10°		
			0.8182 ¹¹ (n 0°)		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
C₂₃H₄₄ Tricosenes					
Tricosene-11					
(High-melting geometrical isomer)	17 to 18 ⁵ 19 ¹⁶	225 ¹⁶ @ 15mm	0.7725 ¹⁶ @ 70° 0.8055 ¹⁶	1.4537 ¹⁶	
C-(C) ₉ -C=C-(C) ₁₀ -C					
Tricosene-11					
(Low-melting geometrical isomer)	1 to 2 ⁸				
C-(C) ₉ -C=C-(C) ₁₀ -C					
C₂₄H₄₆ Tetracosenes					
2-Methyltricosene-2					
$\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_{19}-\text{C} \\ \\ \text{C} \end{array}$	41.5 ⁹	234 to 237 ⁹ @ 10mm	0.7656 ⁹ @ 100° 0.7994 ⁹ @ 50° 0.8047 ⁹ @ 41.5°		$\frac{dD}{dt} = -0.0006710/^{\circ}\text{C.}$ (40° to 100°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
5-Butyleicosene-4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_{14}-\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$		219 to 221 ¹¹ @ 10mm	0.7568 ¹¹ @ 99° 0.7631 ¹¹ @ 90° 0.7694 ¹¹ @ 80° 0.7755 ¹¹ @ 70° 0.7821 ¹¹ @ 60° 0.7889 ¹¹ @ 50° 0.7951 ¹¹ @ 40° 0.8018 ¹¹ @ 30° 0.8077 ¹¹ 0.8139 ¹¹ @ 10° 0.8205 ¹¹ @ 0°		
C₂₆H₅₂ Hexacosenes Hexacosene-1 $\text{C}=\text{C}-(\text{C})_{23}-\text{C}$	51 to 52 ¹⁷	200 to 205 ¹⁷ @ 2mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyl-5-isoamyleicosene-(4 or 5) (Mixtures of <i>cis</i> and <i>trans</i> isomers are possible if compound is 2-Methyl-5-isoamyleicosene-4) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_{14}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \qquad \\ \qquad \qquad \qquad \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-(\text{C})_{13}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \qquad \\ \qquad \qquad \qquad \text{C} \end{array}$		235 to 240 ^{10,11} @ 15mm			
C₂₇H₅₄ Heptacosenes Heptacosene-1 (?) Cerotene $\text{C}=\text{C}-(\text{C})_{24}-\text{C} (?)$	57 to 58 ^{1,2}				
Heptacosene-13 (High-melting geometrical isomer)	34.2 ⁵				
$\text{C}-(\text{C})_{11}-\text{C}=\text{C}-(\text{C})_{12}-\text{C}$					

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Heptacosene-13 (Low-melting geometrical isomer) C-(C) ₁₁ -C=C-(C) ₁₂ -C	4 to 5 ⁵	210 ⁵ @ 1mm			
C₂₈H₅₆ Octacosenes Octacosene-1 C=C-(C) ₂₅ -C	56 to 57 ¹⁷	220 to 223 ¹⁷ @ 1.5mm			
10-Nonylnonadecene-9 C-(C) ₇ -C=C-(C) ₈ -C (C) ₈ C		227.5 to 228.5 @ 2.5mm ¹⁵			
C₃₁H₆₂ Hentriacontenes Hentriacontene-1 C=C-(C) ₂₈ -C	64 ⁸	233 ⁸ @ 1.5mm 295 ⁸ @ 15mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hentriacontene-15					
(High-melting geometrical isomer)	45.2 to 45.4 °	245 to 246 ° @ 1mm			
C-(C) ₁₃ -C=C-(C) ₁₄ -C					
Hentriacontene-15					
(Low-melting geometrical isomer)		241 to 242 ° @ 2mm			
C-(C) ₁₃ -C=C-(C) ₁₄ -C					
C₃₂H₆₄ Dotriacontenes					
7-Methyl-8-[2-methyl-heptyl]-tricosene-7 and 8					
(Mixtures of geometrical isomers)		170 to 175 ° @ 0.1mm	0.8450 ° @ 23.5°		
$ \begin{array}{c} \text{C}-(\text{C})_8-\text{C}=\text{C}-(\text{C})_{14}-\text{C} \\ \quad \\ \text{C} \quad \text{C}-(\text{C})_6-\text{C} \\ \\ \text{C} \end{array} $					

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
7-Methyl-8-[2-methyl-heptyl]-tricosene- (7 or 8) (Mixtures of geometrical isomers are possible if compound is 7-Methyl-8-[2-octyl]-tricosene-7) $\begin{array}{c} C-(C)_6-C=C-(C)_{14}-C \\ \\ C-C-(C)_6-C \\ \\ C \end{array}$ or $\begin{array}{c} C-(C)_6-C-C=C-(C)_{12}-C \\ \\ C-C-(C)_6-C \\ \\ C \end{array}$		175 to 178 ¹⁰ @ 0.1mm	0.8450 ¹⁰ @ 23°		
$C_{11}H_{20}$ Tritriacontenes 3-Pentadecyloctadecene-2 $\begin{array}{c} C-C=C-(C)_{14}-C \\ \\ (C)_{14} \\ \\ C \end{array}$	10 ¹⁴				
$C_{15}H_{28}$ Pentatriacontenes Pentatriacontene-17 (High-melting geometrical isomer)	66,5 ⁶				
$C-(C)_{15}-C=C-(C)_{16}-C$					

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentatriacontene-17					
(Low-melting geometrical isomer)	45 to 46 °	267 ° @ 1mm			
C-(C) ₁₅ -C=C-(C) ₁₆ -C					
C₃₇H₇₄, Heptatriacontenes					
3-Heptadecyleicosene-2					
$\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_{16}-\text{C} \\ \\ (\text{C})_{16} \\ \\ \text{C} \end{array}$	21.5 °				

- (1) B. J. Brodie, Ann. **67**, 180, **1848**.
- (2) B. J. Brodie, Ann. **71**, 144, **1849**.
- (3) J. Mai, Ber. **22**, 2133, **1889**.
- (4) R. Schaal, Ber. **40**, 4784, **1907**.
- (5) A. Grün, E. Ulbrich, and F. Krczil, Z. angew. Chem. **39**, 421, **1926**.
- (6) I. M. Heilbron, T. P. Hilditch, and E. D. Kamm, J. Chem. Soc. **1926**, 3131.
- (7) J. v. Braun, W. Teuffert, and Weissbach, Ann. **472**, 121, **1929**.
- (8) R. Pummerer and H. Kranz, Ber. **62B**, 2620, **1929**.
- (9) S. Landa and R. Riedl, Collection Czechoslov. Chem. Commun. **2**, 520, **1930**.
- (10) G. Hugel, Chimie et industrie **26**, 1282, **1931**.
- (11) S. Landa, J. Cech, and V. Sliva, Collection Czechoslov. Chem. Commun. **5**, 204, **1933**.
- (12) M. Lerer, Ann. combustibles liquides **8**, 681, **1933**.
- (13) A. Krussilchik, Ann. combustibles liquides **10**, 923, **1935**.
- (14) H. Staudinger and F. Staiger, Ber. **68**, 707, **1935**.
- (15) J. Strating and H. J. Backer, Rec. trav. chim. **55**, 903, **1936**.
- (16) A. D. Pétróff, K. I. Karasseff, and M. A. Tschelzowa, Bull. soc. chim. [5] **3**, 169, **1936**.
- (17) D. Aelony, Thesis—Leland Stanford Univ., **1938**.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Propadiene	-136.1	-34.34			
Allene	-146 ¹	-32 ¹	0.6629 ¹⁷²	1.4169 ¹⁷¹	$\frac{dD}{dt} = -0.0001214/^\circ C.$ (-80° to -34.34°)
C=C=C	-136.1 ¹⁷³	-34.34 ¹⁷¹	@	@	$\frac{dn}{dt} = -0.0007719/^\circ C.$ (-70° to -34.34°)
		-35.0 ¹⁷⁴	-34.34°	-34.34°	
		-73.4 ¹⁷⁴	0.6699 ¹⁷²	1.4212 ¹⁷¹	
		@ 100mm	@ -40°	@ -40°	
			0.7184 ¹⁷²	1.4444 ¹⁷¹	
			@ -80°	@ -70°	
C₄H₆ Butadiene-1,2					
C=C=C-C		10.3 ⁴	0.676 ⁴	1.4205 ⁴	
		18 to 19 ²	@ 0°	@ 1.3°	
Butadiene-1,3					
C=C-C=C	-108.7 ¹⁷³	-4.75 ³	0.650 ³	1.422 ³	
		-5 to -4 ⁵	@ -6°	@ -6°	
		-2.6 ¹⁴⁷		1.4293 ¹⁴⁷	
		-4.51 ¹⁷³		@ -25°	
		@ 757mm			
C₅H₈ Pentadiene-1,2		44.7	0.6904	1.4191	
Ethylallene		44.7 ¹⁹⁰	0.6909 ¹⁹⁰	1.4208 ¹⁹⁰	
C=C=C-C-C		44 to 45 ⁶	0.6890 ⁶	1.4149 ⁶	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentadiene-1,3					
Piperylene		42.4 to 42.6 ¹⁰⁸ @ 766mm	0.6794 ¹² @ 25°	1.4206 ¹² @ 25°	
(Mixtures of geometrical isomers)		42.2 ¹⁰⁰	0.685 ¹⁵	1.4307 ¹⁰⁰	
		41.5 ¹⁸⁴	0.6803 ¹⁶⁸	1.4309 ¹⁶⁸	
C=C-C=C-C		41.8 to 42.2 @ 748mm ¹³³	0.6852 ¹⁴⁴ 0.6830 ⁷	1.4309 ¹⁵ 1.4280 ⁷	
		42 ^{7,10}	0.6812 ¹⁷	1.44020 ⁸	
		42 to 44 ⁸	@ 19°	@ 16.5°	
		43 ¹⁵	0.6957 ⁸	1.4258 ⁹	
		42.0 to	@ 16.5°	@ 16°	
		42.3 ¹⁹¹	0.6907 ¹⁶ @ 16°	1.43398 ¹³³ @ 15°	
			0.6827 ¹³³ @ 15°	1.4366 ¹³³ @ 0°	
			0.7037 ¹² @ 0°		
			0.6951 ¹¹ @ 0°		
Pentadiene-1,4					
C=C-C-C=C	-148.1 ¹⁷³	26.27 ¹⁷³ @ 767mm 29 to 30 ¹⁸ 25.8 to 26.2 ¹⁴ @ 756mm 28.5 to 29.2 @ 742mm ¹⁵²	0.6453 ¹¹		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentadiene-2,3 $C-C=C-C-C$		49 to 51 ¹⁶	0.7023 ¹⁶ 0.7216 ¹⁶ @ 0°		$\frac{dD}{dt} = -0.000965/^{\circ}C.$ (0° to 20°)
3-Methylbutadiene-1,2 $C=C-C-C$ C		40.5 40.5 to 41.5 ²⁰ 40 to 40.5 ²⁵ 39 to 40.5 ²⁶	0.6833 0.6940 ²⁰ 0.6833 ²⁵ 0.678 ²⁶ 0.6913 ²⁶ @ 3.6° 0.7135 ²⁶ @ 0° 0.7029 ²⁶ @ 0°	1.41658 ²⁵ 1.41722 ²⁶ @ 3.3°	$\frac{dD}{dt} = -0.00151/^{\circ}C.$ (0° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D_4^{20}	n_D^{20}	Additional Data
3-Methylbutadiene-1,3 or 2-Methylbutadiene-1,3	-146.8	34.076	0.6808	1.42158	$\frac{dD}{dt} = -0.0009166/^\circ\text{C.}$ (0° to 20°)
Isoprene	-120 ²¹	33.75 to 34 ²⁴	0.6805 ¹⁴³	1.4224 ¹⁶	
	-146.8 ¹⁴⁴	@ 762mm	0.6806 ¹⁶⁸	1.42160 ¹⁴⁷	
		32 to 33 ¹⁸	0.6812 ²¹	1.41540 ²⁴	
		33.5 ¹⁹	0.6811 ²⁴	1.4207 ¹⁶⁸	
		33.5 to 34 ²²	0.682 ¹⁵	1.42617 ²³	
		34 ¹⁵	0.6794 ¹⁹	@ 16.5°	
		34.076 ¹⁴³	@ 19°	1.42245 ²¹	
		34 to 34.5 ²⁴	0.6785 ²²	@ 13°	
		@ 758mm	@ 18.5°		
		33.9 to 35.3 ¹⁶⁸	0.6867 ²³		
		@ 750mm	@ 16.5°		
			0.6849 ²¹		
			@ 16°		
			0.6842 ²⁴		
			@ 15°		
			0.6988 ¹⁹		
			@ 0°		
			0.6663 ¹⁷⁶		
			D_{25}^{25}		
			0.6705 ¹⁷⁶		
			D_{20}^{20}		
			0.6748 ¹⁷⁶		
			D_{18}^{18}		
			0.6796 ¹⁷⁶		
			D_{10}^{10}		
			0.6856 ¹⁷⁶		
			D_4^4		
			0.6696 ¹⁷⁶		
			D_{25}^{25}		
			0.6730 ¹⁷⁶		
			D_{20}^{20}		
			0.6768 ¹⁷⁶		
			D_{18}^{18}		
			0.6813 ¹⁷⁶		
			D_{10}^{10}		
			0.6874 ¹⁷⁶		
			D_4^4		
Isoprene (from India rubber)					
Isoprene (from turpentine)					

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Hexadiene-1,2 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}$		78 to 79 ²⁷	0.7198 ²⁷ @ 17°	1.4298 ²⁷ @ 17°	
Hexadiene-1,3 (Mixtures of geometrical isomers) $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}$		72 to 74 ²⁸	0.714 ²⁸ @ 12°		
Hexadiene-1,4 (Mixtures of geometrical isomers) $\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}$		64 to 66 ²⁹ 64.3 to 64.6 ¹⁰² @ 745mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexadiene-1,5,	140.8	59.57	0.6899	1.4034	$\frac{dD}{dt} = -0.000998/^\circ\text{C.}$ (0° to 60°)
Diallyl	-140.8 ¹⁷³	59.3 ³² @ 769.3mm	0.6503 ³² @ 59.3°	1.4009 ³⁵	
C=C-C-C-C=C	-140.9 ³⁴	59.87 ¹⁷³ @ 767mm	0.6863 ³⁴ @ 25°	1.40102 ³³ 1.4044 ³⁴ 1.4012 ³⁴ @ 25° 1.4076 ³⁴ @ 15°	$\frac{dn}{dt} = -0.00064/^\circ\text{C.}$ (15° to 25°)
		59.57 ^{13,34}	0.6848 ¹⁷³	@ 25°	
		59.5 ³¹	@ 25°		
		59 to 61 ¹³⁵	0.7074 ³¹ @ 20.5°		
		57 to 59 ¹⁴⁵	0.6940 ³⁵		
		57 to 58.5 ³⁵	0.6880 ³³		
		57.8 ³⁰ @ 744mm	0.6898 ¹⁷³ 0.6872 ³⁰ @ 15.9°		
			0.6946 ¹⁷³ @ 15°		
			0.6983 ³³ @ 11.9°		
			0.6993 ¹⁷³ @ 10°		
			0.7052 ¹⁷³ @ 4°		
			0.7106 ³⁴ @ 0°		
Hexadiene-2,3					$\frac{dD}{dt} = -0.00091/^\circ\text{C.}$ (0° to 20°)
C-C=C-C-C-C		67.75 to 68.25 ¹⁶⁴	0.6804 ¹⁶⁴ 0.6986 ¹⁶⁴ @ 0°	1.40125 ¹⁶⁴ n _D 1.40645 ¹⁶⁴ n _r	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexadiene-2,4 (Mixtures of geometrical isomers) $C-C=C-C=C-C$		87 to 89 ^{38,41} 80 to 82 ^{12,159} 80 ¹⁵ 82 ⁷ 77 to 78 ⁴⁰ @ 752mm	0.7179 ⁷ @ 22° 0.7177 ¹² @ 21° 0.7167 ¹⁵⁹ 0.720 ¹⁵ 0.7727 ³⁸ 0.72732 ⁴⁰ @ 12.5° 0.72656 ¹² @ 0°	1.4490 ⁷ @ 22° 1.4463 ¹² @ 21° 1.4514 ¹⁵ 1.4450 ³⁸ 1.4502 ¹⁵⁹ 1.45591 ⁴⁰ @ 12.5°	
3-Methylpentadiene-1,2 $C=C-C-C-C$ C		70 to 71 ³⁶	0.7309 ³⁶ @ 0°		
4-Methylpentadiene-1,2 $C=C-C-C-C$ C		70 ³⁷	0.7061 ³⁷ @ 22°	1.4232 ³⁷ @ 22°	
2-Methylpentadiene-1,3 (Mixtures of geometrical isomers) $C=C-C-C-C$ C		75 to 77 ⁴³ @ 779mm 75.6 to 75.7 ¹⁵⁸ @ 762mm 75.6 to 76.0 ¹⁵¹ 76 to 77 ¹⁵⁹	0.71896 ¹⁵¹ 0.7196 ¹⁵⁸ 0.7215 ¹⁵⁹ 0.71761 ⁴³ @ 16°	1.4418 ¹⁵⁹ 1.44655 ¹⁵¹ 1.4467 ¹⁵⁸	

Name and Carbon Skeleton	M. P., °C	B. P., °C. (at 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Methylpentadiene-1,3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \\ \text{C} \end{array}$		76 to 79 ^{51,55} ₁₅₉ 77 to 78 ⁵⁰	0.7452 ¹⁵⁹ 0.741 ⁵⁵ 0.7473 ⁵¹ @ 16.5° 0.7576 ⁵¹ @ 0°	1.4528 ¹⁵⁹ 1.4346 ⁵⁵ 1.4561 ⁵⁰ @ 21° 1.45427 ⁵¹ @ 16.5°	
4-Methylpentadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-70 ⁵³	74 to 75 ⁴⁴ 75.5 to 76 ⁴⁷ 76 to 77 ¹⁵⁹ 76.0 to 76.5 @ 759mm ¹⁵¹	0.7189 0.71415 ⁴⁶ 0.7183 ¹⁵⁸ 0.71814 ¹⁵¹ 0.7204 ¹⁵⁹	1.4503 1.44664 ⁴⁷ 1.4472 ¹⁵⁹ 1.4491 ⁵⁴ 1.4525 ¹⁵⁸ 1.45317 ¹⁵¹	
2-Methylpentadiene-1,4 Isodiallyl $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \\ \text{C} \end{array}$		80 to 83 ¹³⁶	0.727 ¹³⁶ @ 15° 0.7413 ¹³⁷ @ 11°		
2-Methylpentadiene-2,3 Trimethylallene $\begin{array}{c} \text{C}-\text{C}=\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		71.5 to 72.5 ⁵² 71 to 73 ⁴⁸ 77 to 78 ⁴⁹	0.71482 ⁴⁸ @ 16.1° 0.73033 ⁴⁸ @ 0°		$\frac{dD}{dt} = -0.000963/^{\circ}\text{C}.$ (0° to 16°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Ethylbutadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C} \\ \\ \text{C} \\ \\ \text{C} \end{array}$		72 to 74 ³⁶ 72 to 77 ⁵⁶			
2,3-Dimethylbutadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-76.0	68.9	0.7263	1.4386	$\frac{dD}{dt} = -0.0009108/^{\circ}\text{C.}$ (0° to 20°)
	-65 ⁵³ -76.0 ¹⁷⁵	69.5 to 70 ⁵⁸ @ 772mm 70 ¹⁵ 71 ⁸⁰ 69 to 70 ¹⁵⁹ 69 ¹³⁴ 68.90 ¹⁷⁵ 67.3 to 67.8 ⁵³ 68.8 to 68.9 ⁶¹ @ 753.5mm 69.5 ⁵⁷ @ 750mm	0.7262 ^{58,134} 0.7263 ¹⁵⁹ 0.7264 ⁸¹ 0.725 ¹⁶ 0.7304 ⁶⁰ @ 16.5° 0.7304 ⁵³ @ 16° 0.73074 ⁵⁹ @ 15° 0.7565 ⁵⁷ @ 0° 0.7445 ⁵⁸ @ 0° 0.7444 ¹³⁴ @ 0°	1.43929 ⁶¹ 1.4390 ¹⁷⁵ 1.437717 ⁵⁸ 1.4375 ¹⁵⁹ 1.4382 ¹⁶ 1.44321 ⁶⁰ @ 16.5° 1.4421 ⁵⁹ @ 15° 1.43866 ⁵³ @ 13°	
C₈H₁₂ Heptadiene-1,2 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}$		105	0.7294	1.4322 @ 18°	$\frac{dD}{dt} = -0.000707/^{\circ}\text{C.}$ (0° to 20°)
		103 to 106 ¹⁷ 105 to 106 ²⁷	0.7306 ²⁷ @ 18° 0.734 ¹⁷ @ 14° 0.7435 ¹⁷ @ 0°	1.4322 ²⁷ @ 18° 1.4524 ¹⁷ @ 16°	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Heptadiene-1,4 (Mixtures of geometrical isomers) $\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}$		92.0 to 92.3 ¹⁸² @ 755mm			
Heptadiene-2,4 (Mixtures of geometrical isomers) $\text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}$		104 to 106 ¹² 107 ¹⁵ 107.5 to 108.0 ¹⁹¹	0.7327 ¹² @ 21.5° 0.731 ¹⁵ 0.75099 ¹² @ 0°	1.4486 ¹² @ 21.5° 1.4534 ¹⁵	
5-Methylhexadiene-1,2 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		96 ³⁷	0.7225 ³⁷ @ 19°	1.4282 ³⁷ @ 19°	
3-Methylhexadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		101 to 103 ⁶³	0.7407 ⁶³ @ 25°	1.45247 ⁶³ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylhexadiene-1,3 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		97 to 98 ⁶⁴	0.7324 ⁶⁴ @ 25°	1.4342 ⁶⁴ @ 25°	
2-Methylhexadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \\ \text{C} \end{array}$		92.5 ⁶⁵ @ 769mm 92 ⁶⁶	0.7289 ⁶⁵ @ 18.5°	1.42376 ⁶⁵ @ 17.3°	
4-Methylhexadiene-2,3 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		107 to 109 ⁶⁷			
2-Methylhexadiene-2,4 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		98 97 to 99 ^{12,159} 104 ¹⁵	0.7460 0.7192 ¹² @ 24° 0.7461 ¹⁵⁹ 0.745 ¹⁵ 0.7389 ¹² @ 0°	1.4590 1.4266 ¹² @ 24.5° 1.4585 ¹⁵⁹ 1.4606 ¹⁵	$\frac{dD}{dt} = -0.00067/^{\circ}\text{C.}$ (20° to 25°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Methylhexadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		107 to 108 ⁵¹	0.7625 ⁵¹ @ 15° 0.7753 ⁵¹ @ 0°	1.46146 ⁵¹ @ 15°	
3-Ethylpentadiene-1,2 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \\ \\ \text{C} \end{array}$		97 96 to 98 ³⁶ 97 ⁵² @ 754mm	0.7381 0.7355 ⁵² @ 23.9° 0.7560 ⁵² @ 0° 0.7474 ³⁶ @ 0°	1.43683 ⁵² @ 23.9°	$\frac{dD}{dt} = -0.000678/^{\circ}\text{C.}$ (0° to 24°)
2-Ethylpentadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C} \\ \\ \text{C}-\text{C} \end{array}$		97 to 99 ¹⁰⁰ @ 735mm		1.4508 ¹⁰⁰	
4,4-Dimethylpentadiene-1,2 $\begin{array}{c} \text{C} \\ \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		82 81 to 82.5 ⁶⁹ 80 to 83 ⁶⁸	0.7183 ⁶⁸ 0.7365 ⁶⁸ @ 0°		$\frac{dD}{dt} = -0.00091/^{\circ}\text{C.}$ (0° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D_4^{20}	n_D^{20}	Additional Data
2,4-Dimethyl- pentadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		93.2 93.1 to 93.2 ⁷⁰ 92 to 94 ⁷¹ @ 759mm 93 ⁸² @ 758mm 92 to 93 ⁷² @ 750mm	0.7371 0.7343 ⁸² @ 23° 0.7368 ⁷⁰ 0.7412 ⁷¹ @ 17.3° 0.7359 ⁸² @ 16° 0.7490 ⁷³ @ 12° 0.7595 ⁷³ @ 0° 0.7471 to 0.7515 ⁶² @ 0°	1.4408 1.43904 ⁸² @ 23° 1.4412 ⁷⁰ 1.44055 ⁷¹ @ 17.3° 1.43804 ⁸² @ 16.5° 1.44684 ⁷³ @ 12°	$\frac{dD}{dt} = -0.001169/^\circ\text{C.}$ (0° to 25°) $\frac{dn}{dt} = -0.000471/^\circ\text{C.}$ (10° to 25°)
2,4-Dimethyl- pentadiene-1,4 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		81.3 ¹⁸¹	0.7116 ¹⁸¹	1.4140 ¹⁸¹	
2,4-Dimethyl- pentadiene-2,4 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C} \\ \quad \quad \\ \text{C} \quad \quad \text{C} \end{array}$		86.5 ⁷⁴ @ 763mm 70 ⁷⁶	0.7343 ⁷⁴ @ 0°	1.42473 ⁷⁴ @ 22°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Isopropyl- butadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C} \\ \\ \text{C}-\text{C} \\ \\ \text{C} \end{array}$		86 to 87 ¹⁵⁷	0.7276 ¹⁵⁷ @ 24.5°	1.4321 @ 23°	
C₈H₁₄ Octadiene-1,5 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}$		117.5 to 118 ¹⁷⁸	0.7320 ¹⁷⁸	1.4264 ¹⁷⁸	
Octadiene-1,6 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}$		122 to 125 ⁸⁹	0.741 ⁸⁹ @ 29°	1.4328 ⁸⁹ @ 29°	
Octadiene-1,7 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}$		117.5 ¹⁸¹	0.7320 ¹⁸¹	1.4211 ¹⁸¹	
Octadiene-2,4 (Mixtures of geometrical isomers) $\text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}$		133.5 to 134 ⁷⁶ 133.5 to 134 ¹⁹¹	0.7427 ⁷⁶ @ 25°	1.4542 ⁷⁶ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octadiene-2,6 Dicrotyl (Mixtures of geometrical isomers) $\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}$		113 to 114 ⁷⁶ 117 to 119 ⁷⁷	0.7420 ⁷⁶ @ 19°	1.4324 ⁷⁶ @ 12°	
Octadiene-2,6 <i>trans-trans</i> Dicrotyl $\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}$	- 76 ⁸⁰	124.0 ¹⁰⁹ @ 747mm	0.736 ¹⁰⁹ @ 19°	1.436 ¹⁰⁹ @ 19°	
2-Methylheptadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		130.7 ⁸¹	0.7673 ⁸¹ @ 13°	1.4605 ⁸¹ @ 13°	
6-Methylheptadiene-1,4 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		116 to 118 ²⁸	0.7401 ²⁸ @ 22°		
3-Methylheptadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		110 to 111 ⁸⁹	0.7289 ⁸⁹	1.4258 ⁸⁹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylheptadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		109.8 to 110.4 ¹⁷⁸ 110.5 to 110.9 ⁸³	0.7284 ⁸³ @ 25° 0.7288 ¹⁷⁸	1.4213 ⁸³ @ 25.1° 1.4293 ¹⁷⁸	
2-Methylheptadiene-1,6 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \\ \text{C} \end{array}$		115.6 ¹⁸¹	0.7357 ¹⁸¹	1.4261 ¹⁸¹	
3-Methylheptadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}=\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		132 to 135 ⁵¹	0.7687 ⁵¹ @ 14.7° 0.7783 ⁵¹ @ 0°	1.46493 ⁵¹ @ 14.7°	
4-Methylheptadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		131 to 132 ⁸⁴ 131 ¹⁵	0.7551 ⁸⁴ @ 25° 0.763 ¹⁵	1.46211 ⁸⁴ @ 25° 1.4625 ¹⁵	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
6-Methylheptadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		117 ¹⁵ 114 to 116 ¹² 30 (at 12mm) ¹⁸⁸	0.7401 ¹² @ 25° 0.733 ¹⁵ 0.7516 ¹² (at 0°)	1.4505 ¹⁵ 1.4397 ¹²	
4-Ethylhexadiene-1,4 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		122 to 123 ⁸⁵	0.7741 ⁸⁵ @ 0°		
2,5-Dimethylhexadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		116 to 118 ⁴⁷	0.7412 ⁴⁷	1.45024 ⁴⁷	
2,5-Dimethylhexadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		100 to 102 ⁹¹ 113 to 114 ^{86,87} 113.5 ¹⁸¹ 137 ⁸⁸ @ 755mm	0.7472 ⁸⁸ @ 21° 0.7512 ⁸⁶ 0.7403 ¹⁸¹	1.43995 ⁸⁸ @ 21° 1.4309 ⁸⁶ 1.4288 ¹⁸¹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4-Dimethyl- hexadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		100 ⁸⁹	0.7226 ⁸⁹ @ 24°	1.419 ⁸⁹ @ 24°	
2,5-Dimethyl- hexadiene-2,3 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$	-80 ⁴⁷	119 to 123 ⁴⁷	0.7637 ⁴⁷	1.45054 ⁴⁷	
2,4-Dimethyl- hexadiene-2,4 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		114 to 115 ⁵¹	0.7635 ⁵¹ @ 16.5° 0.7714 ⁵¹ @ 0°	1.45457 ⁵¹ @ 16.5°	$\frac{dD}{dt} = -0.000479/^{\circ}\text{C}.$ (0° to 15°)
3,4-Dimethyl- hexadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		132 to 134 ⁹⁰ 71 to 72 ⁹⁰ @ 100mm	0.7832 ⁹⁰ @ 19.2°	1.4630 ⁹⁰ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,5-Dimethyl- hexadiene-2,4 Diisocrotyl $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$	0 ⁹⁴ 4 to 5 ⁹⁵ 6 ⁹⁵ 11 ⁹² 14.5 ⁹⁶	134 to 135 ⁹⁴ @ 768.8mm 132 to 134 ⁹⁵ 134.6 ⁹⁶ 125 to 130 ⁹³ 75 ⁹² @ 100mm	0.7726 ⁹³ @ 18° 0.7646 ⁹⁶ @ 17.8°	1.4796 ⁹⁶ @ 19.5°	
2,2-Dimethyl- hexadiene-3,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		107.4 to 108 ⁸³	0.7375 ⁸³ @ 25°	1.4425 ⁸³ @ 25°	
2-Butylbutadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C} \end{array}$		44 to 45 ¹⁸¹ @ 49mm			
C₆H₁₀ Nonadiene-1,5 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}$		142.2 to 143 ¹⁷⁸	0.7438 ¹⁷⁸	1.4310 ¹⁷⁸	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (at 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
Nonadiene-2,6 (Mixtures of geometrical isomers) <chem>C-C-C-C-C-C-C</chem>		140.6 to 146.6 ¹⁷⁸	0.7499 ¹⁷⁸	1.4332 ¹⁷⁸	
Nonadiene-1,8 <chem>C=C-C-C-C-C-C=C</chem>		142.8 ¹⁸¹	0.7431 ¹⁸¹	1.4272 ¹⁸¹	
3-Methyloctadiene-1,5 <chem>C-C-C-C-C-C-C</chem> C		135.6 to 136.2 ¹⁷⁸	0.7454 ¹⁷⁸	1.4309 ¹⁷⁸	
4-Methyloctadiene-1,5 <chem>C-C-C-C-C-C-C</chem> C		132.9 to 133.5 ¹⁷⁸	0.7413 ¹⁷⁸	1.4291 ¹⁷⁸	
2-Methyloctadiene-1,7 <chem>C-C-C-C-C-C-C</chem> C		141.6 ¹⁸¹	0.7532 ¹⁸¹	1.4351 ¹⁸¹	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Methyloctadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		155 to 157 ⁸¹ @ 750mm	0.7817 ⁸¹ @ 13°	1.4626 ⁸¹ @ 13°	
4-Methyloctadiene-2,6 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		134 to 134.6 ¹⁷⁸	0.7465 ¹⁷⁸	1.4310 ¹⁷⁸	
4-Methyloctadiene-3,5 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		148 to 151 ⁶³ 150 ¹⁵	0.7640 ⁶³ @ 25° 0.771 ¹⁵	1.46285 ⁶³ @ 25° 1.4663 ¹⁵	
2-Methyloctadiene-4,6 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		149 ^{12, 15}	0.751 ¹⁵ 0.7521 ¹² @ 18° 0.7653 ¹² @ 0°	1.4553 ¹⁵ 1.4543 ¹² @ 18°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Ethylheptadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		84 to 86 ⁹⁷ @ 102mm			
2,6-Dimethylheptadiene-1,3 Isogeraniolene $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		140 to 141 ⁹⁸ 143 to 145 ⁷³ @ 755mm 31 @ 7mm ¹⁰³	0.7923 ¹⁰³ @ 22° 0.7648 ⁷³ @ 10°	1.4606 ¹⁰³ @ 22° 1.45409 ⁹⁸ 1.46202 ⁷³ @ 10°	
2,5-Dimethylheptadiene-1,5 $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		144 to 146 ⁵¹ 117 to 119 ¹⁸⁶	0.7404 ¹⁸⁶ 0.7752 ⁵¹ @ 14° 0.7853 ⁵¹ @ 0°	1.4339 ¹⁸⁶ 1.46335 ⁵¹	
2,6-Dimethylheptadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		140 to 142 ¹⁰⁰ 140 to 143 ¹⁰⁴ @ 745mm	0.7648 0.7626 ¹⁰⁰ @ 22° 0.7750 ¹⁰⁴ @ 11°	1.4442, 1.44361 ¹⁰⁰ @ 22° 1.44707 ¹⁰⁴ @ 11°	$\frac{dD}{dt} = -0.0011/^{\circ}\text{C.}$ (11° to 22°) $\frac{dn}{dt} = -0.000315/^{\circ}\text{C.}$ (11° to 22°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4-Dimethyl- heptadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		131.2 to 131.7 ¹⁷⁸	0.7463 ¹⁷⁸	1.4313 ¹⁷⁸	
2,6-Dimethyl- heptadiene-1,6 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		139.6 ¹⁷⁸	0.7539 ¹⁷⁸	1.4341 ¹⁷⁸	
2,6-Dimethyl- heptadiene-1,5 or 1,6 Geraniolene $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$ or $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		127 ⁶⁶ @ 740mm			
2,3-Dimethyl- heptadiene-2,5 or 3,5 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		128 ¹⁴² @ 732mm	0.7478 ¹⁴²	1.4489 ¹⁴²	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyl-3-ethyl- hexadiene-1,5 $\begin{array}{c} \text{C}-\text{C} & \text{C}-\text{C} & \text{C}-\text{C} \\ & & \\ \text{C} & \text{C} & \text{C} \end{array}$	-70 ²¹	142 to 143 ^{21,99} 144 to 145 ⁶⁵	0.757 ⁹⁹ 0.7649 ⁶⁵ @ 17.4°	1.4368 ⁹⁹ 1.44319 ⁶⁵ @ 15.1°	
2,5,5-Trimethyl- hexadiene-1,3 $\begin{array}{c} & & & \text{C} & & \\ & & & & & \\ \text{C} & \cdot & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & \\ & & \text{C} & & & & \text{C} & & \end{array}$		146 to 149 ¹⁰¹			
C₁₀H₁₈ Decadiene-1,3 $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}$		168 to 170 ¹⁰⁵	0.750 ¹⁰⁵		
Decadiene-1,9 $\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}$		170 ¹⁰⁶			

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D_4^{20}</i>	<i>n_D^{20}</i>	<i>Additional Data</i>
Decadiene-2,8 (Mixtures of geometrical isomers) $C-C=C-C-C-C-C=C-C$		168 ¹⁸⁴ @ 740mm	0.7665 ¹⁸³ D_{18}^{20-5}	1.4370 ¹⁸³ @ 22°	
Decadiene-3,7 (Mixtures of geometrical isomers) $C-C-C=C-C-C-C-C-C$		166.5 ¹⁰⁷ @ 742mm	0.7559 ¹⁰⁷ @ 23°	1.4356 ¹⁰⁷ @ 23°	
4-Methylnonadiene-3,5 (Mixtures of geometrical isomers) $C-C-C-C-C=C-C-C-C$ C		170 to 172 ⁸¹ @ 745mm	0.7873 ⁸¹ @ 13°	1.4595 ⁸¹ @ 13°	
3-Ethyl-octadiene-1,5 $C-C-C-C-C=C-C-C$ C-C		156 ¹⁰⁷ @ 742mm	0.7540 ¹⁰⁷ @ 23°	1.4324 ¹⁰⁷ @ 23°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Ethyl-octadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		105 to 107 ⁹⁷ @ 90 to 95mm			
2,6-Dimethyl-octadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		58 ¹⁰³ @ 12mm	0.7933 ¹⁰⁸	1.456 ¹⁰³	
3,7-Dimethyl-octadiene-1,3 $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		162 to 163 ¹⁰³	0.7439 ¹⁰³	1.4450 ¹⁰³	
3,7-Dimethyl-octadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		164 to 167 ⁵¹ 58 ¹⁰³ @ 12mm	0.7933 ¹⁰² @ 22° 0.7832 ⁸¹ @ 14.5° 0.7939 ⁵¹ @ 0°	1.456 ¹⁰³ 1.46650 ⁵¹ @ 14.5°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6-Dimethyl-octadiene-2,6 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		166 to 168 ¹¹² @ 761mm 171.5 to 173.5 ¹¹¹ 168 to 170 ¹⁶⁵ 165 to 166 ¹⁰⁴ 165 to 167 ¹¹⁴ @ 750mm 89 @ 52mm ¹⁰⁴ 75 @ 30mm ¹¹²	0.775 ¹¹⁵ @ 21° 0.7802 ¹¹³ 0.7792 ¹¹² @ 15° 0.7811 ¹¹⁴ @ 14.4° 0.7918 ¹⁰⁴ @ 12° 0.7916 ¹¹⁴ @ 0°	1.4501 ¹¹³ 1.45102 ¹¹⁴ @ 15.8° 1.45245 ¹⁰⁴ @ 15° 1.4497 ¹¹² @ 10°	
2,7-Dimethyl-octadiene-2,6 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \qquad \\ \text{C} \qquad \qquad \qquad \text{C} \end{array}$		163.5 to 164.5 ¹¹⁷ 161 to 163 ¹¹⁶	0.7849 ¹¹⁶	1.44814 ¹¹⁶	
3,6-Dimethyl-octadiene-2,6 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \qquad \\ \text{C} \qquad \qquad \qquad \text{C} \end{array}$		153 to 155 ¹¹⁶	0.7767 ¹¹⁶	1.44453 ¹¹⁶	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,5-Dimethyl- octadiene-2,6 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		152.9 to 153.8 ⁸³	0.7611 ⁸³ @ 25°	1.4375 ⁸³ @ 25.1°	
2,6-Dimethyl- octadiene-2,7 β-Linaloolene $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		158 to 160 ¹⁶⁵ @ 761mm 160 to 161 ¹⁶⁴ 161 to 162 ¹⁶³ 165 to 168 ¹¹⁸	0.7617 0.7882 ¹¹⁸ 0.7601 ¹⁶³ 0.7580 ¹⁶⁴	1.4359 1.455 ¹¹⁸ 1.4362 ¹⁶³ 1.4358 { ¹⁶⁴ , ¹⁶⁵	
2,5-Dimethyl- octadiene-3,5 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		165 ⁸⁴	0.7754 ⁸⁴ @ 25°	1.46136 ⁸⁴ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,6-Dimethyl- octadiene-3,5 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & & & \text{C} \end{array}$		167 to 170 ¹¹⁹			
4-Propylheptadiene-1,4 $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & & & \text{C} & - & \text{C} - \text{C} \end{array}$		158 ¹²⁰	0.7721 ¹²⁰ @ 15° 0.7840 ¹²⁰ @ 0°		
4-Propylheptadiene-1,5 $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & & & \text{C} & & \\ & & & & & & \\ & & & & \text{C} & & \\ & & & & & & \\ & & & & \text{C} & & \end{array}$		156.2 to 156.6 ¹⁹¹	0.7501 ¹⁹¹ @ 25°	1.4310 ¹⁹¹ @ 25°	
2-Methyl-3-ethyl- heptadiene-2,5 $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ & & \text{C} & & \text{C} & - & \text{C} \end{array}$		158 to 161 ¹⁰¹			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3,4-Diethyl- hexadiene-1,5 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C}-\text{C} \end{array}$		144 ¹⁰⁷ @ 742mm	0.7526 ¹⁰⁷ @ 23°	1.4315 ¹⁰⁷ @ 23°	
3,4-Diethyl- hexadiene-2,4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C} \quad \text{C}-\text{C} \end{array}$	158 to 163 ¹⁵²				
2,6-Dimethyl- octadiene-1 or 2, 6 or 7 Linaloolene Dihydromyrcene Dihydroocimene $\begin{array}{c} \text{C}=\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \\ \text{C} \quad \quad \quad \text{C} \end{array}$		169 to 171 ¹¹⁰ @ 764mm 161 ¹¹¹ @ 763mm 168 ¹⁰⁹ 62 to 63 ⁸³ @ 17mm 58 ¹⁰⁹ @ 12mm	0.768 ¹¹¹ @ 25° 0.7767 ⁸³ 0.775 ¹¹⁰ 0.7824 ¹⁰⁴ @ 15° 0.792 ¹¹⁰ @ 0°	1.4481 1.4492 ¹¹⁰ 1.4482 ¹¹⁰ 1.4458 ¹¹¹ 1.45251 ¹⁰⁹ @ 15°	$\frac{dD}{dt} = -0.000878/^{\circ}\text{C.}$ (0° to 25°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Undecadiene-1,10 $C=C-(C)_7-C=C$		187 ¹²² @ 755mm 76 ¹²² @ 12mm 70 to 72 ¹⁰⁸ @ 0mm	0.768 0.769 ¹⁰⁸ 0.7671 ¹²²	1.4382 1.4398 ¹⁰⁸ 1.43497 ¹²²	
2-Methyldecadiene-1,3 $C=C-C=C-C-C-C-C-C-C$ $\quad \quad \quad $ $\quad \quad \quad C$		184 ¹²³			
5-Methyldecadiene-4,6 (Mixtures of geometrical isomers) $C-C-C-C-C-C-C-C-C-C$ $\quad \quad \quad \quad \quad $ $\quad \quad \quad \quad \quad C$		187 to 188 ⁸¹ @ 742mm	0.7858 ⁸¹ @ 14°	1.4603 ⁸¹ @ 14°	
2,6-Dimethyl- nonadiene-2,6 (Mixtures of geometrical isomers) $C-C=C-C-C-C=C-C-C$ $\quad \quad \quad \quad \quad $ $\quad \quad C \quad \quad \quad C$		181 to 183 ¹⁰⁴ @ 746mm	0.8007 ¹⁰⁴ @ 10°	1.45807 ¹⁰⁴ @ 10°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,4-Dimethyl- nonadiene-3,5 (Mixtures of geometrical isomers) $\begin{array}{cccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & \\ & & \text{C} & & & & \text{C} & & & & & & \end{array}$		181 to 183 ⁸¹ @ 752mm	0.7931 ⁸¹ @ 14°	1.4573 ⁸¹ @ 14°	
2,6-Dimethyl- nonadiene-4,6 (Mixtures of geometrical isomers) $\begin{array}{cccccccc} \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & \\ & & \text{C} & & & & & & \text{C} & & & & \end{array}$		185 to 189 ⁸⁴	0.7779 ⁸⁴ @ 25°	1.46189 ⁸⁴ @ 25°	
2,6,7-Trimethyl- octadiene-2,6 $\begin{array}{ccccccc} \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} \\ & & & & & & & & & & & & \\ & & \text{C} & & & & & & \text{C} & & \text{C} & & \end{array}$		182 to 183 ¹⁰⁴ @ 756mm	0.8100 ¹⁰⁴ @ 11°	1.46085 ¹⁰⁴ @ 11°	
4-Butylheptadiene-1,5 $\begin{array}{ccccccc} \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & & & & & & & \\ & & & & & & \text{C} & & & & & & \\ & & & & & & & & & & & & \\ & & & & & & \text{C} & & & & & & \\ & & & & & & & & & & & & \\ & & & & & & \text{C} & & & & & & \\ & & & & & & & & & & & & \\ & & & & & & \text{C} & & & & & & \end{array}$		110.1 to 111.1 @ 85mm ¹⁹¹	0.7565 ¹⁹¹ @ 25°	1.4342 ¹⁹¹ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D_4^{20}	n_D^{20}	Additional Data
2,6-Dimethyl- nonadiene-1,7 or 2,7 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		61 to 62 ¹²⁴ @ 9mm	0.7730 ¹²⁴		
3-Heptybutadiene-1,3 3-Methylenedecene-1 Heptoprene $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C} \\ \\ \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \end{array}$		52 to 54 ¹⁶¹ @ 5mm	0.7796 ¹⁶¹	1.4511 ¹⁶¹	
$C_{11}H_{20}$ Dodecadiene-1,11 $C=(C)_{10}=C$		207 ¹⁵⁶			
Dodecadiene		79 to 84 ¹²⁵ @ 11mm	0.779 ¹²⁵ @ 22°	1.444 ¹²⁵ @ 22°	Perhaps a mixture of isomers.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6-Dimethyl- decadiene-1,8 and 2,8 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$ and $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		81 to 82 ¹²⁶ @ 9mm	0.7813 ¹²⁶		[α] _D ²⁰ = -6.64° ¹²⁶
2,6-Dimethyl- decadiene-2,6 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		201 to 202 ¹⁰⁴ @ 747mm			
2,3,6,7-Tetramethyl- octadiene-2,6 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \quad \qquad \quad \quad \\ \text{C} \quad \text{C} \qquad \quad \text{C} \quad \text{C} \end{array}$		87.5 to 88.5 ¹²⁷ @ 18mm	0.7971 ¹²⁷ @ 25°	1.45963 ¹²⁷ @ 25°	
2,3-Di-<i>tert</i>-butyl- butadiene-1,3 $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C}-\text{C}-\text{C} \\ \quad \\ \text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		168 to 170 ¹²⁸	0.7754 ¹²⁸ @ 15°	1.43648 ¹²⁸ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Oleatridecadiene		83 to 85 ¹⁷⁰ @ 5mm	0.8552 ¹⁷⁰ @ 18°	1.4686 ¹⁷⁰ @ 16°	
2-Methyl- dodecadiene-1,11 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_9-\text{C}=\text{C} \\ \\ \text{C} \end{array}$		152 ¹²³ @ 67mm			
2,6-Dimethyl- undecadiene-1,8 and 2,8 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_3-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \\ \text{and} \\ \text{C}-\text{C}=(\text{C})_3-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		90 to 91 ¹²⁴ @ 8mm	0.7873 ¹²⁴	1.44903 ¹²⁴	[α] _D ²⁰ = -6.68° ¹²⁴
2,6,9-Trimethyl- decadiene-2,6 $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C} \\ \qquad \qquad \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \qquad \qquad \text{C} \end{array}$		214 ¹⁰⁴ @ 742mm	0.8037 ¹⁰⁴ @ 11°	1.45967 ¹⁰⁴ @ 11°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
2,11-Dimethyl- dodecadiene-1,11 $\begin{array}{c} \text{C}=\text{C}-(\text{C})_8-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		239 to 241 ¹⁵⁰	0.7437 ¹⁵⁰ @ 99° 0.7581 ¹⁵⁰ @ 90° 0.7653 ¹⁵⁰ @ 80° 0.7725 ¹⁵⁰ @ 70° 0.7798 ¹⁵⁰ @ 60° 0.7869 ¹⁵⁰ @ 50° 0.7932 ¹⁵⁰ @ 40° 0.7992 ¹⁵⁰ @ 30° 0.8066 ¹⁵⁰ 0.8148 ¹⁵⁰ @ 10° 0.8220 ¹⁵⁰ @ 0°		$\frac{dD}{dt} = -0.0007010/^{\circ}\text{C.}$ (0° to 100°)
2,11-Dimethyl- dodecadiene-2,10 $\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_6-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \qquad \\ \text{C} \qquad \qquad \qquad \text{C} \end{array}$		239.5 to 240.5 ¹²⁹	0.7932 ¹²⁹ @ 19°	1.4535 ¹²⁹ @ 19°	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
4,5-Dipropyl- octadiene-2,6 (Mixtures of geometrical isomers) $ \begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array} $		221 to 222 ¹⁹¹ @ 76mm	0.7804 ¹⁹¹ @ 25°	1.4472 ¹⁹¹ @ 25°	
C₁₈H₃₆ Hexadecadiene-1,15 $\text{C}=\text{C}-(\text{C})_{12}-\text{C}=\text{C}$	-14 to -12 ¹²²	142 to 147 ¹²² @ 6mm	0.8149 ¹²² @ 18°	1.45612 ¹²² @ 18°	
Oleahexadecadiene		133 ¹⁷⁰	0.8609 ¹⁷⁰ @ 18°	1.4785 ¹⁷⁰ @ 16°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4,5-Di-<i>n</i>-butyl- octadiene-2,6 (Mixtures of geometrical isomers) $ \begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \quad \\ \text{C} \quad \text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array} $		148.7 to 150.7 @ 25mm ¹⁹¹	0.7949 ¹⁹¹ @ 25°	1.4528 ¹⁹¹ @ 24.9°	
C₁₈H₃₄ 2-Methyl- heptadecadiene-2,3 (?) (Mixtures of geometrical isomers) $ \begin{array}{c} \text{C}-\text{C}=\text{C}=\text{C}-(\text{C})_{12}-\text{C} \\ \\ \text{C} \end{array} $		185 to 188 ¹³⁰	0.845 ¹³⁰ @ 0°		
3,12-Diethyltetra- decadiene-2,12 (Mixtures of geometrical isomers) $ \begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_8-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C}-\text{C} \qquad \quad \text{C}-\text{C} \end{array} $		168 ¹⁶² @ 16mm	0.8121 ¹⁶²	1.44431 ¹⁶² @ 16.1°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Oleanonadecadiene		155 ¹⁷⁰	0.8640 ¹⁷⁰ @ 18°	1.4810 ¹⁷⁰ @ 16°	
C₂₀H₃₈ Eicosadiene-1,19 C=C-(C) ₁₆ -C=C	20.3 ¹³¹ 30 to 32 ¹⁶⁸	175 ¹³¹ @ 2.5mm			
C₂₂H₄₂ 2,19-Dimethyl- eicosadiene-1,19 $ \begin{array}{c} \text{C}=\text{C}-(\text{C})_{16}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array} $	0 ¹⁵⁰	264 to 266 ¹⁸⁰ @ 158mm 239.5 to 240.5 @ 21mm ¹⁸⁰	0.7636 ¹⁵⁰ @ 99° 0.7696 ¹⁸⁰ @ 90° 0.7764 ¹⁵⁰ @ 80° 0.7832 ¹⁵⁰ @ 70° 0.7909 ¹⁵⁰ @ 60° 0.7976 ¹⁵⁰ @ 50° 0.8043 ¹⁵⁰ @ 40° 0.8110 ¹⁵⁰ 0.8201 ¹⁸⁰ @ 15° 0.8245 ¹⁵⁰ @ 10°		This is a mixture of isomers

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2-Methyl- tricosadiene-2,14 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-(\text{C})_{10}-\text{C}=\text{C}-(\text{C})_8 \\ \\ \text{C} \end{array}$		210.5 to 211.5 @ 3.5mm ¹⁴⁶			
C₃₀H₅₈ Octahydrosqualene		229 to 234 ¹⁶⁷ @ 3mm	0.8200 ¹⁶⁷	1.4625 ¹⁶⁷	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Tetraatriacontadiene-9,25 (Mixtures of geometrical isomers) $C-(C)_7-C-C-(C)_7-(C)_7-C-C-(C)_7-C$	20.5 to 21 ¹⁴⁰ 22.5 ¹³¹		0.8412 ¹⁴⁰ @ 22°	1.4655 ¹⁴⁰ @ 22°	
$C_{40}H_{70}$ Hexatriacontadiene (?)	48 to 49 ¹³²				
$C_{44}H_{82}$ Tetrateetracontadiene (?)	60 to 62 ¹³²				
Phytadiene		186 to 187 ¹³⁹ @ 13mm 185 to 188 ¹⁴⁰ @ 13mm	0.826 ¹³⁹ @ 0°		

- (1) R. Lespieau and G. Chavanne, *Compt. rend.* **140**, 1035, 1905.
- (2) L. M. Norton and A. A. Noyes, *Am. Chem. J.* **10**, 430, 1888.
- (3) C. Prévost, *Compt. rend.* **186**, 1209-11, 1928.
- (4) C. D. Hurd and R. N. Meinert, *J. Am. Chem. Soc.* **53**, 289, 1931.
- (5) J. Thiele, *Ann.* **308**, 337, 1899.
- (6) M. Bouis, *Bull. soc. chim.* **41**, 1160, 1927.
- (7) C. Prévost, *Ann. Chim.* [10] **10**, 113, 1928.
- (8) C. Harries and F. Düvel, *Ann.* **410**, 57, 1915.
- (9) E. Grischkewitsch-Trochimowski, *J. Russ. Phys. Chem. Soc.* **48**, 898, 1916.
- (10) A. W. Hofmann, *Ber.* **14**, 664, 1881.
- (11) Wosnesenski, *J. Russ. Phys. Chem. Soc.* **36**, 532, 1904.
- (12) J. Reif, *Ber.* **41**, 2744, 1908.
- (13) H. B. Dykstra, J. F. Lewis, and C. E. Boord, *J. Am. Chem. Soc.* **52**, 3396, 1930.
- (14) P. N. Kroggerman, *J. Am. Chem. Soc.* **52**, 5060, 1930.
- (15) K. v. Auwers and H. W. Westermann, *Ber.* **54**, 2993, 1921.
- (16) Kukuritschkin, *J. Russ. Phys. Chem. Soc.* **35**, 873, 1904.
- (17) J. M. Dumoulin, *Compt. rend.* **182**, 974, 1926.
- (18) V. N. Ipatieff, *J. prakt. Chem.* [2] **55**, 6, 1897.
- (19) W. Mokijewski, *J. Russ. Phys. Chem. Soc.* **30**, 885, 1899.
- (20) Addo and Gmelius, *Handbook of Organic Chemistry*, **311**, 331.
- (21) C. J. Enklaar, *Rec. trav. chim.* **36**, 248, 1917.
- (22) G. Steimmig, *Ber.* **47**, 852, 1914.
- (23) C. Harries, *Ber.* **47**, 2001, 1914.
- (24) O. Aschan, *Oversikt Finska, Vetenskapa Soc. Fork.* **58**, 122, 1915.
- (25) L. Kutscherov, *J. Russ. Phys. Chem. Soc.* **45**, 1643, 1913.
- (26) K. v. Auwers, *Ber.* **51**, 1126, 1918.
- (27) M. Bouis, *Compt. rend.* **183**, 133, 1916.
- (28) H. Fournier, *Bull. soc. chim.* [3] **15**, 400, 1896.
- (29) G. Griner, *Ann. chim.* [6] **26**, 332, 1892.
- (30) J. F. Eijkmann, *Chem. Weekblad* **3** 653, 685, 701, 1906; **41**, 1907.
- (31) Zander, *Ann.* **214**, 148, 1882.
- (32) R. Schiff, *Ann.* **220**, 90, 1883.
- (33) E. W. Bruhl, *Ann.* **200**, 184, 1880.
- (34) F. Cortese, *J. Am. Chem. Soc.* **51**, 2266, 1929.
- (35) N. D. Zelinsky and K. A. Kozeschkow, *Ber.* **60**, 1102, 1927.
- (36) V. N. Ipatieff, *J. prakt. Chem.* [2] **526**, 1899.
- (37) M. Bouis, *Ann. chim.* [10] **9**, 402, 1928.
- (38) P. Duden and R. Lemme, *Ber.* **35**, 1338, 1902.
- (40) E. W. Bruhl, *Ber.* **41**, 3713, 1908.
- (41) M. Schramm, *Ber.* **30**, 638, 1897.
- (43) C. Harries and S. Adamientz, *Ber.* **34**, 302, 1901.
- (44) M. Kohn, *Ann.* **351**, 149, 1907.
- (45) M. Saizew and A. Saizew, *Ann.* **185**, 756, 1877.
- (46) E. Ljuborski, *J. Russ. Phys. Chem. Soc.* **32**, 140, 1900.
- (47) W. Krestinsky, *Ber.* **55**, 2754, 1922.
- (48) V. N. Ipatieff, *J. Russ. Phys. Chem. Soc.* **27**, 371, 1895.
- (49) W. Kerp, *Ann.* **290**, 123, 1896.
- (50) H. L. Fisher and F. D. Chittenden, *Ind. Eng. Chem.* **22**, 869, 1930.
- (51) P. Abelman, *Ber.* **43**, 1583, 1910.
- (52) B. Mereshkowski, *J. Russ. Phys. Chem. Soc.* **45**, 1348, 1965, 1913.
- (53) C. J. Enklaar, *Rec. trav. chim.* **36**, 238, 1917.
- (54) N. Kishner and W. Klawikordow, *J. Russ. Phys. Chem. Soc.* **43**, 604, 1911.
- (55) T. Midgley and A. L. Henne, *J. Am. Chem. Soc.* **51**, 1215, 1929.

- (56) Pariselle and J. Simon, *Compt. rend.* **173**, 86, 1921.
- (57) F. Couturier, *ann. chim.* [6] **26**, 485, 1892.
- (58) I. Kondakow, *J. prakt. Chem.* [2] **62**, 162, 1900.
- (59) A. Courtot, *Bull. soc. chim.* [3] **35**, 972, 1906.
- (60) C. Harries, *Ann.* **383**, 184, 1911.
- (61) P. N. Krogermann, *Sitzber. Naturforsch. Ges. Univ. Tartu.* **41**, 3 62, 1934.
- (62) C. Weizmann and S. F. Garrard, *J. Chem. Soc.* **117**, 324, 1920.
- (63) E. Bjelouss, *Ber.* **45** 626, 1912.
- (64) N. A. Milas and A. McAlevy, *J. Am. Chem. Soc.* **57**, 580, 1935.
- (65) K. v. Auwers and W. Moosbrugger, *Ann.* **387**, 167, 1912.
- (66) W. H. Perkins and S. Pickles, *J. Chem. Soc.* **87**, 658, 1905.
- (67) A. Gry, *Bull. soc. chim.* [4] **3**, 380, 1908.
- (68) A. L. Faworski and E. Opel, *J. Russ. Phys. Chem. Soc.* **50**, 43, 1918.
- (69) A. L. Faworski, L. Marew and O. Alexejewa, *J. Russ. Phys. Soc.* **50**, 565, 1918.
- (70) H. I. Waterman and W. J. C. De Kok, *Rec. trav. chim.* **52**, 234, 1933.
- (71) K. v. Auwers and F. Eisenlohr, *J. prakt. Chem.* [2] **82**, 75, 1910.
- (72) V. Grignard, *Compt. rend.* **140**, 372, 1905.
- (73) V. Grignard *Ann. de Université de Lyon VI* 1-116 1901.
- (74) B. K. Mereshkowski, *J. Russ. Phys. Chem. Soc.* **45**, 1954, 1913.
- (75) L. Henry, *Ber.* **8**, 400, 1875.
- (76) J. v. Braun and W. Schirmacher, *Ber.* **538**, 1923.
- (77) E. Charon, *Ann. chim.* [7] **17**, 265, 1899.
- (78) A. Kirmann, *Compt. rend.* **182**, 1629, 1926.
- (79) R. Breckpot, *Bull. soc. chim. Belg.* **32**, 412, 1923.
- (80) M. Mugdan, *Ann.* **298**, 131, 1897.
- (81) V. Grignard and M. Dubien, *Ann. chim.* [10] **2**, 282, 1924.
- (82) M. Kohn and J. Graconi, *Monatsh.* **28**, 476, 1907.
- (83) S. P. Mulliken, R. L. Wakeman and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
- (84) E. Bjelouss, *Ber.* **43**, 2332, 1910.
- (85) S. Reformatski, *J. prakt. Chem.* [2] **30**, 224, 1884.
- (86) W. Krestinski and K. Kriworotko, *J. Russ. Phys. Chem. Soc.* **45**, 946, 1913.
- (87) S. A. Przibytek, *Ber.* **20**, 3240, 1887.
- (88) C. Harries and H. Türk, *Ann.* **343**, 365, 1905.
- (89) R. Lespieau and P. Heitzmann, *Compt. rend.* **200**, 1077, 1935.
- (90) A. D. McCallum and G. S. Whitby, *Trans. Roy. Soc. Can.* **22**, 39, 1928.
- (91) A. Mailhé, *Bull. soc. chim.* [4] **37**, 305, 1925.
- (92) S. Lebedev, *J. Russ. Phys. Chem. Soc.* **45**, 1322, 1913.
- (93) S. A. Przibytek, *J. Russ. Phys. Chem. Soc.* **20**, 507, 1888.
- (94) A. L. Faworski, *J. prakt. Chem.* [2] **44**, 228, 1891.
- (95) Pogorzelski, *J. Russ. Phys. Chem. Soc.* **30**, 977, 1899.
- (96) C. Prévost, *Compt. rend.* **184**, 1460, 1927.
- (97) V. Grignard and A. Vesterman, *Bull. soc. chim.* [4] **37**, 425, 1925.
- (98) F. Tiemann and H. Ligges, *Ber.* **33**, 565, 1900.
- (99) F. Tiemann and F. W. Semmler, *Ber.* **26**, 2708, 1893.
- (100) C. Harries and R. Weil, *Ber.* **37**, 846, 1904.
- (101) O. Wallach, *Ann.* **408**, 185, 1915.
- (103) M. Pastureau and Mlle. Zamenof, *Bull. soc. chim.* **39**, 1430, 1926.
- (104) R. Escourrou, *Bull. soc. chim.* **39**, 1249, 1926.
- (105) H. Fournier, *Bull. soc. chim.* [3] **13**, 884, 1895.
- (106) J. v. Braun, H. Deutsch, and A. Schmatlock, *Ber.* **45**, 1255, 1912.
- (107) C. Prévost and G. Richard, *Bull. soc. chim.* **49**, 1368, 1931.
- (108) A. L. Ward and W. H. Fulwider, *J. Am. Chem. Soc.* **56**, 1641, 1934.
- (109) Schimmel and Co., *Chem. Zentr.* **1912 I**, 245.

- (110) E. Chablay, *Ann. chim.* [9] **8**, 194, 1917.
(111) M. D. Forster and D. Cardwell, *J. Chem. Soc.* **103**, 1343, 1913.
(112) C. J. Enklaar, *Rec. trav. chim.* **26**, 164, 1907.
(113) F. W. Semmler, *Ber.* **34**, 3126, 1901.
(114) M. Tiffeneau, *Compt. rend.* **146**, 1154, 1908.
(115) C. J. Enklaar, *Rec. trav. chim.* **27**, 422, 1908.
(116) W. Krestinsky, *J. Russ. Phys. Chem. Soc.* **46**, 904, 1914.
(117) M. Bouvet, *Bull. soc. chim.* [4] **17**, 205, 1915.
(118) F. W. Semmler, *Ber.* **27**, 2520, 1894.
(119) A. Wassilieff, *J. Russ. Phys. Chem. Soc.* **30**, 993, 1899.
(120) S. Reformatski, *J. prakt. Chem.* [2] **27**, 389, 1883.
(121) S. Reformatski, E. Grischkewitsch-Trochimowski and A. Semezow, *Ber.* **44**, 1885-6, 1911.
(122) V. J. Harding, G. M. Walsh, and C. Weizmann, *J. Chem. Soc.* **99**, 450, 1911.
(123) H. Rupe, *Ann.* **402**, 149, 1913.
(124) A. Kirrmann and G. Grard, *Compt. rend.* **190**, 876, 1930.
(125) H. Rupe and L. Silberstrom, *Ann.* **414**, 103, 1918.
(126) T. Midgley, Jr. and A. L. Henne, *J. Am. Chem. Soc.* **52**, 2075, 1930.
(127) A. E. Paworski and I. N. Nazarov, *Compt. rend.* **196**, 1229, 1933.
(128) E. Kisslowskaja, *J. Russ. Phys. Chem. Soc.* **45**, 1976, 1913.
(129) V. N. Ipatieff and Grawe, *J. Russ. Phys. Chem. Soc.* **33**, 18, 1901.
(130) J. Petersen, *Zeit. Elektrochem.* **18**, 713, 1912.
(131) V. Vesely and L. K. Chudoz'lov, *Collection Czechoslov. Chem. Commun.* **2**, 95, 1930.
(132) N. Demjanow and M. Dojarenko, *Ber.* **55**, 2718, 1922.
(133) S. Lebedev and A. Jakubtschik, *J. Russ. Phys. Chem. Soc.* **60**, 793, 1928.
(134) J. F. Norris and J. M. Joubert, *J. Am. Chem. Soc.* **49**, 873, 1927.
(135) G. Merling, *Ann.* **264**, 310, 1891.
(136) J. F. Bijkmann, *Ber.* **25**, 3072, 1892.
(137) W. F. Paragher, W. A. Gruse and F. H. Garner, *Ind. Eng. Chem.* **1044**, 1921.
(138) R. Willstätter, E. W. Mayer, and E. Hüni, *Ann.* **378**, 109, 1911.
(139) R. Willstätter and F. Hocheder, *Ann.* **354**, 205, 1907.
(140) Asahina et al. *Acta Phyto chim. (Japan)* **1**, 67-89, 1923.
(141) K. N. Campbell, *J. Am. Chem. Soc.* **59**, 1980, 1937.
(142) N. Bekkedahl, L. A. Wood, and M. Wojciechowski, *J. Research Nat. Bur. Standards* **17**, 883, 1936.
(143) M. Bouis, *Compt. rend.* **184**, 1563-5, 1927.
(144) R. Ya Levina, D. A. Petrov, and D. M. Trakhtenberg, *J. Gen. Chem. (U. S. S. R.)* **6**, 1496, 1936.
(145) J. Strating and H. J. Backer, *Rec. trav. chim.* **55**, 903, 1936.
(146) A. v. Grosse, *J. Am. Chem. Soc.* **59**, 2739, 1937.
(147) M. V. Dovers and C. J. Helmers, *Ind. Eng. Chem.* **27**, 455, 1935.
(148) S. Landa and A. Kejvan, *Collection Czechoslov. Chem. Commun.* **3**, 367, 1931.
(149) N. van Keersbilck, *Bull. soc. chim. Belg.* **38**, 205, 1929.
(150) B. A. Shoemaker and C. E. Boord, *J. Am. Chem. Soc.* **53**, 1505, 1931.
(151) H. J. Backer and J. Strating, *Rec. trav. chim.* [4] **53**, 525, 1934.
(152) H. van Risseghem, *Bull. soc. chim. Belg.* **44**, 593, 1935.
(153) M. Pastureau and Mlle. Zamenhof, *Bull. soc. chim.* **39**, 1430, 1926.
(154) J. v. Braun and E. Anton, *Ber.* **64**, 2865, 1931.
(155) J. v. Braun and W. Keller, *Ber.* **64**, 2617, 1931.
(156) L. Ruzicka, M. Stall, W. Scherrer, H. Schinz, and C. F. Seidel, *Helv. chim. Acta* **15**, 59, 1932.
(157) G. S. Whitby and W. Gallay, *Can. J. Research* **6**, 281, 1932.
(158) W. L. Evers and H. S. Rothrock, *J. Am. Chem. Soc.* **55**, 1136, 1933.
(159) W. H. Carothers and G. J. Berchet, *J. Am. Chem. Soc.* **55**, 2813, 1933.

- (162) S. Landa and M. Habada, Collection Czechoslov. Chem. Commun. **8**, 473, 1936.
- (163) W. Longinow and E. Margoliss, Bull. soc. chim. [4] **45**, 156, 1929.
- (164) C. Mannich, K. Handke, and K. Roth, Ber. **69B** 2112, 1936.
- (165) W. Longinow and R. Khasanorva, Bull. soc. chim. [4] **51**, 636, 1932.
- (166) B. A. Arbusow, J. Gen. Chem. (U. S. S. R.) **3**, 28, 1933.
- (167) I. M. Heilbron, T. P. Hilditch, and E. D. Kamm, J. Chem. Soc. **1926**, 3131.
- (168) E. H. Farmer and F. L. Warren, J. Chem. Soc. **1931**, 3221.
- (169) R. Lespieau and P. Heitzmann, Bull. soc. chim. [5] **3**, 273, 1936.
- (170) H. Marcelet, Compt. rend. **202**, 867, 1936.
- (171) A. v. Grosse and C. Linn, Unpublished data.
- (172) A. v. Grosse and R. Wackher, Unpublished data.
- (173) G. B. Kistiakowsky, J. R. Ruhoff, H. A. Smith, and W. E. Vaughan, J. Am. Chem. Soc. **58**, 146, 1936.
- (174) R. Livingston and G. B. Heisig, J. Am. Chem. Soc. **52**, 2409, 1930.
- (175) M. A. Dolliver, T. L. Gresham, G. B. Kistiakowsky, and W. E. Vaughan, J. Am. Chem. Soc. **59**, 831, 1937.
- (176) W. H. Perkin, J. Chem. Soc. **67**, 255, 1895. 831, 1937.
- (178) O. C. Slotterbeck and C. E. Boord, Abstracts of Doctors' Dissertations, Ohio State University, No. 20, 1936.
- (179) A. Gubjeava and T. Dauguleva, Caoutchouc and Rubber (U. S. S. R.), **1937**, No. 1, 53.
- (180) H. J. Backer and J. Strating, Rec. trav. chim. **56**, 1069, 1937.
- (181) C. E. Boord and C. E. Frank, Unpublished Data, 1938.
- (182) J. M. Slobodin, Chem. J. Ser. A. J. Allg. Chem. [russ. chim. Shurnal, Sser. A. Shurnal Abschtschie Chimie] **6**, 1806, 1936.
- (183) F. Fichter and T. Holbro, Helv. Chim. Acta **20**, 333-45, 1937.
- (184) O. Schales, Ber. **70**, 116-21, 1937.
- (185) R. J. Lewina, Chimitschiski Shurnal Sser. A. Shurnal Obschtschei Chimii **6**, 1092, 1936.
- (186) W. N. Levow, J. Gen. Chem. (U. S. S. R.) **7**, 928, 1936.
- (187) E. I. du Pont de Nemours and Co., W. H. Carothers, A. P. 2,072,867 12/26/31.
- (188) P. D. Bartlett, M. Kuna, and P. A. Levene, J. Biol. Chem., **118**, 513, 1937.
- (189) R. G. R. Bacon and E. H. Farmer, J. Chem. Soc. **1937**, 1065.
- (190) E. P. Carr, Unpublished Data.
- (911) R. Wakeman, Thesis—Massachusetts Institute of Tech. 1930.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexatriene-1,3,4 $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}$		113 to 114 ¹	0.764 ¹	1.50786 @ n _a ^{19.8} 1.53743 @ n _β ^{19.8}	
Hexatriene-1,3,5 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}=\text{C}$		77 to 78.5 ² @ 764.4mm 77.5 ³	0.7175 ²	1.4577 ² 1.4884 ³ @ 13.5°	
C₇H₁₀ Heptatriene-1,3,5 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}$	-14.5 ⁴				
Heptatriene-1,3,6 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}$		115 ⁵			

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octatriene-2,4,6 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $C-C=C-C=C-C=C$	52.5 °	147 to 148 ° @ 764mm 125 to 130 ° 43 @ 10mm °	0.7961 ° @ 23° 0.8394 ° @ 18°	1.5131 ° @ 27° 1.45193 ° @ 18°	
2-Methyl- heptatriene-2,4,6 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $C-C=C-C=C-C=C$ C		99 to 101 ° @ 215mm 42 to 44 ° @ 14mm			
3-Methyl- heptatriene-2,4,6 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $C-C=C-C=C-C=C$ C	-90 to -85 °	82 to 83.5 ° @ 96mm	0.7938 ° @ 10.8°	1.53301 ° @ 15.3°	
2-Methyl- heptatriene-2,5,6 $C-C=C-C-C=C=C$ C		77 to 82 ° @ 80mm			

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,5-Dimethyl- hexatriene-1,3,5 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		124 to 126 ¹⁰	0.778 ¹⁰ @ 15°	1.483 ¹⁰ @ 15°	
C₈H₁₄ 4-Methyl- octatriene-3,5,7 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \\ \text{C} \end{array}$	-70 °	162 to 167 ° 85 to 87 ° @ 36mm	0.802 ° @ 19.3°	1.519 ° @ n _D ²² 1.548 ° @ n _D ²²	
2,6-Dimethyl- heptatriene-1,3,5 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$	-23 to -22 ¹¹	53 to 54 ¹¹ @ 10mm	0.7951 ¹¹	1.5276 ¹²	

Name and Carbon Skeleton	M. P., °C	B. P., °C. (@ 760mm)	D ₄ ²⁰	n _D ²⁰	Additional Data
7-Methyl- nonatriene-1,3,7 Cryptotaenene (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C} \\ \\ \text{C} \end{array}$		67 to 68 ¹³ @ 15mm	0.8128 ¹³ @ 25°	1.47476 ¹³ @ 25°	[α] _D ^{19.8} = +2.66°
2,6-Dimethyl- octatriene-1,5,7 Ocimene (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}=\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		81 @ 30mm ¹⁴ 72 to 74 ¹⁵ @ 19mm	0.7989 ¹⁵ @ 30° 0.8031 ¹⁴ @ 15°	1.48436 ¹⁵ @ 19° 1.4857 ¹⁴ @ 18°	
2,6-Dimethyl- octatriene-2,4,6 Alloocimene (Mixtures of <i>cis</i> , <i>trans</i> isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$		193 ⁷ @ 739mm 81 to 83 ¹⁵ @ 13mm 81 @ 12mm ¹⁴ 79 to 80 ⁷ @ 12mm	0.8172 ¹⁴ @ 16°	1.5420 ¹⁵ @ 18° 1.5296 ¹⁴ @ 16°	

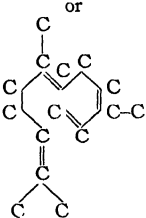
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6-Dimethyl- octatriene-2,5,7 (High boiling) $\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}=\text{C}$ C C		188 ¹⁷ @ 750mm 95 @ 24mm ¹⁷ 81 @ 12mm ¹⁷	0.899 ¹⁷ @ 21.5° 0.8133 ¹⁷ @ 15°	1.5447 ¹⁷ @ 21°	
2,6-Dimethyl- octatriene-2,5,7 (Low boiling) $\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}=\text{C}$ C C		176 to 178 ¹⁹ (Decom- position) 81 @ 30mm ¹⁸ 73 to 74 ¹⁹ @ 21mm	0.799 ¹⁴ @ 21°	1.4861 ¹⁹ 1.4857 ¹⁸ @ 18°	
2-Methyl-6-Methylene- octadiene-2,7 (Myrcene) $\text{C}-\text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}$ C C		171 166 to 168 ²⁰ @ 774mm 171 to 172 ²⁴ @ 760mm 70 @ 25mm ²² 67 to 68 ²⁴ @ 20mm 62 to 63 ²⁵ @ 17mm 56 to 58 ²⁶ @ 15mm 56 to 57 ²³ @ 12mm 51 to 51.5 ²¹ @ 8.5mm	0.797 0.799 ²⁴ @ 21° 0.7937 ²⁶ 0.7982 ²³ 0.8028 ²² @ 15.8° 0.8047 ²¹ @ 15° 0.8046 ²⁰ @ 15° 0.8023 ²⁴ @ 15° 0.8013 ¹⁷ @ 15°	1.472 1.4722 ²¹ 1.4716 ²⁶ 1.47065 ²³ 1.4645 ²⁰ 1.4700 ¹⁷ @ 19° 1.46684 ²² @ 15.8° 1.47 ²³ @ 15°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6-Dimethyl-4-Methyleneheptadiene-2,5 $\begin{array}{ccccccc} \text{C} & -\text{C} & =\text{C} & -\text{C} & -\text{C} & =\text{C} & -\text{C} \\ & & & & & & \\ & \text{C} & & \text{C} & & & \text{C} \end{array}$		55 to 57 ²⁶ @ 14mm			
C₁₁H₁₈ 5-Ethyl-nonatriene-1,4,8 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & =\text{C} & -\text{C} & -\text{C} & =\text{C} & -\text{C} & -\text{C} & -\text{C} & =\text{C} \\ & & & & & & & & \\ & & & & & \text{C} & -\text{C} & & \end{array}$		92 to 93 ²⁷ @ 63mm 74 @ 41mm ²⁷	0.8000 ²⁷ @ 12.8°	1.45941 ²⁷ @ 14.8°	
2,6-Dimethylnonatriene-2,6,8 (Mixtures of geometrical isomers) $\begin{array}{ccccccc} \text{C} & -\text{C} & =\text{C} & -\text{C} & -\text{C} & =\text{C} & -\text{C} & -\text{C} & =\text{C} \\ & & & & & & & & \\ & \text{C} & & & & & \text{C} & & \end{array}$		195 to 197 ²⁸ @ 750mm 76 to 78 ²⁸ @ 8mm	0.814 ²⁸ @ 11.3° 0.8215 ²⁸ @ 0°	1.48686 ²⁸ @ 11.3°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6-Dimethyl- nonatriene-1 or 2,5,8 (Mixtures of geometrical isomers are possible in either case) $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \qquad \\ \text{C} \qquad \qquad \qquad \text{C} \end{array}$ or $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C}-\text{C}-\text{C}=\text{C} \\ \qquad \qquad \qquad \\ \text{C} \qquad \qquad \qquad \text{C} \end{array}$		81 to 82 ²⁷	0.8162 ²⁷ @ 18.8°	1.47388 ²⁷ @ 17.9°	
C₁₃H₂₀ Dodecatriene		90 to 95 ²⁰ @ 15mm			
C₁₃H₂₂ 2,6-Dimethyl- undecatriene-1 or 2,8,10		94 to 95 ³¹ @ 8mm	0.8005 ³¹	1.47261 ³¹	[α] _D ²⁰ = -10.12° ³¹
2,6-Dimethyl- undecatriene- 1 or 2, 5 or 6, 8		224 to 225 ³⁰ @ 751mm	0.8151 ³⁰ D ₀ ²⁰	1.4725 ³⁰	

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Dihydroaplatoxen		154 to 157 ³²	0.8177 ³² @ 21°	1.47105 ³²	
C₂₃H₄₂ Oleatricosatriene		205 to 210 ³⁴	0.8710 ³⁴ @ 18°	1.4910 ³⁴ @ 16°	
C₃₀H₅₈ Hexahydrosqualene		232 to 234 ³⁶ @ 3mm	0.8334 ³⁶ <i>D</i> ₂₀ ²⁰	1.4710 ³⁶	

- (1) K. v. Auwers, J. prakt. Chem. **105**, 361, 1923.
- (2) E. H. Farmer, B. D. Larvia, T. M. Switz, and T. J. Thorpe, J. Chem. Soc. **1927**, 2937.
- (3) P. v. Romburgh and van Dorsen, J. Chem. Soc. **90I**, 130, 1906.
- (4) C. J. Enklaar, Chem. Weekblad **10**, 60; 187, 1913.
- (5) M. Saizew, Ann. **185**, 144, 1877.
- (6) R. Lespieau, Guillemont and E. Urion, Kolloid Zeit. **63**, 84, 1933.
- (7) F. G. Fischer and K. Löwenberg, Ber. **66B**, 669, 1933.
- (8) V. Grignard, Bull. soc. chim. [3] **21**, 574, 1899.
- (9) C. J. Enklaar, Rec. trav. chim. **36**, 249, 1917.
- (10) M. Bourguet and R. Rombauid, Bull. soc. chim. [4] **47**, 173, 1930.
- (11) W. H. Carothers and D. D. Coffman, J. Am. Chem. Soc. **54**, 4071, 1932.
- (12) Hirano, J. Soc. Chem. Ind. Japan, **29**, 48, 1926.
- (13) C. J. Enklaar, Rec. trav. chim. **26**, 157, 1907; **27**, 422, 1908; **36**, 215, 1916; **45**, 337, 1926.
- (14) Asahina, Ishio, Kashiwagi, et al, Acta Phyto-chim. (Japan) **I**, 67, 1923.
- (15) B. Arbusow, Ber. **68**, 1435, 1935.
- (16) C. J. Enklaar, Rec. trav. chim. **26**, 166, 1907.
- (17) C. J. Enklaar, Rec. trav. chim. **26**, 162, 1907.
- (18) P. v. Romburgh, Koninkl. akad. v. Wetenschappen te Amsterdam, 1900, 445.
- (19) A. C. Chapman, J. Chem. Soc. **83**, 506, 1903.
- (20) B. Arbuzow and W. F. Abramov, Ber. **67B**, 1942, 1934.
- (21) J. F. Eijkmann, Chem. Weekblad. **3**, 653; 685; 701, 1906; **4**, 41, 1907.
- (22) S. W. Lebedev, J. Russ. Phys. Chem. Soc. **45**, 1324, 1913.
- (23) F. W. Semmler, Ber. **34**, 3126, 1901.
- (24) F. W. Semmler and Mayer, Ber. **44**, 2009, 1911.
- (25) V. Fellenberg, Ber. **37**, 3580, 1904.
- (26) K. v. Auwers and W. Moosbrugger, Ann. **387**, 191, 1912.
- (27) V. Grignard, Ann. chim. [7] **24**, 479, 1901.
- (28) K. Ziegler, L. Jacob, H. Wollthan, and A. Wenz, Ann. **511**, 64, 1934.
- (29) N. Kishner, J. Russ. Phys. Chem. Soc. **43**, 1400, 1911.
- (30) H. Rupe, Ann. **402**, 173, 1913.
- (31) F. W. Semmler and J. Feldstein, Ber. **47**, 2691, 1914.
- (32) C. J. Enklaar, Chem. Weekblad **9**, 68, 1912.
- (33) H. Marcelet, Compt. rend. **202**, 867, 1936.
- (34) I. M. Heilbron, T. P. Hilditch, and E. D. Kamm, J. Chem. Soc. **1926**, 3131.
- (35) C. Mannich, K. Handke, and K. Roth, Ber. **69**, 2112, 1936.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_{20}^{20}	n_D^{20}	Additional Data
Decatetraene-2,4,6,8 (Mixtures of geometrical isomers) $C-C=C-C=C-C=C-C$	125 ¹				
$C_{15}H_{24}$ 3,7,11-Trimethyldodecatetraene-1,3,6,10 α Farnesene (Mixtures of geometrical isomers) $C-C-C=(C)_8-C-(C)_8-C-C$ $\begin{array}{c} C \\ \\ C-C-C \\ \quad \quad \\ C \quad C \quad C \end{array}$ or 		128 to 130 ² @ 12mm 129 to 132 ³ @ 12mm	0.877 ³ @ 18° 0.8385 ² @ 18°	1.49951 ³ 1.4965 ² @ 18°	
$C_{17}H_{28}$ Heptadecatetraene		153 to 155 ⁴ @ 11mm	0.831 ⁴ @ 21°	1.483 ⁴	$[\alpha]_D = 0^\circ$ ⁴

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
2,6,10,15,19,23-Hexamethyltetracosahexaene-2,6,10,14,18,22 Squalene $ \begin{array}{c} \text{C}-\text{C}(\text{C})=\text{C}-\text{C}(\text{C})=\text{C}(\text{C})=\text{C}(\text{C})=\text{C}(\text{C})=\text{C}(\text{C})=\text{C}-\text{C} \\ \quad \quad \quad \quad \quad \quad \\ \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \end{array} $		284 to 285 ¹⁴ @ 25mm 262 to 264 ¹² @ 10mm 260 to 262 ¹³ @ 9mm 252 to 254 ¹² @ 5mm	0.860 @ 15° 0.8598 ¹⁴ @ 15° 0.8587 ¹³ @ 15° 0.8603 ¹¹ @ 15°	1.4965 ^{12,13} 1.4963 ¹⁴ @ 15°	Heilbron proved spinacene and squalene are identical ¹⁶

- (1) R. Kuhn, Z. angew. Chem. 50, No. 34, 703, 1937.
- (2) L. Ruzicka, Helv. Chim. Acta. 6, 483, 1923.
- (3) C. Harries and R. Haarmann, Ber. 46, 1741, 1913.
- (4) F. W. Semmler and J. Feldstein, Ber. 47, 2690, 1914.
- (5) H. Marcellet, Compt. rend. 202, 867-4, 1936.
- (7) I. M. Heilbron, T. P. Hilditch and E. D. Kamm, J. Chem. Soc. 1926, 3131-6.
- (8) W. Schlenk and E. Bergman, Ann. 463, 1-97, 1928.
- (9) A. I. Zacharova, Sci. Rept. Leningrad State Univ. 1936, 2, No. 2, 162-195.
- (10) A. C. Chapman, J. Chem. Soc. 111, 58, 1917.
- (11) A. C. Chapman, J. Chem. Soc. 113, 458, 1918.
- (12) M. Tsujimoto, Ind. Eng. Chem. 8, 889, 1916; 9, 1098, 1917.
- (13) I. M. Heilbron, E. D. Kamm, and N. Owens, J. Chem. Soc. 1926, 1630-44.
- (14) B. Kubota, J. Tokyo Chem. Soc. 39, 879-907, 1918.
- (15) P. Karrer and A. Helfenstein, Helv. Chim. Acta. 14, 78, 1931.
- (16) I. M. Heilbron, Proc. 5th Pacific Sci. Congr. 5, 3683-92, 1934.

IV. PHYSICAL CONSTANTS OF ALKYNES OR ACETYLENES

1. Alkynes or Acetylenes
2. Alkadiynes or Diacetylenes
3. Mixed Alkene-Alkynes of the Aliphatic Series

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Ethyne	-81.8		0.6179 ² @ -81.8°		$\frac{dD}{dt} = -0.001563$ (-55 to -85) ¹²
Acetylene	-81 ²	-82.2 ⁴	0.5185 ⁴		
	-81.0 ²	-82.4 ⁴	@		
C≡C	-81.5 ⁷	-83.6 ^{1,4,12}	-23.75°		
	-81.8 ^{1,8,12}	-83.6 ¹	0.5763 ¹²		
		(Sublimation point)	@ -55.2°		
		-84.0 ⁹	0.5779 ¹²		
		-85 ²	@ -56°		
			0.5875 ¹²		
			@ -62.5°		
			0.5935 ¹²		
			@		
			-66.35°		
			0.6009 ¹²		
			@		
			-70.85°		
			0.6093 ¹²		
			@		
			-76.15°		
			0.6136 ¹²		
			@		
			-79.15°		
			0.6154 ¹²		
			@ -80.3°		
			0.6181 ¹²		
			@ -81.8°		
			0.6208 ²		
			@ -83.6°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D_4^{20}	n_D^{20}	Additional Data
Propyne	-101.5	-23.3	0.6714₀	1.3746	$\frac{dD}{dt} = -0.001165^{13}$ (0° to -60°)
			@ -23.3°	@ -23.3°	$\frac{dn}{dt} = -0.007006$ (-23° to -40°)
C≡C-C	-101.5 ²	-23 ⁸⁴		1.3746 ⁷⁵	
	-104.7 ¹²	-23.3 ²		@	
	-110 ¹³	-23.5 ¹³	0.6447 ⁸⁴	-23.3°	
		-27.5 ¹²	@-0.5°	1.3863 ⁷⁵	
			0.6582 ⁸⁴	@-40°	
			@-12.7°		
			0.6600 ¹²		
			@-12.9°		
			0.6617 ⁸⁴		
			@-14.4°		
			0.6652 ⁸⁴		
			@-17.5°		
			0.6710 ⁸⁴		
			@-22.7°		
			0.6698 ²		
			@-23.3°		
			0.6759 ¹²		
			@-26.5°		
			0.6827 ⁸⁴		
			@-32.5°		
			0.6873 ⁸⁴		
			@-36.8°		
			0.6911 ⁸⁴		
			@-40.9°		
			0.6936 ⁸⁴		
			@-42.4°		
			0.6992 ⁸⁴		
			@-47.4°		
			0.7039 ⁸⁴		
			@-51.9°		
			0.7065 ⁸⁴		
			@-53.1°		
			0.7128 ¹²		
			@-55.3°		
			0.7109 ⁸⁴		
			@-57.0°		

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Butyne-1	-122.5	8.6	0.6682 @ 8.6°		^{15,16,17} are wrong values and were not averaged with the rest.
C≡C-C-C	-122.5 ² -130 ¹⁶ -137 ¹⁴	7.9 ⁸⁵ 8.5 ¹⁴ 8.6 ² 14 to 14.5 ¹⁷ 18 ¹⁵ 18.5 ¹⁶	0.6682 ² @ 8.6° 0.668 ¹⁶ @ 0°		
Butyne-2			0.6937	1.3939	$\frac{dD}{dt} = -0.001044$ (0° to 30°)
C-C≡C-C	-24.0 ² -32.5 ¹⁰	27.1 ² 27.2 ¹⁹ 27.2 to 27.6 ⁸⁷ 28 ^{20,21} 27 to 28 ¹⁸ @ 734.8mm	0.6873 ² @ 27.1° 0.688 ¹⁹ @ 25° 0.697 ²⁰ @ 16° 0.715 ¹⁹ @ 0°	1.3893 ¹⁹ @ 25° 1.3975 ²⁰ @ 16°	$\frac{dn}{dt} = -0.0009111$ (16° to 25°)
C₅H₈					
Pentyne-1	-98	39.7	0.695 ₆	1.386 ₆	$\frac{dD}{dt} = -0.00118/°C.$ (0° to 40°)
C≡C-C-C-C	-95 ¹⁴ -98.0 ²	39.3 ⁸⁵ 39.7 ² 39.5 to 40 ²² 40 ¹⁴ 48 to 49 ²³ 39.5 to 40.5 ⁸⁸	0.6714 ² @ 39.7° 0.6909 ⁸⁸ @ 25° 0.694 ²² @ 17° 0.7221 ¹⁴ @ 0°	1.38270 ⁸⁵ @ 25° 1.388 ²² @ 17°	$\frac{dn}{dt} = -0.000663/°C.$ (15° to 25°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentyne-2					
C-C≡C-C-C	-101 ²⁴	50 to 55 ²² 55.5 ²⁴ 55.5 to 56 ²⁵	0.7127 ²⁴ @ 17.2°	1.4045 ²⁴ @ 17.2°	
3-Methylbutyne-1		28	0.665		$\frac{dD}{dt} = -0.00102/^\circ\text{C.}$ (0° to 20°)
$\begin{array}{c} \text{C}\equiv\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		27.5 to 28.5 ⁷⁴ 28 to 29 ²⁶ @ 751mm	0.666 ⁷⁴ @ 19° 0.6854 ²⁶ @ 0°	1.3785 ⁷⁴ @ 19°	
C₆H₁₀ Hexyne-1			0.7195,	1.3990,	$\frac{dD}{dt} = -0.0009719/^\circ\text{C.}$ (15° to 45°)
C≡C-C-C-C-C	-124 ³¹	71.5 to 72 ⁸³ @ 765mm 68 to 70 ²⁸ 70 to 72 ⁸³ 70.5 to 72 ²⁹ 71.0 ⁸⁵ 71 to 72 ^{27,30} 71.35 71.4 ³¹ 35 ⁷⁷ @ 200mm 4.7 ⁷⁸ @ 50mm	0.69521 ⁷⁸ @ 45° 0.7146 ⁸⁶ @ 25° 0.721 ²⁷ 0.71976 ⁷⁸ 0.720 ³⁰ @ 17° 0.7193 ³¹ @ 15° 0.736 ³⁸ @ 0°	1.3936 ⁷⁶ @ 30° 1.39621 ⁸⁵ @ 25° 1.3992 ⁷⁶ 1.402 ^{27,30} @ 19° 1.4095 ⁷⁶ @ 0° 1.4228 ⁷⁶ @ -25°	$\frac{dn}{dt} = -0.0005286/^\circ\text{C.}$ (-25° to +30°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexyne-2			0.7305		$\frac{dD}{dt} = -0.000946/^{\circ}\text{C.}$ (0° to 15°)
C-C≡C-C-C-C	-92 ³¹	83 to 84 ²⁸ 83.7 to 84 ³¹ 84 to 85 ²⁷	0.7352 ³¹ @ 15° 0.7376 ²² @ 13° 0.7494 ²² @ 0°	1.4140 ³¹ n _{Hα} ³¹	
Hexyne-3			0.7255,	1.4121,	$\frac{dD}{dt} = -0.0009308/^{\circ}\text{C.}$ (20° to 45°)
C-C-C≡C-C-C	-51 ³⁴	79 to 80 ³⁴ @ 770mm 82.0 ²⁶ 81.9 ⁷⁵ 81.0 to 81.5 ⁷⁸ 81.5 ⁶⁵ @ 744mm 74.5 ⁶⁵ @ 600mm 50 ⁶⁵ @ 245mm 50.0 ⁷⁷ @ 245mm 11.1 ⁷⁶ @ 50mm	0.70227 ⁷⁸ @ 45° 0.7263 ^{65,76} @ 25° 0.72569 ⁷⁸ 0.724 ³⁴	1.4092 ⁷⁵ @ 25° 1.4112 ^{65,76} @ 25° 1.4115 ³⁴ 1.4119 ⁷⁵ 1.4223 ⁷⁵ @ 0° 1.4331 ⁷⁵ @ -20° 1.4356 ⁷⁵ @ -25° 1.4385 ⁷⁵ @ -30°	$\frac{dn}{dt} = -0.0005237/^{\circ}\text{C.}$ (-30° to +25°)
3-Methylpentyne-1					
$\begin{array}{c} \text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	65 to 70 ⁸⁶	77 ⁸⁶			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
4-Methylpentyne-1 $\begin{array}{c} \text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		61.5 to 62 ³⁶	0.7244 ³⁶ @ 0°		
4-Methylpentyne-2 $\begin{array}{c} \text{C}-\text{C}\equiv\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		72			
		71 to 72.5 ³⁷ 72 to 72.5 ⁷⁴	0.7321 ³⁷ 0.716 ⁷⁴ @ 19°	1.4078 ⁷⁴ @ 19°	
3,3-Dimethylbutyne-1 $\begin{array}{c} \text{C} \\ \\ \text{C}\equiv\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$	-81.2 ⁸⁰	38	0.6686 ₆	1.37439	$\frac{dD}{dt} = -0.001070/^{\circ}\text{C.}$ (-0° to 20°)
		37.5 to 38.5 ⁷³ 37.6 to 37.8 ⁶⁹ 37.8 ³⁶ 38 to 39 ²⁵	0.6683 ⁸⁰ 0.6682 ³⁶ 0.6695 ⁷³ 0.6737 ⁸⁰ @ 15° 0.69015 ⁷³ @ 0° 0.6899 ⁸⁰ @ 0°	1.373778 ⁷³ 1.37493 ³⁶ 1.37725 ⁸⁰ @ 15°	$\frac{dn}{dt} = -0.000572/^{\circ}\text{C.}$ (15° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Heptyne-1 <chem>C#C-C-C-C-C-C-C</chem>		99.6	0.7332	1.4083,	$\frac{dD}{dt} = -0.0008739/^{\circ}\text{C.}$ (0° to 45°)
	-81 to	87 ⁴⁰	0.71141 ⁷⁸	1.4057 ⁷⁶	$\frac{dn}{dt} = -0.000504/^{\circ}\text{C.}$ (-25° to +25°)
	-80 ³⁹	87 to 88.5 ³⁴	@ 45°	@ 25°	
		98.0 ⁸⁶	0.7246 ³⁴	1.40553 ⁸⁵	
		99.4 ⁷⁵	@ 25°	@ 25°	
		99 ⁴¹	0.7288 ⁵¹	1.4043 ³⁴	
			@ 25°	@ 25°	
		99 to 100 ³⁹	0.7297 ⁸⁵	1.4023 ⁴⁰	
		99 to 101 ⁸³	@ 25°	@ 22°	
		99.5 to 100 ²²	0.7272 ⁴⁰	1.4088 ⁷⁵	
		99.8 ⁷⁶	@ 22°	1.4086 ³⁹	
		100 ²⁷	0.7470 ⁴⁰	1.40944 ⁴²	
		100.4 to	0.73442 ⁷⁸	@ 19.5°	
		100.8 ⁶⁸	0.7338 ³⁹	1.418 ²⁷	
		98 to 99 ⁴²	0.7326 ⁴²	@ 19°	
		@ 740 to	@ 19.5°	1.41356 ⁴¹	
		760mm	0.750 ²⁷	@ 12.6°	
		107 to 110 ⁴⁰	@ 19°	1.4183 ⁷⁵	
		@ 745mm	0.7545 ⁴⁹	@ 0°	
		43.6 ⁷⁷	@ 15°	1.4309 ⁷⁵	
		@ 100mm	0.7384 ⁴¹	@ -25°	
		26.5 ⁷⁶	@ 12.6°		
		@ 50mm	0.7505 ³⁹		
		26 ⁴⁹	@ 0°		
		@ 10mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Heptyne-2 <chem>C-C#C-C-C-C-C</chem>		111.8 112.0 ⁷⁶ 111.8 ⁷⁵ 111.5 to 113.0 ⁶⁸ 111.5 to 112.5 ⁴³ 111 to 113 ³⁸ @ 750.4mm 107 to 111 ⁸³ @ 750mm 110 to 111 ⁶⁶ @ 747mm 55 ⁷⁷ @ 100mm 39.6 ⁷⁶ @ 50mm	0.748, 0.745 ^{76,83} @ 25° 0.748 ⁴³ @ 21° 0.749 ⁷⁶ 0.748 ⁶⁸ 0.7632 ³⁸ @ 0°	1.4237 1.4220 ^{76,83} @ 25° 1.4208 ⁴³ @ 21° 1.4239 ⁶⁶ 1.4245 ⁷⁶	$\frac{dD}{dt} = -0.000729/^\circ\text{C.}$ (0° to 25°) $\frac{dn}{dt} = -0.000602/^\circ\text{C.}$ (20° to 25°)
Heptyne-3 <chem>C-C-C#C-C-C-C</chem>		106 105 to 106 ^{44,38} 106 ⁴⁴ 106 to 107 ²⁷ 105.3 to 106.7 ⁶⁸	0.7337 ³⁴ @ 25° 0.765 ²⁷ @ 19° 0.760 ³⁸ @ 0°	1.422 1.415 ³⁴ @ 25° 1.423 ²⁷ @ 19°	$\frac{dn}{dt} = -0.0013/^\circ\text{C. (?)}$ (19° to 25°)
5-Methylhexyne-1 <chem>C#C-C-C-C-C</chem> C		87 87 ⁴⁸ 92 to 93 ⁴⁶	0.7339 0.7272 ⁴⁸ @ 22° 0.7365 ⁴⁶ @ 17° 0.7515 ⁴⁶ @ 0°	1.4023 @ 22° 1.4023 ⁴⁸ @ 22° 1.4075 ⁴⁶ @ 17°	$\frac{dD}{dt} = -0.000882/^\circ\text{C.}$ (0° to 20°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (at 760mm)	D_4^{20}	n_D^{20}	Additional Data
4,4-Dimethylpentyne-1 $\begin{array}{c} \text{C} \\ \\ \text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		73 to 75 ⁴⁷	0.7154 ⁴⁷	1.4028 ⁴⁷	
4,4-Dimethylpentyne-2 $\begin{array}{c} \text{C} \\ \\ \text{C}-\text{C}\equiv\text{C}-\text{C}-\text{C} \\ \\ \text{C} \end{array}$		82.9 to 83 ⁶⁰	0.7176 ⁶⁰ 0.7224 ⁶⁰ @ 15°	1.4071 ⁶⁰ @ 20.1°	$\frac{dD}{dt} = -0.00096/^\circ\text{C.}$ ⁶⁰ (15° to 20°)
3-Ethylpentyne-1 $\begin{array}{c} \text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		87 to 88.5 ³⁴	0.7246 ³⁴ @ 25°	1.4043 ³⁴ @ 25°	

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octyne-1 <chem>C#C-C-C-C-C-C-C</chem>		126.0	0.7469₆	1.4169	$\frac{dD}{dt} = -0.001011$ (1 - .00351t)/°C. (0° to 703°)
	-70 ⁴⁹	124 to	0.7040 ⁵¹	1.4140 ⁷⁶	
	-79 ³⁹	125 ^{39,41}	@ 70°	@ 25°	
	-80 ³⁹	125.0 ⁷⁶	0.7213 ⁵¹	1.4172 ³⁹	$\frac{dn}{dt} = -0.000566/°C.$ (12° to 25°)
		126 ²⁷	@ 50°	1.426 ²⁷	
		126.0 ⁷⁶	0.743 ⁷⁶	@ 17°	
		127 to 127.5 ²²	@ 25°	1.42075 ⁴¹	
		127.6 to	0.7414 ⁵¹	@ 12.5°	
		128.0 ⁴⁸	@ 25°		
		131 to 132 ³⁸	0.7470 ³⁹		
		@ 762.6mm	0.762 ²⁷		
		130.6 to 131.2	@ 17°		
		@ 756mm ⁶⁰	0.7680 ⁴⁹		
		130 to 132 ⁴⁹	@ 15°		
		@ 745mm	0.7530 ⁴¹		
		85.0 ⁷⁷	@ 12.5°		
		@ 200mm	0.7701 ³⁸		
		50.8 ⁷⁶	@ 0°		
		@ 50mm	0.7667 ³⁹		
			@ 0°		
Octyne-2 <chem>C-C#C-C-C-C-C-C</chem>		136	0.761 @ 25°	1.4285 @ 25°	
		131 to 135 ^{8,4}	0.761 ^{76,83}	1.4285 ^{76,83}	
		133 to 134 ³⁸	@ 25°	@ 25°	
		135.5 to 137 ²⁷			
		137.2 ⁷⁶			
		138.0 to			
		138.4 ⁶⁸			
		77.3 ⁷⁷			
		@ 100mm			
		60.2 ⁷⁶			
		@ 50mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octyne-3 C-C-C≡C-C-C-C		131 131 to 131.5 ²⁷ 132.7 ⁷⁸ 133 ⁷⁸ 127 to 130 ⁸³ @ 750mm 129 to 130 ⁸⁸ @ 747mm 131.8 ⁸⁸ @ 737mm 118.5 ⁸⁸ @ 498mm 86.7 ^{88,77} @ 169mm 56.7 ⁷⁸ @ 50mm	0.7501 ⁸⁸ @ 25° 0.763 ⁸³ @ 25° 0.748 ⁸⁸	1.4261 1.4230 ⁸⁸ @ 25° 1.4273 ⁸³ @ 25° 1.4261 ⁸⁸	$\frac{dn}{dt} = -0.00062/^\circ\text{C.}$ (20° to 25°)
Octyne-4 C-C-C-C≡C-C-C		130.6 131 ⁷⁸ 130.6 ⁷⁸ 130.4 to 130.6 @ 745mm ⁸³ 130 ⁸⁸ @ 744mm 116.7 ⁸⁸ @ 498mm 85.1 ^{88,77} @ 169mm 55 ⁷⁸ @ 50mm	0.7479 0.7474 ⁸⁸ @ 25° 0.7484 ⁸³ @ 25°	1.4225 1.4225 ⁸³ @ 25° 1.4226 ⁸³ @ 25°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Methyl-3-ethyl-pentyne-1 $\begin{array}{c} \text{C} \\ \\ \text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C} \\ \\ \text{C}-\text{C} \end{array}$		98 to 100 ⁵² @ 745mm	0.7360 ⁵²	1.4102 ⁵²	
C₈H₁₆ Nonyne-1 $\text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}$	-65 ⁴⁹	151 149 to 151 ⁵⁴ 151 ²⁷ 160 ⁴⁹ @ 745mm	0.763 0.760 ²⁷ 0.765 ⁵⁴ 0.7799 ⁴⁹ @ 15°	1.425 1.426 ⁵⁴ 1.423 ²⁷	
Nonyne-2 $\text{C}-\text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}$		160 160.0 ⁷⁶ 158 to 159 ⁵⁴ 161 ²⁷ 155 to 156 ⁶⁶ @ 747mm 112.3 ⁷⁷ @ 170mm 65.1 ⁷⁷ @ 25mm	0.768 ²⁷ @ 21° 0.769 ⁶⁶ 0.770 ⁵⁴ @ 18°	1.434 ²⁷ @ 21° 1.4331 ⁶⁶ 1.433 ⁵⁴ @ 18°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Nonyne-3 C-C-C≡C-C-C-C-C		153 150 to 154 ⁸³ 151 to 154 ⁷⁰ 155 to 157 ⁵³ 157 to 160 ⁴⁴ 153 to 155 ⁰⁶ @ 745mm	0.764 0.762 ⁸³ @ 25° 0.763 ⁵³ 0.765 ⁰⁶	1.4299 1.4300 ⁸³ @ 25° 1.4299 ⁰⁶ 1.429 ⁵³	
Nonyne-4 C-C-C-C≡C-C-C-C		155.1 to 156.1 ⁰⁸ 150 to 154 ⁸³ @ 750mm	0.757 ⁸³ @ 25° 0.7716 ⁰⁸ @ 25°	1.4296 ⁸³ @ 25° 1.4330 ⁰⁸ @ 24.9°	
C₁₀H₁₈ Decyne-1 C≡C-(C) _r -C	-36 ⁴⁹ -40 ⁵⁵	181 to 182 ⁴⁹ @ 745mm 74 to 75 ⁵⁴ @ 19mm 69 to 70 ⁴⁹ @ 10mm 59 ⁵⁵ @ 13mm	0.772 ⁵⁴ @ 17° 0.7924 ⁴⁹ @ 15° 0.791 ⁵⁵ @ 0°	1.436 ⁵⁴ @ 17°	
Decyne-3 C-C-C≡C-(C) _r -C		175 to 176 ⁵⁴	0.765 ⁵⁴ @ 21°	1.433 ⁵⁴ @ 21°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Decyne-4 C-C-C-C≡C-(C) ₄ -C		74.75 ⁵⁴ @ 19mm	0.772 ⁵⁴ @ 17°	1.436 ⁵⁴ @ 17°	
Decyne-5 C-C-C-C-C≡C-(C) ₃ -C		175.3 175.3 ⁷⁵ 172 ⁸³ @ 745mm 115.9 ⁸⁵ @ 115mm 106.3 ⁸⁵ @ 80mm 78.8 ⁸⁵ @ 25mm	0.768 @ 25° 0.7673 ⁸⁵ @ 25° 0.7692 ⁸³ @ 25°	1.4311 @ 25° 1.4311 ^{85,83} @ 25°	
C₁₁H₂₀ Undecyne-1 C≡C-(C) ₈ -C	-33 ⁴⁹	202 210 to 215 ⁵⁷ 198 to 202 ⁵⁸ 202 to 204 ⁴⁹ @ 745mm 110 to 111 ⁵⁰ @ 17mm 91 @ 8mm ⁴⁹	0.8706 0.8143 ⁵⁰ @ 90° 0.8302 ⁵⁰ @ 70° 0.8465 ⁵⁰ @ 50° 0.8666 ⁵⁰ @ 25° 0.8024 ⁴⁹ @ 15°		$\frac{dD}{dt} = -0.0008053$ (25° to 90°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Undecyne-2 C-C≡C-(C) ₇ -C		199 to 210 ⁵⁸ 81.5 ⁵⁸ @ 10.5mm			
Undecyne-5 C-C-C-C-C≡C-(C) ₄ -C		196 195 to 196 ⁵³ 195 to 197 ⁵⁴	0.785 0.785 ^{53, 54}	1.437 1.437 ^{53, 54}	
C₁₂H₂₂ Dodecyne-1 C≡C-(C) ₉ -C		95 to 97 ⁵⁹ @ 15mm 95 to 98 ⁷² @ 15mm	0.7758 ⁷² @ 24°	1.4351 ⁷² @ 25.7° 1.4426 ⁷² @ 8°	$\frac{dn}{dt} = -0.000424/^\circ\text{C.}$ (8° to 25°)
Dodecyne-2 C-C≡C-(C) ₈ -C	-9 ⁶⁰	105 ⁶⁰ @ 15mm	0.7788 ⁶⁰ @ 32.5° 0.7917 ⁶⁰ @ 15° 0.8030 ⁶⁰ @ 0°		$\frac{dD}{dt} = -0.0007444$ (0° to 35°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Dodecyne-3 C-C-C≡C-(C) ₇ -C		95 ⁸¹ @ 12mm	0.7871 ⁸¹	1.44415 ⁸¹	
Dodecyne-6 C-C-C-C-C-C≡C-(C) ₄ -C		207.2 ⁷⁶ 209 ⁸³ @ 745mm 151 ⁷⁷ @ 124mm 115 ⁶⁵ @ 30mm 110 ⁶⁵ @ 23mm 100 @ 14mm 85.0 ⁷⁷ @ 7.5mm	0.787 ⁸ 0.7753 ⁸³ @ 30° 0.7816 ⁶⁵ @ 25° 0.790 ⁶⁴ @ 18°	1.4425 1.4351 ⁸³ @ 30° 1.4374 ⁶⁵ @ 25° 1.445 ⁶⁴ @ 18°	$\frac{dD}{dt} = -0.00123/^\circ\text{C.}$ (15° to 30°) $\frac{dn}{dt} = -0.000803/^\circ\text{C.}$ (15° to 30°)
C₁₄H₂₆ Tetradecyne-1 C≡C-(C) ₁₁ -C		128 ⁶⁰ @ 15mm			
Tetradecyne-2 C-C≡C-(C) ₁₀ -C	6.5 ⁶⁰	134 ⁶⁰ @ 15mm	0.7892 ⁶⁰ @ 30° 0.8000 ⁶⁰ @ 15.2° 0.8064 ⁶⁰ @ 6.5°		$\frac{dD}{dt} = -0.0007317/^\circ\text{C.}$ (5° to 30°)

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Pentadecyne-1 C≡C-(C) ₁₂ -C		112 to 113 ⁸⁸ @ 5mm	0.8261 ⁸⁸	1.4410 ⁸⁸	
C₁₆H₃₀ Hexadecyne-1 C≡C-(C) ₁₃ -C	15 ^{61, 68}	157 to 159 ⁸² @ 17mm 155 ⁶¹ @ 15mm 156 to 157 ⁶⁸ @ 15mm	0.7965 ⁶¹ 0.7999 ⁶¹ @ 15°		$\frac{dD}{dt} = -0.000680/^\circ\text{C.}$ ⁶¹ (15° to 20°)
Hexadecyne-2 C-C≡C-(C) ₁₂ -C	20 ⁶⁰	160 ⁶⁰ @ 15mm 145 to 146 ⁸² @ 8.5mm	0.7969 ⁶⁰ @ 30° 0.8039 ⁶⁰		$\frac{dD}{dt} = -0.00070/^\circ\text{C.}$ (20° to 30°)
C₁₈H₃₄ Octadecyne-1 C≡C-(C) ₁₅ -C	28 22.5 ⁵⁶ 26 ⁵⁹ 28 ⁶⁴	180 ⁵⁹ @ 15mm	0.8025 0.7955 ⁵⁹ @ 30° 0.7983 ⁵⁹ @ 26° 0.8695 ⁵⁵ @ 0°		$\frac{dD}{dt} = -0.00070/^\circ\text{C.}$ (26° to 30°)

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Octadecyne-2 $C \equiv C-(C)_{14}-C$	30 ⁶⁰	184 ⁶⁰ @ 15mm	0.8016 ⁶⁰ @ 30°		
$C_{19}H_{38}$ Nonadecyne-1 $C \equiv C-(C)_{16}-C$	37 to 38 ⁷¹	144 ⁷¹ @ 1.5mm			
$C_{20}H_{38}$ Eicosylene		314 to 315 ⁶³	0.8181 ⁶³ @ 24°		

- (1) C. C. Coffin and O. Maass, J. Am. Chem. Soc. **50**, 1427, 1928.
- (2) F. R. Morehouse and O. Maass, Can. J. Research **11**, 37, 1934.
- (3) P. Villard, Bull. soc. chim. [3] **13**, 997, 1895.
- (4) D. McIntosh, J. Phys. Chem. **11**, 306, 1907.
- (5) Willson and Suckert, J. Franklin Inst. **139**, 327, 1895.
- (6) A. Ladenburg and C. Krügel, Ber. **33**, 638, 1900.
- (7) G. Baume and A. Germann, Compt. rend. **153**, 571, 1911.
- (8) O. Maass and J. Russell, J. Am. Chem. Soc. **40**, 1571, 1918.
- (9) G. A. Burrell and I. W. Robertson, J. Am. Chem. Soc. **37**, 2482, 1915.
- (10) K. Stahrfoss, J. chim. phys. **16**, 187, 1918.
- (11) O. Maass and D. McIntosh, J. Am. Chem. Soc. **36**, 740, 1914.
- (12) O. Maass and C. H. Wright, J. Am. Chem. Soc. **43**, 1098, 1921.
- (13) R. Lespieau and G. Chavanne, Compt. rend. **140**, 1035, 1905.
- (14) M. Picon, Compt. rend. **158**, 1184, 1914.
- (15) R. Lespieau, Ann. chim. [8] **27**, 146, 1912.
- (16) G. Dupont, Compt. rend. **148**, 1522, 1909.
- (17) H. E. Roscoe, Ann. **232**, 351, 1886.
- (18) A. Faworski, J. prakt. Chem. [2] **42**, 147, 1890.
- (19) G. B. Heisig and H. M. Davis, J. Am. Chem. Soc. **57**, 339, 1935.
- (20) B. Gredy, Ann. chim. [11] **4**, 5, 1935.
- (21) C. W. Schlechter, German Patent 253,802, 1912.
- (22) M. Bourguel, Bull. soc. chim. [4] **37**, 546, 1925.
- (23) C. Friedel, Zeit. Chem. **1869**, 124.
- (24) H. von Risseghem, Compt. rend. **158**, 1696, 1914.
- (25) A. Faworski, J. prakt. Chem. [2] **37**, 387, 1888.
- (26) F. Flavitzki and Krylow, J. Russ. Phys. Chem. Soc. **10**, 342, 1878.
- (27) M. Bourguel, Ann. chim. **3**, 191, 325, 1925.
- (28) A. Faworski, J. Russ. Phys. Chem. Soc. **19**, 562, 1887.
- (29) J. Welt, Ber. **30**, 1494, 1897.
- (30) V. Grignard, L. Lapayre and Tcheou Faki, Compt. rend. **187**, 517, 1928.
- (31) H. van Risseghem, Bull. soc. chim. Belg. **35**, 328, 1926.
- (32) O. Hecht, Ber. **11**, 1050, 1878.
- (33) P. Lebeau and M. Picon, Compt. rend. **156**, 1077, 1913.
- (34) R. Lespieau and Wiemann, Bull. soc. chim. **45**, 627, 1929.
- (35) R. Lespieau, Bull. soc. chim. [4] **29**, 528, 1921.
- (36) V. N. Krestinsky and M. K. Kelbovskaia, Ber. **68B**, 512, 1935.
- (37) V. N. Ipatieff, J. Russ. Phys. Chem. Soc. **27**, 404, 1895.
- (38) A. Béhal, Ann. chim. [6] **15**, 415, 1888.
- (39) P. Landrieu and F. Baylocq, Bull. soc. chim. [4] **45**, 217, 1929.
- (40) C. Prevost, Compt. rend. **187**, 946, 1928.
- (41) C. Moureu, Ann. chim. [8] **7**, 541, 1906.
- (42) F. Strous and R. Kuhnel, Ber. **65B**, 154, 1932.
- (43) B. Gredy, Compt. rend. **197**, 327, 1933.
- (44) L. Meunier and E. Desparmet, Bull. soc. chim. [4] **35**, 481, 1924.
- (45) M. Picon, Compt. rend. **168**, 894, 1919.
- (46) André, Ann. chim. [8] **29**, 554, 1913.
- (47) I. L. Ozanne and C. S. Marvel, J. Am. Chem. Soc. **52**, 5267, 1930.
- (48) C. Prevost and J. Dujat, Bull. soc. chim. [4] **47**, 588, 1930.
- (49) H. Noerdlinger, Chemische Fabrik. Flörsheim, Chem. Zentr. **1912** **1**, 210.
- (50) P. Walden and R. Swinne, J. pharm. chim. **82**, 275.
- (51) C. Moureu, P. T. Muller, and J. Varin, Ann. chim. [9] **2**, 275, 1914.
- (52) D. W. Davis and C. S. Marvel, J. Am. Chem. Soc. **53**, 3840, 1931.
- (53) R. Truchet, Compt. rend. **191**, 854, 1930.

- (54) R. Truchet, *Ann. chim.* **16**, 309, 1931.
- (55) M. Picon, *Compt. rend.* **169**, 32, 1919.
- (56) A. Giesecke, *Zeit.* **1870**, 431.
- (57) P. Bruylants, *Ber.* **8**, 413, 1875.
- (58) H. Thoms and C. Mannich, *Ber.* **36**, 2546, 1903.
- (59) F. Krafft and R. Reuter, *Ber.* **25**, 2250, 1892.
- (60) F. Krafft, *Ber.* **17**, 1372, 1884.
- (61) F. Krafft, *Ber.* **29**, 2236, 1896.
- (62) E. Lippmann and J. Hawliczek, *Ber.* **12**, 69, 1879.
- (63) K. H. Meyer and P. Streuli, *Helv. Chim. Acta* **20**, 1179, 1937.
- (64) E. A. Bried and G. F. Hennion, *J. Am. Chem. Soc.* **59**, 1310, 1937.
- (65) S. D. Thorn, G. F. Hennion, and J. A. Nieuwland, *J. Am. Chem. Soc.* **58**, 796, 1936.
- (66) G. S. Whitby and W. Gallay, *Can. J. Research* **6**, 280, 1932.
- (67) S. P. Mulliken, R. L. Wakeman, and H. T. Gerry, *J. Am. Chem. Soc.* **57**, 1605, 1935.
- (68) H. de Graef, *Bull. soc. chim. Belg.* **34**, 427, 1925.
- (69) T. H. Vaughn, R. R. Vogt, and J. A. Nieuwland, *J. Am. Chem. Soc.* **56**, 2120, 1934.
- (70) D. D. Coffman, J. Chien-Yu Tsao, L. E. Schniepp, and C. S. Marvel, *J. Am. Chem. Soc.* **55**, 3792, 1933.
- (71) T. H. Vaughn, *J. Am. Chem. Soc.* **55**, 3453, 1933.
- (72) S. W. Lebedev and N. A. Kudrjawzeiv, *J. Gen. Chem. (U. S. S. R.)* **5**, 1859, 1935.
- (73) B. Gredy, *Bull. soc. chim. [5]* **2**, 1951, 1935.
- (74) A. v. Grosse and C. Linn, Unpublished results on G. F. Hennion's samples
- (75) G. F. Hennion, Paper presented before the Indiana Academy of Science at Manchester College, Manchester, Indiana, Nov. 5, 1937.
- (76) G. F. Hennion, Private communication, April, 1938.
- (77) R. W. Moehl, Private communication, May, 1938.
- (78) H. van Risseghem, *Bull. soc. chim. Belg.* **31**, 62, 1922.
- (79) J. R. Johnson, A. M. Schwartz and T. H. Jacobs, *J. Am. Chem. Soc.* **60**, 1882, 1938.
- (80) S. L. Langedijk and P. L. Stedehouder, *Rec. trav. chim.* **56**, 526, 1937.
- (81) T. H. Vaughn, G. F. Hennion, R. R. Vogt, and J. A. Nieuwland, *J. Org. Chem.* **2**, 1, 1937.
- (82) O. Maass, Private Communication
- (83) F. J. Krieger and H. H. Wenzke, *J. Am. Chem. Soc.* **60**, 2115, 1938.
- (84) R. Lespieau and Wiemann, *Compt. rend.* **188**, 998, 1929.
- (85) J. Wislicenus and P. Schmidt, *Ann.* **313**, 221, 1900.
- (86) L. L. Ryden, F. J. Glavis, and C. S. Marvel, *J. Am. Chem. Soc.* **59**, 1014, 1937.
- (87)

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Butadiyne-1,3	-36.4	10.3			
Diacetylene	-36.4 ³	13.6 ²	0.7107 ⁴	1.4198 ⁴	
	-36 to	10.3 ³	@ 5°	@ 5°	
C≡C-C≡C	-35 ¹	9.5 to 10 ^{1,21}	0.7364 ¹	1.43862 ¹	
	-36 to	10 ⁴	@ 0°	@ 0.8°	
	-37 ²	0 ¹			
		@ 517.6mm			
		0 ²			
		@ 466.7mm			
		-35.5 ¹			
		@ 93.5mm			
		-40 ²			
		@ 66.2mm			
		-78.2 ¹			
		@ 1.6mm			
 C₅H₂					
Pentadiyne-1,3					
Methyldiacetylene		54 to 56 ⁵	0.7375 ⁵	0.4431 ⁵	
			@ 21°	@ 21°	
C≡C-C≡C-C					
 C₆H₂					
Hexadiyne-1,3					
Ethyldiacetylene		87 ⁵			
C≡C-C≡C-C-C					

Name and Carbon Skeleton	M. P., °C.	B. P., °C. (@ 760mm)	D_4^{20}	n_D^{20}	Additional Data
Hexadiyne-1,4					
Methylpropargylacetylene <chem>C#C-C-C#C</chem>		78 to 83 °	0.825 ° @ 0°		
Hexadiyne-1,5			0.7874		
Dipropargyl <chem>C#C-C-C-C#C</chem>	-6 °	86 to 87 ° 85.4 ° 19.5 ° @ 46mm	0.7849 ° D_{25}^{25} 0.8049 ° 0.7888 ° D_{20}^{20} 0.7930 ° D_{15}^{15} 0.8032 ° D_4^4 0.8191 ° @ 0°		$\frac{dD}{dt} = -0.0009822/^\circ\text{C}.$ (0° to 25°)
Hexadiyne-2,4	64.5	129			
Dimethyldiacetylene <chem>C-C#C-C#C</chem>	64.5 ° 64 °	129 to 130 ° 129 °			

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
Heptadiyne-1,3 Propyldiacetylene <chem>C#C-C#C-C-C-C</chem>		115 ⁵			
Heptadiyne-1,5 <chem>C#C-C-C-C#C-C</chem>		26 to 27 ¹⁰ @ 30mm	0.810 ¹⁰ @ 21°	1.4521 ¹⁰ @ 21°	
Heptadiyne-1,6 <chem>C#C-C-C-C-C#C</chem>		111.5 to 112.5 ¹¹	0.8164 ¹¹ @ 17°	1.451 ¹¹ @ 17°	
C₈H₁₀ Octadiyne-1,7 <chem>C#C-C-C-C-C-C#C</chem>		135 to 136 ¹²	0.8169 ¹² @ 21°	1.453 ¹² @ 21°	
Octadiyne-2,6 <chem>C-C#C-C-C-C#C-C</chem>	26.5 to 27 ¹⁰	5.5 ¹⁰ @ 13mm	0.828 ¹⁰ @ 30°	1.4658 ¹⁰ @ 30°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octadiyne-3,5 $C-C-C\equiv C-C\equiv C-C$		163 to 164 ¹³	0.826 ¹³ @ 0°	1.4968 ¹³ @ 0°	
C₈H₁₀ Nonadiyne-1,8 $C\equiv C-C-C-C-C-C\equiv C$	-21 ¹¹	55.0 to 55.5 ¹¹ @ 13mm	0.8159 ¹¹ @ 21°	1.452 ¹¹ @ 21°	
C₁₀H₁₄ Decadiyne-4,6 $C-C-C-C\equiv C-C\equiv C-C-C$		88 @ 12mm ¹⁵			
2,7-Dimethyl- octadiyne-3,5 $\begin{array}{c} C-C-C-C\equiv C-C-C \\ \qquad \qquad \\ C \qquad \qquad C \end{array}$		74 @ 12mm ¹⁶	0.8090 ¹⁶		
C₁₁H₁₆ Undecadiyne-1,10 $C\equiv C-(C)_7\equiv C$	-17 ¹⁷	82.5 to 83 ¹⁷ @ 12mm	0.8182 ¹⁷ @ 21°	1.453 ¹⁷ @ 21°	

Name and Carbon Skeleton	M. P., °C	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Dodecadiyne-5,7 $C-(C)_5 \equiv C-C \equiv C-(C)_4$		104 @ 8mm ²² 103 @ 8mm ¹⁵			
2,2,7,7-Tetramethyloctadiyne-3,5 $ \begin{array}{c} C & & C \\ & & \\ C-C-C \equiv C-C-C-C \\ & & \\ C & & C \end{array} $	130 to 131 ¹⁸				
C₁₃H₂₀ Tridecadiyne-1,12 $C \equiv C-(C)_9-C \equiv C$	-3 to -2 ¹⁹	115.5 ¹⁹ @ 12mm	0.8262 ¹⁹ @ 21°	1.454 ¹⁹	
C₁₄H₂₂ Tetradecadiyne-6,8 $C-(C)_4-C \equiv C-C \equiv C-(C)_4-C$		118 to 119 ¹⁵ @ 12mm			

<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D_4^{20}</i>	<i>n_D^{20}</i>	<i>Additional Data</i>
Pentadecadiyne-6,9 $C-(C)_4-C\equiv(C)\equiv C-(C)_4-C$		134 to 136 ²⁰	0.84 ²⁰	1.4693 ²⁰ @ 21°	
$C_{16}H_{22}$ Hexadecadiyne-1,15 $C\equiv C-(C)_{12}-C\equiv C$	44 to 45 ¹⁷	152 to 155 ¹⁷ @ 12mm			
Hexadecadiyne-6,9 $C-(C)_4-C\equiv(C)\equiv C-(C)_5-C$		169 to 170 ²⁰ @ 15mm	0.845 ²⁰ @ 18°	1.4694 ²⁰ @ 18°	
Hexadecadiyne-6,10 $C-(C)_4-C\equiv(C)\equiv C-(C)_4-C$		157 to 158 ²⁰ @ 10mm	0.846 ²⁰ @ 17°	1.4686 ²⁰ @ 22°	
$C_{17}H_{24}$ Heptadecadiyne-7,10 $C-(C)_5-C\equiv(C)\equiv C-(C)_5-C$		150 to 155 ²⁰ @ 6mm	0.84 ²⁰ @ 19°	1.4700 ²⁰ @ 19°	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octadecadiyne-7,11 $C-(C)_6-C\equiv(C)_6-C-(C)_5-C$		167 to 168 ²⁰ @ 7mm	0.84 ²⁰ @ 19°	1.4698 ²⁰ @ 19°	
C₁₀H₁₄ Eicosadiyne-1,19 $C\equiv C-(C)_{18}-C\equiv C$	54 to 56 ¹⁹				
C₂₃H₄₀ Tricosadiyne-10,13 $C-(C)_8-C\equiv(C)_5-C-(C)_8-C$	26 to 31 ²⁰				
C₃₄H₆₂ Tetracosadiyne-10,14 $C-(C)_8-C\equiv(C)_6-C-(C)_8-C$	38.5 to 39 ²⁰				
C₃₉H₆₆ Hexatria- contadiyne-17,19 $C-(C)_{15}-C\equiv C-C\equiv C-(C)_{15}-C$	59 ²¹				

- (1) F. Straus and L. Kallek, Ber. **59B**, 1664, 1926.
- (2) F. G. Müller, Helv. Chim. Acta, **8**, 826, 1925.
- (3) H. Tannenburger, Ber. **66B**, 484, 1933.
- (4) R. Lespieau and C. Prévost, Compt. rend. **180**, 675, 1925.
- (5) C. Prévost, Ann. chim. [10] **10**, 113, 1929.
- (6) G. Griner, Ann. chim. [6] **26**, 347, 1892.
- (7) W. H. Perkins, J. Chem. Soc. **67**, 258, 1895.
- (8) E. W. Brühl, Ber. **25**, 2642, 1892.
- (9) G. Mignonac and R. V. de Saint-Aunay, Compt. rend. **188**, 959, 1929.
- (10) E. Urion, Compt. rend. **185**, 1286, 1927.
- (11) R. Lespieau and Journaud, Compt. rend. **188**, 1410, 1929.
- (12) R. Lespieau and Deluchat, Compt. rend. **183**, 889, 1926.
- (13) G. Dupont, Compt. rend. **148**, 1523, 1909.
- (14) G. Dupont, Compt. rend. **152**, 199, 1911; Ann. chim. [8] **30**, 514, 1913.
- (15) V. Grignard and Tcheoufaki, Compt. rend. **188**, 357, 1928.
- (16) Jozitch and Orelkin, J. Russ. Phys. Chem. Soc. **42**, 728, 1910.
- (17) R. Lespieau, Compt. rend. **178**, 1565, 1924.
- (18) R. Favorski and Morev, J. Russ. Phys. Chem. Soc. **50**, 571, 1920.
- (19) R. Lespieau, Compt. rend. **184**, 460, 1927.
- (20) Tchao Yui Lai, Bull. soc. chim. [4] **53**, 1537, 1933.
- (21) K. H. Meyer and P. Streuli, Helv. Chim. Acta, **20**, 1179, 1937.
- (22) J. P. Danehy and J. A. Nieuwland, J. Am. Chem. Soc. **58**, 1609, 1936.

C₆H₈ 3. Mixed Alkene-Alkynes of the Aliphatic Series 390

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
Buten-3-yne-1					
Vinylacetylene <chem>C#C-C=C</chem>		5 @ 757mm ¹ 2 to 3 @ 729mm	0.705 ¹ @ 1.5° 0.7095 ¹ @ 0°		
C₆H₈					
Penten-1-yne-3					
1-Methyl-2-vinylacetylene <chem>C#C-C#C-C=C</chem>		59.2 ²	0.7401 ²	1.4496 ²	
Penten-1-yne-4					
Allylacetylene <chem>C#C-C=C-C#C</chem>		41 to 42 ³	0.777 ³ D_{22}^{22}	1.3653 ³ @ 22°	
2-Methylbuten-1-yne-3					
<chem>C#C-C#C-C=C</chem> C		34 ⁵ 32 to 32.5 ⁵ 32 to 35 ⁴	0.6801 ⁴ @ 110°	1.41666 ⁴ n_a 1.43046 ⁴ n_B	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexen-1-yne-3 $C=C-C\equiv C-C-C$		84.5 to 85.3 ° @ 758mm 83 @ 742mm ⁷	0.749 0.7492 ° 0.748 ⁷	1.4523 ⁷ 1.4522 °	
Hexen-5-yne-1 Diallylene $C\equiv C-C-C-C=C$		70 °	0.8579 ° @ 18.2°		
2-Methylpenten-1-yne-3 $C=C-C\equiv C-C$ $\quad $ $\quad C$		75 to 77 °		1.4002 °	
3-Methylpenten-3-yne-1 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $C\equiv C-C-C-C$ $\quad \quad $ $\quad \quad C$		68 to 71 ° 67 to 69 °		1.4332 °	

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hepten-1-yne-3 $C=C-C\equiv C-C-C-C$		109 to 110 ¹⁰ @ 750mm	0.787 ¹⁰ @ 25°	1.4694 ¹⁰ @ 25°	
2-Methylhexen-3-yne-5 (Mixtures of <i>cis</i> , <i>trans</i> isomers) $C-C-C-C-C\equiv C$ C		117 to 120 ¹¹ @ 750mm 60 to 80 ¹¹ @ 80mm			
C₈H₁₂ Octen-1-yne-3 1-Butyl-2-vinylacetylene $C=C-C\equiv C-C-C-C-C$		62 to 63 ² @ 61mm 59 to 60 ² @ 50mm	0.7830 ²	1.4592 ²	
2-Methylhepten-4-yne-6 $C-C-C-C-C-C\equiv C$ C		126 to 129 ¹¹ @ 750mm			

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Nonen-1-yne-4 <chem>C=C-C-C#C-(C)4-C-C-C</chem>		58 @ 22mm ¹⁰	0.777 ¹⁰ @ 25°	1.4694 ¹⁰ @ 25°	
C₁₀H₁₈ Decen-1-yne-4 <chem>C=C-C-C=C-(C)4-C</chem>		73 to 74 ¹⁰ @ 22mm 82 to 85 ¹² @ 18 to 20mm	0.785 ¹⁰ @ 25° 0.806 ¹² D ₁₁ ¹¹	1.459 ¹² @ 15° 1.444 ¹⁰ @ 15°	
C₁₁H₁₈ Undecen-1-yne-3 1-Heptyl-2-vinylacetylene <chem>C=C-C#C-(C)6-C</chem>		74.5 @ 9mm ²	0.7962 ²	1.4606 ²	

- (1) J. A. Nieuwland, W. S. Calcott, F. B. Downing, and A. S. Carter, *J. Am. Chem. Soc.* **53**, 4197, 1931.
- (2) R. A. Jacobson and W. H. Carothers, *J. Am. Chem. Soc.* **55**, 1622, 1933.
- (3) V. Grignard, L. Lapayre, and Tcheoufaki, *Compt. rend.* **187**, 517, 1928.
- (4) H. Scheibler and A. Fischer, *Ber.* **55B**, 2903, 1922.
- (5) Bayer and Co., *Ger. Pat.* 290,740, 1916.
- (6) W. H. Carothers and D. D. Coffman, *J. Am. Chem. Soc.* **54**, 4071, 1932.
- (7) S. D. Thorn, G. F. Hennion, and J. A. Nieuwland, *J. Am. Chem. Soc.* **58**, 796, 1936.
- (8) Henry, *Fortschr. Chem., Physik, physik. Chem.*, **1878**, 380.
- (9) C. D. Hurd and F. L. Cohen, *J. Am. Chem. Soc.* **53**, 1068, 1931.
- (10) J. P. Danehy, D. B. Killian, and J. A. Nieuwland, *J. Am. Chem. Soc.* **58**, 611, 1936.
- (11) V. Grignard, *Bull. soc. chim. [3]* **21**, 574, 1899.
- (12) V. Grignard and L. Lapayre, *Compt. rend.* **192**, 250, 1931.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Octatriene-1,5,7-yne-3 $C=C-C\equiv C-C-C-C=C$		156 ¹ (Decom- position) 82 @ 100mm ¹ (Polymeriza- tion) 50 @ 30mm ¹ 40 @ 20mm ¹	0.830 ¹	1.576 ¹	
C₁₃H₁₄ 4-Vinyl-4-ethinyl- heptadiene-1,6 (?) $\begin{array}{c} C\equiv C \\ \\ C=C-C-C-C-C=C \\ \\ C=C \end{array}$		49 @ 20mm ²	0.819 ²	1.472 ²	
C₃₀H₅₂ Dihydrosqualene		237 @ 3mm ³	0.8529 ³	1.4872 ³	

(1) J. A. Nieuwland, W. S. Calcott, F. B. Downing and A. S. Carter, J. Am. Chem. Soc. **53**, 4197, 1931.

(2) R. Lespieau and Journard, Compt. rend. **192**, 964, 1931.

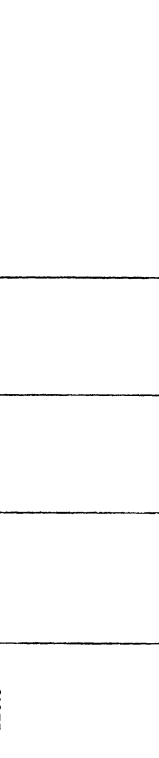
(3) I. M. Heilbron, T. P. Hilditch and E. D. Kamm, J. Chem. Soc. **1926**, 3131.

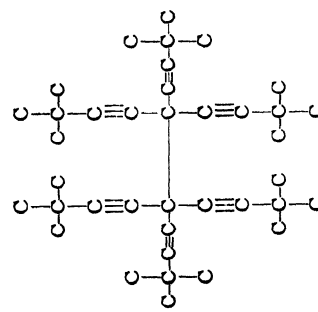
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
Hexadiene-1,3-yne-5 (Mixtures of geometrical isomers) $\text{C}=\text{C}-\text{C}=\text{C}-\text{C}\equiv\text{C}$		56 to 57 ° @ 200mm 32 ° @ 100mm	0.7821 ° D ₄ ²⁰ 0.7880 ° @ 15°	1.5058 ° 1.4900 °	
Hexadiene-1,5-yne-3 $\text{C}=\text{C}-\text{C}\equiv\text{C}-\text{C}=\text{C}$		83.5 84.5 to 85 ° 83.5 ° 46 to 47 ° @ 200mm	0.7852 0.7857 ° 0.7851 ° 0.7723 °	1.504 1.5045 ° 1.504 ° 1.498 °	
C₆H₁₀ 2,5-Dimethylhexadiene-1,5-yne-3 $\begin{array}{c} \text{C}=\text{C}-\text{C}\equiv\text{C}-\text{C}=\text{C} \\ \quad \\ \text{C} \quad \text{C} \end{array}$		123 to 124 ° 32 ° @ 17mm	0.7898 ° @ 15°	1.4859 °	

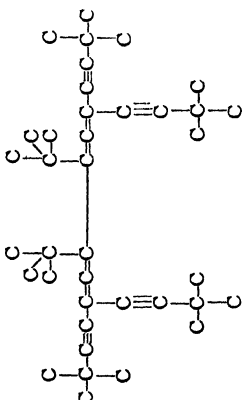
Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
3-Allylpenten-1-yne-4 $\begin{array}{c} \text{C}=\text{C}-\text{C}-\text{C}\equiv\text{C} \\ \\ \text{C}-\text{C}=\text{C} \end{array}$		120 to 125 °			
C₉H₁₄ 3,6-Dimethyloctadiene-2,6-yne-4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}\equiv\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C} \qquad \qquad \text{C} \end{array}$	-45 °	170 ° 71 ° @ 20.5mm	0.8071 °	1.4977 °	
C₁₂H₁₈ 3,6-Diethyloctadiene-2,6-yne-4 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}=\text{C}-\text{C}\equiv\text{C}-\text{C}=\text{C}-\text{C} \\ \qquad \qquad \\ \text{C}-\text{C} \qquad \text{C}-\text{C} \end{array}$		80 to 81 ° @ 5mm	0.8196 °	1.4965 °	

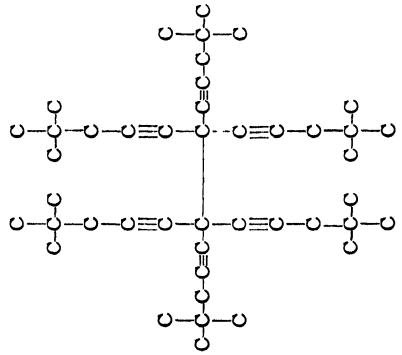
<i>Name and Carbon Skeleton</i>	<i>M. P., °C.</i>	<i>B. P., °C. @ 760mm</i>	<i>D₄²⁰</i>	<i>n_D²⁰</i>	<i>Additional Data</i>
6,9-Dimethyltetradecadiene-5,9-yne-7 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-(\text{C})_2-\text{C}=\text{C}-\text{C}\equiv\text{C}-\text{C}=\text{C}-(\text{C})_2-\text{C} \\ \quad \quad \quad \quad \quad \quad \\ \quad \quad \quad \text{C} \quad \quad \quad \text{C} \end{array}$		95 to 98° @ 0.5mm	0.824°	1.4866°	
4,7-Dipropyldecadiene-3,7-yne-5 (Mixtures of geometrical isomers) $\begin{array}{c} \text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C}\equiv\text{C}-\text{C}-\text{C}-\text{C}-\text{C}-\text{C} \\ \quad \quad \quad \quad \quad \quad \\ \quad \quad \quad \text{C}-\text{C}-\text{C} \quad \text{C}-\text{C}-\text{C} \end{array}$		125 to 127° @ 18mm	0.81313° @ 19°	1.4890°	

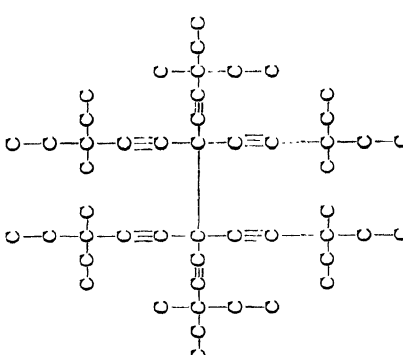
- (1) A. L. Kiebenskii, U. A. Dranitzina, and I. M. Dobromilskaya, *Compt. rend. sci. U. R. S. S.* **2**, 229, 1935.
- (2) P. Zhavoronkov, A. P. Alekhina, and Shter, *Sintek Kauchuk* **1934**, No. 2, 12-14.
- (3) J. A. Nieuwland, W. S. Calcott, F. B. Downing, and A. S. Carter, *J. Am. Chem. Soc.* **53**, 4197, 1931.
- (4) R. Lespiau and Guillemonet, *Compt. rend.* **195**, 245, 1932.
- (5) Bayer and Co., *Ger. Pat.* 241,424, 1911.
- (6) G. Dupont, *Compt. rend.* **152**, 197, 1911; *ann. chim.* [8] **30**, 514, 1913.
- (7) D. T. Mitchell and C. S. Marvel, *J. Am. Chem. Soc.*, **55**, 4276, 1933.
- (8) A. T. Blomquist and C. S. Marvel, *J. Am. Chem. Soc.* **55**, 1655-62, 1933.
- (9) V. Grignard, L. Lapayre, and Tcheoufaki, *Compt. rend.* **187**, 517, 1928.

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
C₄H₁₀ 2,2,9,9-Tetramethyl-5,6-diisobutyl-5,6-di- (3,3-dimethylbutyn-1-yl)-decadiene-3,7 Diterbutyl-tetra [tert-butylethynyl] ethane 	120 to 120.5 ¹				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
C₂₄H₄₄ 2,2,9,9-Tetramethyl-5,6,6-tetra-(3,3-dimethyl- butyn-1-yl)-decadiene-3,7 (Hexa-[tert-butylethynyl] ethane 	130 to 131 °				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
$C_{28}H_{44}$ 2,2,13,13-Tetramethyl-7,8-<i>tert</i>-butyl-5,10-di (3,3-dimethylbutyn-1-yl)-tetradeca- tetraene-5,6,8,9-diyne-3,11 2,2,13,13-Tetramethyl-5,10-di-<i>tert</i>-butyl- ethynyl-7,8-di-<i>tert</i>-butyl-tetradeca- tetraene-5,6,8,9-diyne-3,11 	172 to 173 °				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D ₄ ²⁰	n _D ²⁰	Additional Data
C₄₂H₈₂ 2,2,11,11-Tetramethyl-6,6,7,7-tetra-(4,4-dimethylpentyn-1-yl)-dodecadiyne-4,8 (Hexa-[ω-tert-butylpropynyl] ethane) 	127.5 to 128.5 °				

Name and Carbon Skeleton	M. P., °C.	B. P., °C. @ 760mm	D_4^{20}	n_D^{20}	Additional Data
$C_{60}H_{14}$ 3,10-Dimethyl-3,10-diethyl-6,6,7,7-tetra (3-methyl-3-ethyl-pentyn-1-yl)-dodecadiyne-4,8 Hexa-[3-ethyl-3-methyl-1-pentyn-yl]-ethane 	122 to 127 *				

(1) H. B. Gillespie and C. S. Marvel, J. Am. Chem. Soc. 52, 3368, 1930.

(2) P. L. Salzberg and C. S. Marvel, J. Am. Chem. Soc. 50, 1737, 1928.

(3) I. L. Ozanne and C. S. Marvel, J. Am. Chem. Soc. 52, 5267, 1930.

(4) D. W. Davis and C. S. Marvel, J. Am. Chem. Soc. 53, 3840, 1931.

(5) W. J. Sparks, W. J. Peppel, and C. S. Marvel, J. Am. Chem. Soc. 59, 1351, 1937.

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