

مراجعة نهائية وفق الهيكل الوزاري متنوعة بالإجابات



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف الثاني عشر المتقدم ← كيمياء ← الفصل الثالث ← ملفات متنوعة ← الملف

تاريخ إضافة الملف على موقع المناهج: 11:26:44 2025-06-06

ملفات اكتب للمعلم اكتب للطالب | اختبارات الكترونية | اختبارات | حلول | عروض بوربوينت | أوراق عمل
منهج انجليزي | ملخصات وتقارير | مذكرات وبنوك | الامتحان النهائي | للمدرس

المزيد من مادة
كيمياء:

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التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة كيمياء في الفصل الثالث

ملزمة مائة سؤال وفق الهيكل الوزاري

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حل تجميعية أسئلة نموذج D وفق الهيكل الوزاري

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Chemistry

*EOT3 coverage
Explication and questions
G12Adv
2024 - 2025*



Mohamed
Ahmed Abdelbari

1) Identify the main (general) characteristic of an organic compound

Organic compounds are so named because they are produced by living creatures such as plants and animals. Dalton presented his theory at the beginning of the nineteenth century, one of its items was that compounds are composed of specific structures of atoms and specific proportions of elements. With Dalton introducing his theory, scientists were able to synthesize many substances and compounds, but were unable to manufacture organic compounds, and that was incorrect. Based on that, scientists concluded the law of *vital force*.

vitalism.

According to vitalism, organisms possessed a mysterious “vital force,” enabling them to assemble carbon compounds.

Friedrich Wöhler prepared the first organic compound in the laboratory, which disproved (proved failed) the vitalism theory.

Carbon

1) *Why is the name (carbon compounds) given to organic compounds?*

Because all organic compounds are made of carbon as an essential element.

In organic compounds, carbon atoms are bonded to hydrogen atoms or atoms of other elements that are near carbon in the periodic table—especially nitrogen, oxygen, sulfur, phosphorus, and the halogens.

2) *Mention some of inorganic substances that contain carbon as one of their components.*

carbon oxides, carbides, and carbonates.

Carbon is located in group 14 in the periodic table, contains six electrons which are distributed $[He]2s^2 2p^2$

3) *How many bonds does a carbon atom make?*

4 bonds

Carbon atoms may be bound together to form chains ranging in length from two to thousands of atoms. And because it can form four bonds, it forms complex, branched-chain structures, ring structures, and even cage-like structures. For this, scientists were able to prepare millions of organic compounds.

Hydrocarbons

Hydrocarbons are compounds that contain only carbon and hydrogen. Hydrocarbons are the simplest type of carbon-based compounds, but they can vary greatly in size. The smallest hydrocarbons have just one or two carbon atoms. The largest hydrocarbons may have thousands of carbon atoms.

The simplest hydrocarbon molecule, methane CH_4 , consists of a carbon atom bonded to four hydrogen atoms. Methane is an excellent fuel and is the main component of natural gas.

1. *Why are organic compounds called "organic"?*
 - A. They are always gases
 - B. They do not contain carbon
 - C. They are made in factories
 - D. They come from living organisms
2. *Who introduced the atomic theory in the early 19th century?*
 - A. Wöhler
 - B. Lavoisier
 - C. Dalton
 - D. Mendeleev
3. *According to Dalton's theory, what are compounds made of?*
 - A. Specific arrangements and ratios of atoms
 - B. Mixtures of gases
 - C. Only one type of element
 - D. Unstructured matter
4. *Why were early scientists unable to synthesize organic compounds?*
 - A. They believed it required a special force found only in living things
 - B. They didn't have the tools
 - C. Carbon was unknown
 - D. Organic compounds do not exist in nature
5. *What is vitalism?*
 - A. A method for producing hydrocarbons
 - B. A theory that all matter is made of energy
 - C. The idea that living things have a unique force to make organic compounds
 - D. The belief in the use of carbon chains for energy
6. *Which scientist disproved vitalism by synthesizing an organic compound in the lab?*
 - A. Avogadro
 - B. Bohr
 - C. Wöhler
 - D. Dalton
7. *What compound did Friedrich Wöhler prepare in the laboratory?*
 - A. Methane
 - B. Carbon dioxide
 - C. Urea
 - D. Water
8. *Why is carbon the central element in organic chemistry?*
 - A. It can form four stable bonds with many elements
 - B. It always forms ionic bonds
 - C. It has the highest atomic mass
 - D. It is the most reactive gas
9. *How many covalent bonds does a carbon atom typically form?*
 - A. 2
 - B. 4
 - C. 3
 - D. 1

10. Which of the following elements commonly bond with carbon in organic compounds?

- A. Magnesium and calcium
- B. Gold and silver
- C. Sodium and potassium
- D. Nitrogen, oxygen, sulfur, phosphorus, and halogens

11. What is the electron configuration of carbon?

- A. $1s^2 2s^2 2p^6$
- B. $1s^2 2s^2 2p^4$
- C. $[\text{He}] 2s^2 2p^2$
- D. $[\text{Ne}] 3s^2$

12. Which of the following is NOT an organic compound?

- A. Glucose
- B. Calcium carbonate
- C. Urea
- D. Methane

13. What are examples of inorganic carbon compounds?

- A. Carbonates, carbon oxides, and carbides
- B. Amino acids and proteins
- C. Alcohols and esters
- D. Hydrocarbons and aldehydes

14. Where is carbon located on the periodic table?

- A. Group 18
- B. Group 17
- C. Group 14
- D. Group 1

15. What is a hydrocarbon?

- A. A compound made of hydrogen and oxygen
- B. A compound containing water and carbon dioxide
- C. A compound containing hydrogen and nitrogen
- D. A compound made only of carbon and hydrogen

16. Which of the following is the simplest hydrocarbon?

- A. Butane
- B. Ethene
- C. Ethane
- D. Methane

17. What is the chemical formula of methane?

- A. CH_4
- B. C_2H_2
- C. C_2H_6
- D. C_3H_8

18. Why is methane considered a good fuel?

- A. It burns without oxygen
- B. It is made of metal atoms
- C. It is radioactive
- D. It is stable and has a high energy content

19. *How can carbon atoms link with each other?*

- A. In chains, branches, rings, and cage-like structures
- B. Only in a straight chain
- C. Only in pairs
- D. Only in gaseous form

20. *How many organic compounds have scientists been able to synthesize due to carbon's bonding ability?*

- A. A few hundred
- B. Only natural ones
- C. Millions
- D. Thousands

Answer Key

- 1) D
- 2) C
- 3) A
- 4) A
- 5) C
- 6) C
- 7) C
- 8) A
- 9) B
- 10) D
- 11) C
- 12) B
- 13) A
- 14) C
- 15) D
- 16) D
- 17) A
- 18) D
- 19) A
- 20) C

2) Differentiate between the reactivity of saturated hydrocarbons (alkanes) and unsaturated hydrocarbons (alkenes and alkynes) using reaction bromine water

Multiple carbon-carbon bonds

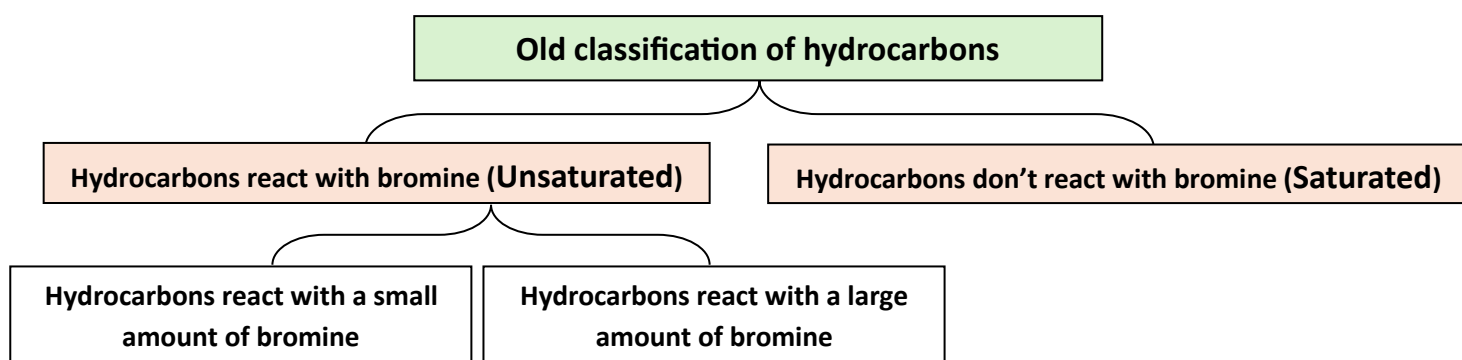
It is possible for carbon atoms to bond with each other by double or triple bonds within the molecules of organic compounds. In the past, researchers were not aware of this type of bonding, but they correctly classified the organic compounds into saturated and unsaturated organic compounds.

4) How did chemists obtain hydrocarbons in the past?

Hydrocarbons were obtained from heating animal fats and plant oils.

5) What substance did scientists use to differentiate between saturated hydrocarbons and unsaturated hydrocarbons? With an explanation of what is happening.

They classified hydrocarbons according to a chemical test in which they mixed each hydrocarbon with bromine and then measured how much reacted with the hydrocarbon.



When some organic substances added to bromine, its color vanishes, so scientists connected between saturation and reactivity.

A **saturated solution** is a solution that contains the maximum amount of solute that is capable of being dissolved.

An **unsaturated solution** is a solution that contains less than the maximum amount of solute that is capable of being dissolved.

Today,

Saturated hydrocarbon is a hydrocarbon having only single bonds.

Unsaturated hydrocarbon is a hydrocarbon that has at least one double or triple bond between carbon atoms.

	Saturated	Unsaturated compounds	
Structural formula	$\begin{array}{c} & \\ -C & -C- \\ & \end{array}$	$\begin{array}{c} \diagup & \diagdown \\ C & =C \\ \diagdown & \diagup \end{array}$	$-C \equiv C-$
Shared pairs	$\begin{array}{c} \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \end{array}$ One shared pair	$\begin{array}{c} \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \end{array}$ Two shared pairs	$\begin{array}{c} \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \end{array}$ Three shared pairs
Number of bonds	Single covalent bond	Double covalent bond	Triple covalent bond
Space for bromine atoms.	No space for bromine atoms to bond to carbon atoms	Has space for bromine atoms to bond to carbon atoms	More space for bromine atoms to bond to carbon atoms

21. Which of the following is an example of an unsaturated hydrocarbon?
- A. Methane
 - B. Butane
 - C. Propene
 - D. Ethane
22. Which term describes a hydrocarbon with only single bonds?
- A. Aromatic
 - B. Saturated
 - C. Alkene
 - D. Unsaturated
23. How many shared electron pairs form a triple bond between carbon atoms?
- A. One
 - B. Two
 - C. Four
 - D. Three
24. What type of bond does a saturated hydrocarbon contain?
- A. Double bond
 - B. Triple bond
 - C. Single bond
 - D. No bond
25. What is the structural difference between saturated and unsaturated hydrocarbons?
- A. Unsaturated compounds have more hydrogen
 - B. Saturated compounds are solid
 - C. Unsaturated compounds have at least one double or triple bond
 - D. Saturated compounds have more carbon atoms
26. What causes the reaction between bromine and unsaturated hydrocarbons?
- A. The number of hydrogen atoms
 - B. The double or triple bonds in the hydrocarbon
 - C. The temperature of the solution
 - D. The presence of oxygen
27. Why don't saturated hydrocarbons react with bromine easily?
- A. They have no reactive double or triple bonds
 - B. They evaporate quickly
 - C. They are too large
 - D. They contain oxygen
28. Which types of bonds can carbon atoms form with each other?
- A. Single only
 - B. Single and double only
 - C. Double and triple only
 - D. Single, double, or triple
29. How were hydrocarbons obtained in the past?
- A. By distillation of alcohol
 - B. By heating fats and oils
 - C. By freezing natural gas
 - D. By fermentation of sugars

30. *What happens when bromine is added to an unsaturated hydrocarbon?*
- A. Bromine turns green
 - B. The solution bubbles
 - C. Bromine color disappears
 - D. Gas is released
31. *Which test confirms whether a hydrocarbon is saturated or unsaturated?*
- A. Iodine test
 - B. Flame test
 - C. Bromine water test
 - D. Benedict's test
32. *Which hydrocarbon will react with bromine?*
- A. Ethene
 - B. Propane
 - C. Methane
 - D. Ethane
33. *How many shared pairs of electrons are in a double bond?*
- A. Two
 - B. Three
 - C. One
 - D. Four
34. *What is the color of bromine in solution?*
- A. Orange-brown
 - B. Blue
 - C. Colorless
 - D. Green
35. *Which of the following hydrocarbons will decolorize bromine solution?*
- A. Propene
 - B. Ethane
 - C. Butane
 - D. Propane
36. *Which of the following is an example of a saturated hydrocarbon?*
- A. Butene
 - B. Ethene
 - C. Methane
 - D. Ethyne
37. *Which of the following has more space to bond with bromine atoms?*
- A. Alcohols
 - B. Saturated hydrocarbons
 - C. Unsaturated hydrocarbons
 - D. Alkanes
38. *Which structural feature is characteristic of alkenes?*
- A. Ionic bond
 - B. Double bond
 - C. Triple bond
 - D. Single bond

39. *What was used to differentiate between saturated and unsaturated hydrocarbons?*

- A. Chlorine
- B. Red litmus
- C. Bromine
- D. Blue litmus

40. *When a hydrocarbon does not change the color of bromine, it is likely to be:*

- A. Aromatic
- B. Unsaturated
- C. Radioactive
- D. Saturated

Answer Key

21) C

22) B

23) D

24) C

25) C

26) B

27) A

28) D

29) B

30) C

31) C

32) A

33) A

34) A

35) A

36) C

37) C

38) B

39) C

40) D

3) Describe the process used to separate petroleum compounds by explaining the physical property used during the process

Fractional distillation (fractionation)

6) Why do raw petroleum sometimes called crude oil?

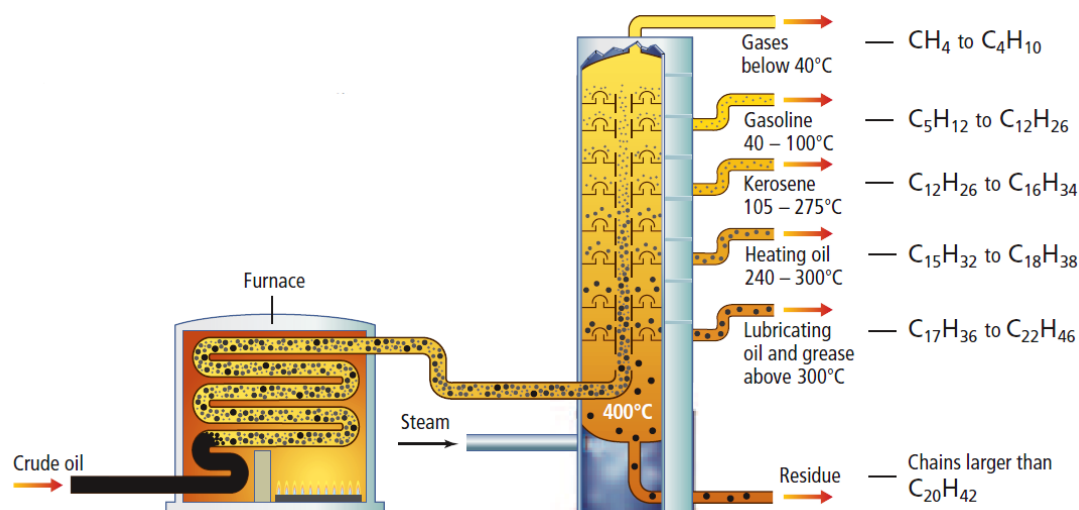
Because petroleum is a complex mixture containing more than a thousand different compounds.

Crude oil has little practical use, Petroleum is much more useful to humans when it is separated into simpler components or fractions. Separation is carried out in a process called fractional distillation, also called fractionation.

Fractional distillation (fractionation)

A process involves boiling the petroleum and collecting components or fractions as they condense at different temperatures.

- ✓ Fractional distillation is done in a fractionating tower.
- ✓ The temperature inside the fractionating tower is controlled so that it remains near 400°C at the bottom, where the petroleum is boiling, and gradually decreases toward the top.
- ✓ The condensation temperatures (boiling points) generally decrease as molecular mass decreases.
- ✓ As the vapors travel up through the column, the hydrocarbons condense and are drawn off.



Unfortunately, fractional distillation towers do not yield fractions in the same proportions that they are needed. For example, distillation seldom yields the amount of gasoline desired. However, it yields more of the heavier oils than the market demands.

7) Define thermal cracking.

The process in which heavier fractions are converted lighter fractions by breaking their large molecules into smaller molecules.

- ✓ Cracking is done in the absence of oxygen and in the presence of a catalyst.
- ✓ In addition to breaking heavier hydrocarbons into molecules of the size range needed for gasoline, cracking also produces starting materials for the synthesis of many different products, including plastic products, films, and synthetic fabrics.

Rating gasoline

8) In the fractionating tower, between 40 and 100 °C, what is the substance drawn off?

9) How many hydrocarbons drawn off in this part of fractionating tower?

10) Does Gasoline (or any other fraction) a pure substance?

11) How does the gasoline pumped into cars today is different from the gasoline used in automobiles in the early 1900s?

The gasoline fraction that is distilled from petroleum is modified by adjusting its composition and adding substances to improve its performance in today's automobile engines and to reduce pollution from car exhaust. It is necessary that ignition occurs in the engine cylinder at a specific time and that the gasoline-air mixture is completely burned.

12) What happens when a gasoline mixture burns before or after the appropriate time?

- 1) It leads to a large loss of energy.
- 2) Low fuel efficiency.
- 3) Loss of engine efficiency.

When combustion straight chains hydrocarbons in engines, ignition occurs early, before the piston is in the correct position, and is accompanied by pinging noise called knocking.

Knocking : The pinging noise accompanied to the incomplete ignition of some hydrocarbons in automobile engines.

antiknock (octane rating) system

Mid-grade gasoline today has a rating of about 89, whereas premium gasoline has higher ratings of 91 or higher.

Factors determine which octane rating a car needs,

- 1) how much the piston compresses the air-fuel mixture.
- 2) The altitude at which the car is driven.

13) Mention two uses of kerosene that were used in the past.

For lighting and lubricants for machines.



Octane rating

- | | |
|------------------------------|-----|
| • Midgrade gasoline for cars | 89 |
| • Aviation fuel | 100 |
| • Racing fuel | 110 |

41. *What physical property is primarily used to separate petroleum compounds during fractional distillation?*
- A) Boiling points
 - B) Density
 - C) Viscosity
 - D) Color
42. *Why is raw petroleum also known as crude oil?*
- A) Because it is very viscous
 - B) Because it is a complex mixture containing many different compounds.
 - C) Because it is found underground
 - D) Because it has a strong odor
43. *What is the main reason crude oil has limited practical use in its raw form?*
- A) It is highly flammable
 - B) It is too expensive to transport
 - C) It is a complex mixture that is more useful when separated into simpler components.
 - D) It is difficult to extract from the earth
44. *What is another name for the process of fractional distillation of petroleum?*
- A) Thermal cracking
 - B) Polymerization
 - C) Hydrogenation
 - D) Fractionation
45. *What two key steps are involved in the process of fractional distillation?*
- A) Boiling the petroleum and collecting components as they condense at different temperatures.
 - B) Heating the petroleum and adding a catalyst
 - C) Cooling the petroleum and adding oxygen
 - D) Mixing petroleum with water and decanting
46. *In what specialized equipment is fractional distillation of petroleum carried out?*
- A) A cracking unit
 - B) A fractionating tower
 - C) A refinery furnace
 - D) A hydrogenation reactor

47. *Describe the temperature gradient within a fractionating tower during petroleum distillation.*
- A) It is coolest at the bottom and hottest at the top
 - B) It remains constant throughout the tower
 - C) It is hottest at the bottom (near 400°C) and gradually decreases towards the top.
 - D) It fluctuates randomly
48. *How do the condensation temperatures (boiling points) of petroleum compounds relate to their molecular mass?*
- A) Condensation temperatures generally increase as molecular mass decreases
 - B) Condensation temperatures are unrelated to molecular mass
 - C) Condensation temperatures are constant regardless of molecular mass
 - D) Condensation temperatures generally decrease as molecular mass decreases.
49. *What happens to the hydrocarbon vapors as they ascend the fractionating column?*
- A) They condense and are drawn off at different levels.
 - B) They undergo cracking
 - C) They become more volatile
 - D) They remain in a gaseous state
50. *What is a common limitation of fractional distillation in terms of product yield?*
- A) It produces too much gasoline
 - B) It does not yield fractions in the same proportions that they are needed by the market.
 - C) It is an energy-intensive process
 - D) It only separates a few types of compounds
51. *Which two types of fractions are typically yielded in disproportionate amounts compared to market demand from fractional distillation?*
- A) More gasoline and less kerosene
 - B) Equal amounts of all fractions
 - C) Less gasoline than desired and more heavier oils than demanded.
 - D) More light gases and less asphalt
52. *What is thermal cracking?*
- A) A process for separating petroleum based on boiling points
 - B) A process for adding hydrogen to hydrocarbons
 - C) A process for purifying gasoline
 - D) A process that converts heavier petroleum fractions into lighter ones by breaking large molecules into smaller molecules.

53. *What are the key conditions required for the process of thermal cracking?*
- A) Absence of oxygen and presence of a catalyst.
 - B) Presence of oxygen and absence of a catalyst
 - C) High pressure and low temperature
 - D) Low pressure and high temperature
54. *Besides producing gasoline-sized molecules, what other significant benefit does cracking offer?*
- A) It purifies crude oil completely
 - B) It produces starting materials for various synthetic products like plastics, films, and synthetic fabrics.
 - C) It reduces the overall volume of petroleum
 - D) It is the primary method for extracting crude oil
55. *In a fractionating tower, what substance is typically drawn off between 40 °C and 100 °C?*
- A) Kerosene
 - B) Fuel oil
 - C) Gasoline
 - D) Bitumen
56. *Is gasoline, drawn off from the fractionating tower, considered a pure substance or a mixture of hydrocarbons?*
- A) A pure substance consisting of a single hydrocarbon
 - B) Primarily composed of one type of alcohol
 - C) A mixture of only two hydrocarbons
 - D) A mixture of many different hydrocarbons.
57. *Is gasoline (or any other fraction) obtained from petroleum considered a pure substance?*
- A) No, it is a mixture of many different compounds.
 - B) Yes, it is a pure substance
 - C) It depends on the refining process
 - D) Only high-octane gasoline is a pure substance
58. *How does modern gasoline differ from gasoline used in the early 1900s?*
- A) Modern gasoline is less refined
 - B) Modern gasoline is modified by adjusting its composition and adding substances to improve performance and reduce pollution.
 - C) Modern gasoline is entirely different and not derived from petroleum
 - D) Modern gasoline is only used in electric cars

- 59.** *Why is precise ignition timing and complete burning of the gasoline-air mixture crucial in an engine cylinder?*
- A) To increase the weight of the fuel
 - B) To make the engine quieter regardless of efficiency
 - C) To ensure efficient operation and prevent issues like knocking.
 - D) To make the fuel last longer by slowing down combustion
- 60.** *What are the consequences of a gasoline mixture burning before or after the appropriate time in an engine?*
- A) It leads to increased engine power
 - B) It results in quieter engine operation
 - C) It has no significant impact on performance
 - D) It leads to a large loss of energy, low fuel efficiency, and loss of engine efficiency.
- 61.** *What phenomenon occurs when straight-chain hydrocarbons in gasoline ignite prematurely in an engine, causing a pinging noise?*
- A) Knocking
 - B) Detonation
 - C) Pre-ignition
 - D) Combustion
- 62.** *What is the definition of knocking in automobile engines?*
- A) The smooth combustion of gasoline
 - B) The pinging noise accompanied to the incomplete ignition of some hydrocarbons in automobile engines.
 - C) The sound of a perfectly tuned engine
 - D) The process of adding octane boosters to fuel
- 63.** *What is the typical octane rating for mid-grade gasoline, and how does it compare to premium gasoline?*
- A) Mid-grade is 91, premium is 89
 - B) Both are always 87
 - C) Mid-grade is about 89, while premium is 91 or higher.
 - D) Octane rating is not relevant for gasoline
- 64.** *What two main factors determine the octane rating a car needs?*
- A) The color of the car and the brand of tires
 - B) The age of the car and its manufacturing country
 - C) The type of oil used and the size of the fuel tank
 - D) How much the piston compresses the air-fuel mixture and the altitude at which the car is driven.

65. *Historically, what were two common uses for kerosene?*

- A) For lighting and as lubricants for machines.
- B) As aviation fuel and racing fuel
- C) For cleaning solvents and plastics
- D) As heating oil and asphalt

66. *According to the provided information, what is the octane rating for aviation fuel?*

- A) 89
- B) 100
- C) 91
- D) 110

67. *What is the octane rating for racing fuel as stated in the text?*

- A) 89
- B) 100
- C) 110
- D) 91

68. *During fractional distillation, at which point in the process are different petroleum components collected?*

- A) Before they are boiled
- B) After they are chemically reacted
- C) During the cracking process
- D) As they condense at different temperatures.

69. *Where in the fractionating tower is the highest temperature maintained?*

- A) At the top, where the lightest fractions condense
- B) At the bottom, where the petroleum is boiling.
- C) In the middle section
- D) It's uniform throughout the tower

70. *What makes petroleum more useful to humans than crude oil?*

- A) Its strong odor
- B) Its natural color
- C) Its abundance in the ground
- D) Its separation into simpler, more useful components or fractions.

Answers

- 41) A
- 42) B
- 43) C
- 44) D
- 45) A
- 46) B
- 47) C
- 48) D
- 49) A
- 50) B
- 51) C
- 52) D
- 53) A
- 54) B
- 55) C
- 56) D
- 57) A
- 58) B
- 59) C
- 60) D
- 61) A
- 62) B
- 63) C
- 64) D
- 65) A
- 66) B
- 67) C
- 68) D
- 69) B
- 70) D

4) Use IUPAC system to name aliphatic alkanes (straight chain, branched, non-substituted and substituted)

14)

The compound	$\text{CH}_3\text{---CH}_2\text{---CH}_2\text{---CH}_2\text{---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH}_2\text{---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$	$\text{CH}_3\text{---CH(CH}_3\text{)---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$
The name			

The compound	$\text{CH}_3\text{---CH}_2\text{---CH(CH}_2\text{CH}_3\text{)---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$	$\text{CH}_3\text{---CH(CH}_3\text{)---CH}_2\text{---CH(CH}_2\text{CH}_3\text{)---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH}_2\text{---C(CH}_3\text{)}_2\text{---CH}_3$
The name			

The compound	$\text{CH}_3\text{---(CH}_2\text{)}_4\text{---CH}_3$	$\text{CH}_3\text{---CH(CH}_2\text{CH}_3\text{)---CH}_2\text{---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$	$\text{CH}_3\text{---CH(CH}_2\text{CH}_3\text{)---CH}_2\text{---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$
The name			

The compound	$\text{CH}_3\text{---C(CH}_3\text{)}_2\text{---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$	$\text{CH}_3\text{---CH(CH}_3\text{)---CH(CH}_3\text{)---CH}_3$	$\text{CH}_3\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$
The name			

The compound	$\text{CH}_3\text{---CH}_2\text{---CH}_2\text{---CH(CH}_3\text{)---CH(CH}_3\text{)---CH}_3$	$\text{CH}_3\text{---CH}_2\text{---C(CH}_3\text{)}_2\text{---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH(CH}_3\text{)---CH}_2\text{---CH(CH}_3\text{)---CH(CH}_3\text{)---CH}_3$
The name			

The compound	$\text{CH}_3\text{---C(CH}_3\text{)}_2\text{---CH}_2\text{---CH}_2\text{---CH(CH}_2\text{CH}_2\text{CH}_2\text{CH}_3\text{)---CH}_2\text{---CH}_2\text{---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH(CH}_3\text{)---CH(CH}_2\text{CH}_3\text{)---CH}_2\text{---CH}_2\text{---C(CH}_3\text{)}_2\text{---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH(CH}_3\text{)---CH(CH}_2\text{CH}_3\text{)---CH(CH}_3\text{)---CH(CH}_3\text{)---CH}_3$
The name			

The compound	$\text{CH}_3\text{---CH}_2\text{---C(CH}_3\text{)}_2\text{---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH}_2\text{---C(CH}_3\text{)}_2\text{---CH}_2\text{---CH}_3$	$\text{CH}_3\text{---CH}_2\text{---CH(CH}_3\text{)---CH}_3$
The name			

15) Draw the structural formula for the following compounds,

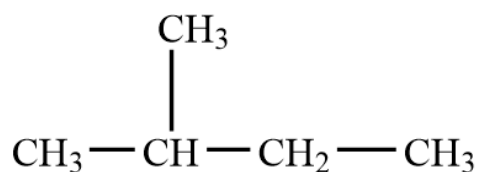
2,4-dimethylpentane	3,3-diethyl-2,5-dimethylnonan
4-ethyl-3-methylheptane	2-methylpropane
3,3,4-trimethyl-4-methylhexane	4-methyloctane
2,3-dimethylbutane	4-ethyl-2-methylheptane

71. What is the IUPAC name for the straight-chain alkane with 6 carbon atoms?

- A) Pentane
- B) Heptane
- C) Hexane
- D) Butane

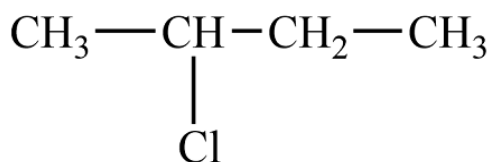
72. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) Isobutane
- B) 2-Methylbutane
- C) Pentane
- D) Butane



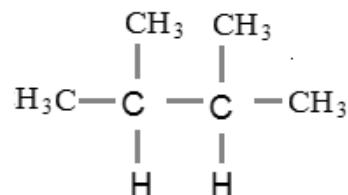
73. What is the IUPAC name for the compound with the structural formula ?

- A) 1-Chlorobutane
- B) 3-Chlorobutane
- C) Chloropropane
- D) 2-Chlorobutane



74. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 2,3-Dimethylpropane
- B) 2,2-Dimethylbutane
- C) 2,3-Dimethylbutane
- D) Tetramethylmethane

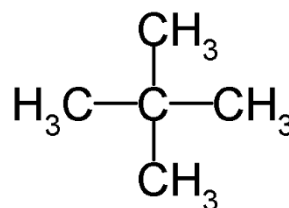


75. What is the IUPAC name for the straight-chain alkane with 8 carbon atoms?

- A) Heptane
- B) Octane
- C) Nonane
- D) Decane

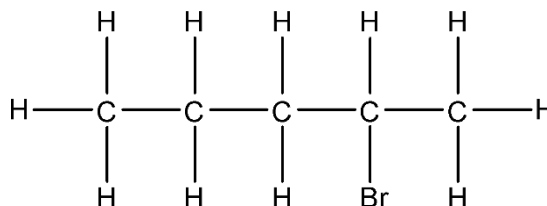
76. What is the IUPAC name for the compound with the structural formula ?

- A) 2-Methylbutane
- B) 2,2-Dimethylpropane
- C) 2,2-Dimethylbutane
- D) Neopentane



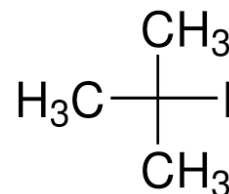
77. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 2-Bromopentane
- B) 3-Bromopentane
- C) 1-Bromopentane
- D) Bromobutane



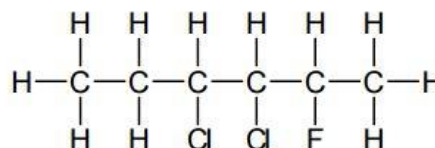
78. What is the IUPAC name for the compound with the structural formula $\text{CH}_3\text{CH}(\text{I})\text{CH}_2\text{CH}_3$?

- A) 1-Iodobutane
- B) Iodopropane
- C) 3-Iodobutane
- D) 2-Iodobutane



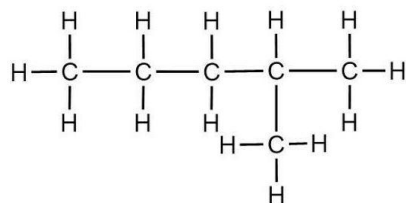
79. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 2-Fluorohexane
- B) 3,4-dichloro-2-fluorohexane
- C) 4-Fluoro-3,4-dichlorohexane
- D) 1-Fluorohexane



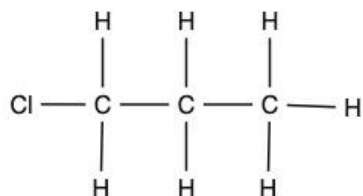
80. What is the IUPAC name for the compound with the structural formula ?

- A) 3-Methylpentane
- B) 2-Methylpentane
- C) Hexane
- D) 2,3-Dimethylbutane



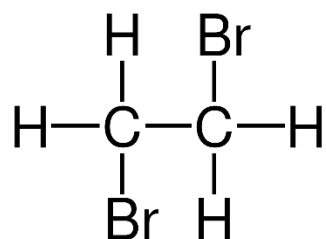
81. What is the IUPAC name for the compound with the structural formula ?

- A) 2-Chloropropane
- B) 1-Chloropropane
- C) 3-Chloropropane
- D) Chlorobutane



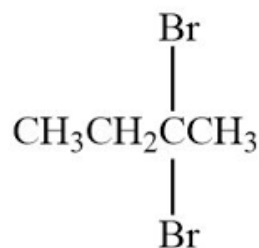
82. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 1,1-Dibromoethane
- B) 1,2-Dibromoethane
- C) Dibromoethylene
- D) 1,2-Dibromopropane



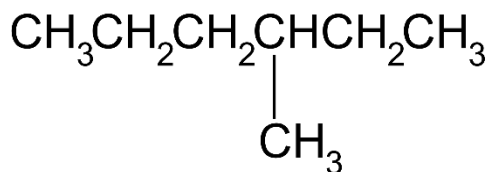
83. What is the IUPAC name for the compound with the structural formula ?

- A) 2,3-Dibromouttane
- B) 2,2-Dibromobutane
- C) 1,4-Dibromopentane
- D) 2,2-Dibromopentane



84. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 2-Methylhexane
- B) 3-Methylhexane
- C) 4-Methylhexane
- D) Heptane

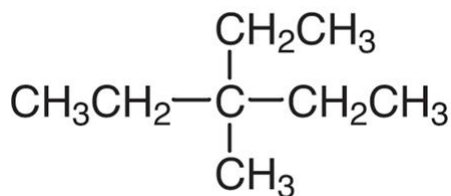


85. What is the IUPAC name for the straight-chain alkane with 10 carbon atoms?

- A) Nonane
- B) Octane
- C) Decane
- D) Undecane

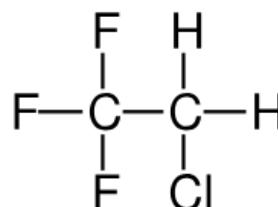
86. What is the IUPAC name for the compound with the structural formula ?

- A) 3-Methylnonane
- B) Heptane
- C) 3-Ethyl-3-methylpentane
- D) 2-Ethyl-3-methylhexane



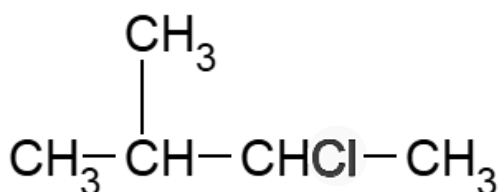
87. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 2-Chloro-1,1,1-trifluoroethane
- B) 1,1,1-trifluoro-2-chloroethane
- C) 1,1,2-Trichloro-1,2,2-trifluoroethane
- D) 1,1,1-Trifluorobutane



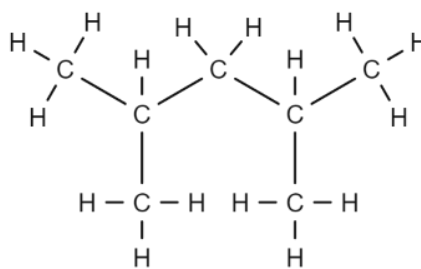
88. What is the IUPAC name for the compound with the structural formula ?

- A) 2-Chloro-3-methylbutane
- B) 3-Chloro-2-methylbutane
- C) 2-Methyl-3-chlorobutane
- D) Chloromethylbutane



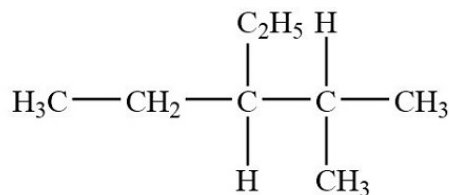
89. Which of the following is the correct IUPAC name for the compound with the structural formula ?

- A) 2,2-Dimethylpentane
- B) 3-Ethylpentane
- C) 2,4-dimethylpentane
- D) 2,3-Dimethylpentane



90. What is the IUPAC name for the compound with the structural formula ?

- A) 2-Methyl-3-ethylpentane
- B) 3-Ethyl-2-methylpentane
- C) 3-Isopropylpentane
- D) 2,3-Diethylbutane



Answers:

71) C

72) B

73) D

74) C

75) B

76) B

77) B

78) D

79) B

80) B

81) B

82) B

83) B

84) B

85) C

86) C

87) A




88) A

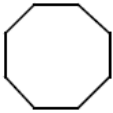


89) C

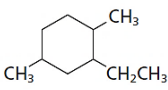
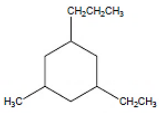
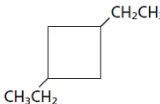
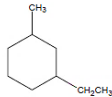
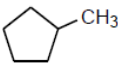
90) B

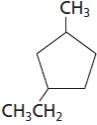
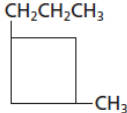
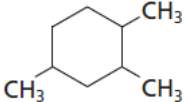
5) Use IUPAC system to name cycloalkanes (non-branched, branched, non-substituted and substituted)

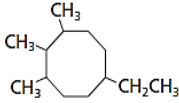
16)

The structural formula			
The name			

The structural formula			
The name			

The structural formula					
The name					

The structural formula			
The name			

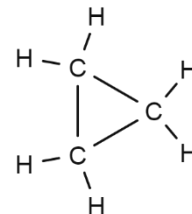
The structural formula			
The name	1,1-diethyl-2-methylcyclopentane	1,2-dimethylcyclopropane	

The structural formula			
The name	1,1-dimethyl-2-ethylcyclobutane	ethyl-cyclooctane	1-ethyl-2-methylcyclobutane

The structural formula			
The name	1-ethyl-2-methylcyclohexane	1,2,2,4-tetramethylcyclohexane	1-ethyl-3-propylcyclopentane

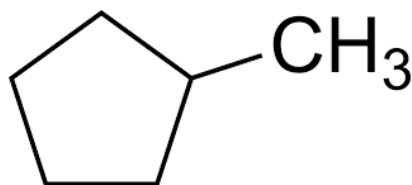
91. What is the IUPAC name?

- A) Cyclobutane
- B) Cyclopentane
- C) Cyclopropane
- D) Cyclohexane



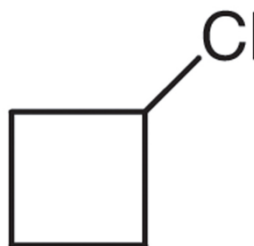
92. Which of the following is the correct IUPAC name?

- A) 1-Methylcyclopentane
- B) Methylcyclohexane
- C) Methylcyclopentane
- D) Cyclopentylmethane



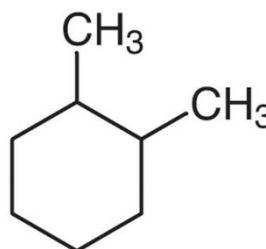
93. What is the IUPAC name?

- A) 1-Chlorocyclobutane
- B) Chlorocyclopropane
- C) Chlorocyclobutane
- D) 2-Chlorocyclobutane



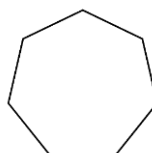
94. Which of the following is the correct IUPAC?

- A) 1,1-Dimethylcyclohexane
- B) 1,3-Dimethylcyclohexane
- C) 1,2-Dimethylcyclohexane
- D) 1,4-Dimethylcyclohexane



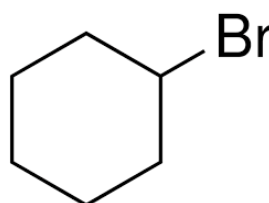
95. What is the IUPAC name for a seven-membered carbon ring?

- A) Cyclohexane
- B) Cyclooctane
- C) Cycloheptane
- D) Cyclononane



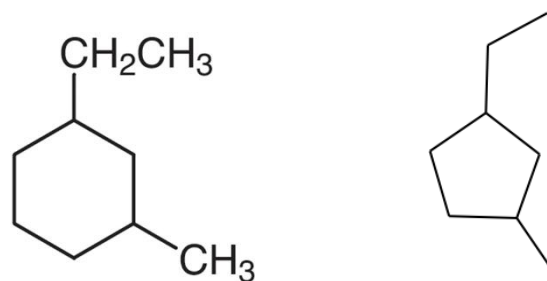
96. What is the IUPAC name?

- A) 1-Bromocyclohexane
- B) Bromocyclopentane
- C) Bromocyclohexane
- D) 2-Bromocyclohexane



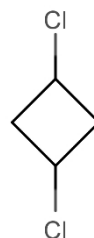
97. Which of the following is the correct IUPAC name?

- A) 1-Methyl-3-ethylcyclopentane
- B) 1-Ethyl-3-methylcyclopentane
- C) 3-Ethyl-1-methylcyclopentane
- D) 1-Ethyl-2-methylcyclopentane



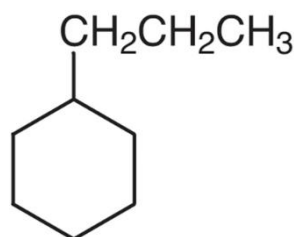
98. What is the IUPAC name?

- A) 1,2-Dichlorocyclobutane
- B) 1,3-Dichlorocyclobutane
- C) 1,1-Dichlorocyclobutane
- D) 2,3-Dichlorocyclobutane



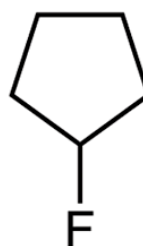
99. Which of the following is the correct IUPAC?

- A) 2-propylcyclohexane
- B) Propylcyclohexane
- C) Cyclohexylpropane
- D) 1-Isopropylcyclohexane



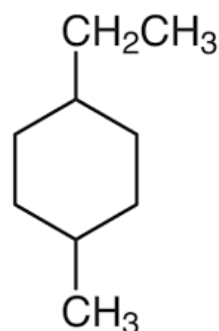
100. What is the IUPAC name?

- A) 1-Fluorocyclopentane
- B) Fluorocyclobutane
- C) Fluorocyclopentane
- D) 2-Fluorocyclopentane



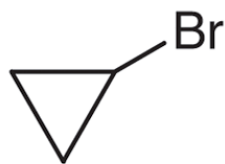
101. What is the IUPAC name?

- A) 1-Ethyl-4-methylcyclohexane
- B) 4-Ethyl-1-methylcyclohexane
- C) 1-Methyl-4-ethylcyclohexane
- D) 4-Methyl-1-ethylcyclohexane



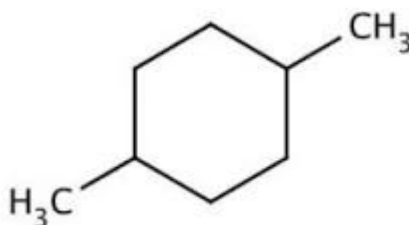
102. Which of the following is the correct IUPAC name?

- A) 1-Bromocyclopropane
- B) Bromocyclopropane
- C) 2-Bromocyclopropane
- D) Bromocyclobutane



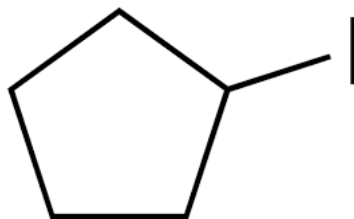
103. What is the IUPAC name for a six-membered carbon ring with two methyl groups, one at position 1 and another at position 4?

- A) 1,2-Dimethylcyclohexane
- B) 1,3-Dimethylcyclohexane
- C) 1,4-Dimethylcyclohexane
- D) 1,1-Dimethylcyclohexane



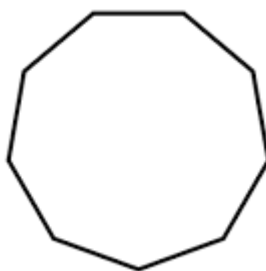
104. Which of the following is the correct IUPAC name?

- A) 1-Iodocyclopentane
- B) Iodocyclobutane
- C) Iodocyclopentane
- D) 2-Iodocyclopentane



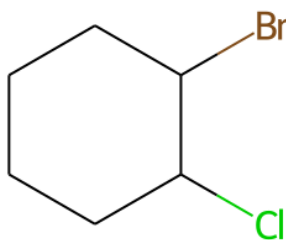
105. What is the IUPAC name for an eight-membered carbon ring?

- A) Cycloheptane
- B) Cyclononane
- C) Cyclooctane
- D) Cyclodecane



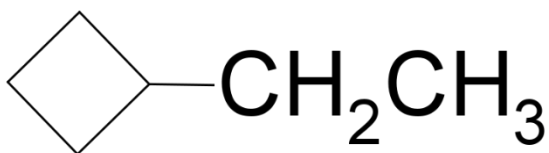
106. What is the IUPAC name?

- A) 2-Bromo-1-chlorocyclohexane
- B) 1-Chloro-2-bromocyclohexane
- C) 1-Bromo-2-chlorocyclohexane
- D) 2-Chloro-1-bromocyclohexane



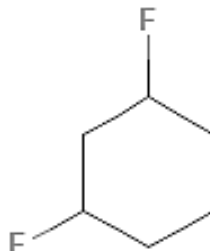
107. Which of the following is the correct IUPAC name?

- A) 1-Ethylcyclobutane
- B) Ethylcyclobutane
- C) Cyclobutylethane
- D) 2-Ethylcyclobutane



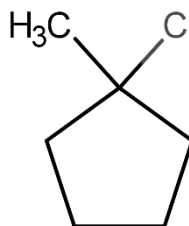
108. What is the IUPAC name?

- A) 1,2-Difluorocyclohexane
- B) 1,3-Difluorocyclohexane
- C) 1,4-Difluorocyclohexane
- D) 1,1-Difluorocyclohexane



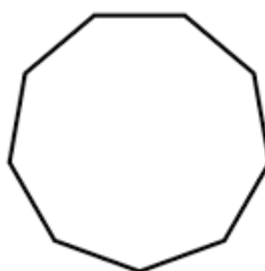
109. Which of the following is the correct IUPAC name?

- A) 1-Chloro-1-methylcyclopentane
- B) 1-Chloro-2-methylcyclopentane
- C) 1-Methyl-1-chlorocyclopentane
- D) 2-Methyl-1-chlorocyclopentane



110. What is the IUPAC name for a nine-membered carbon ring?

- A) Cyclooctane
- B) Cyclodecane
- C) Cyclononane
- D) Cycloheptane



Answers:

91) C

92) C

93) C

94) C

95) C

96) C

97) B

98) B

99) B

100) C

101) A

102) B

103) C

104) C

105) C

106) C

107) B

108) B

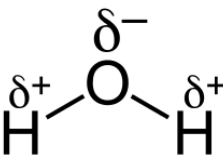
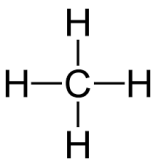
109) A

110) C

6) Explain the physical properties of alkanes (polarity, solubility, and hydrogen bonding)

Physical Properties of alkanes

When comparing an alkane with water,

Substance and formula	Water (H ₂ O)	Methane (CH ₄)
		
Molecular mass	18 amu	16 amu
State at room temperature	liquid	gas
Boiling point	100°C	-162°C
Melting point	0°C	-182°C

The bond between oxygen and hydrogen is a polar bond.

Polar means that the difference in electronegativity between atoms is high so one of them has a positive charge and the other one has a negative charge (sometimes they have partial +ve or -ve charge).

As the molecule has charges, attraction forces are generated between the different poles on the molecules resulting in high melting and boiling points, and also causes water to be liquid at room temperature.

The bond between carbon and hydrogen is a nonpolar bond.

nonpolar means that the difference in electronegativity between atoms is low so no charges formed on any atom in the molecule.

As the molecule has no charges, no attraction forces are generated between the molecules resulting in low melting and boiling points, and also causes methane to be gas at room temperature.

17) Use the difference in polarity to explain the immiscibility of alkanes and other hydrocarbons with water.

the attractive forces between alkane molecules are stronger than the attractive forces between the alkane and water molecules. Therefore, alkanes are more soluble in solvents composed of nonpolar molecules like themselves than in water, a polar solvent.

Chemical properties of alkanes

- ✓ The main chemical property of alkanes is their low reactivity.
- ✓ Many chemical reactions occur between substances with opposite charges (full charge or partial charge). Alkanes, in which atoms are connected by nonpolar bonds, have no charge. As a result, they have little attraction for ions or polar molecules.

The low reactivity of alkanes can also be attributed to the relatively strong C–C and C–H bonds.

111. *According to the text, what defines a "polar" bond?*

- A) The difference in electronegativity between atoms is high, leading to charges.
- B) The atoms share electrons equally.
- C) The bond results in low melting and boiling points.
- D) The difference in mass between atoms is high.

112. *Based on the text, what is the nature of the bond between carbon and hydrogen in alkanes?*

- A) Polar
- B) Nonpolar
- C) Ionic
- D) Metallic

113. *According to the provided information, what type of attractive forces are generated between molecules that have charges?*

- A) No attraction forces
- B) Dispersion forces only
- C) Attraction forces between different poles
- D) Only covalent bonds

114. *The low melting and boiling points of methane are attributed to:*

- A) Its high molecular mass.
- B) Strong attraction forces between molecules.
- C) The fact that it is a liquid at room temperature.
- D) The absence of charges and thus no strong attraction forces between molecules.

115. *What is the main chemical property of alkanes mentioned in the text?*

- A) High reactivity
- B) High polarity
- C) Low reactivity
- D) Ability to form strong hydrogen bonds

116. *According to the text, why do alkanes have little attraction for ions or polar molecules?*

- A) They are composed of charged particles.
- B) They have no charge, as atoms are connected by nonpolar bonds.
- C) They have high partial charges.
- D) Their atoms are connected by polar bonds.

117. *The relatively strong C-C and C-H bonds contribute to which property of alkanes?*

- A) High solubility in water
- B) Low melting point
- C) High reactivity
- D) Low reactivity

118. *Based on the table, what is the state of water at room temperature?*

- A) Gas
- B) Liquid
- C) Solid
- D) Plasma

119. *Why is methane a gas at room temperature and text?*

- A) It has a high boiling point.
- B) Strong attraction forces are generated between its molecules.
- C) It has no charges, leading to no strong attraction forces between molecules.
- D) Its molecular mass is higher than water.

120. *According to the explanation provided for immiscibility, what is true about the attractive forces when comparing alkane and water molecules?*

- A) Attractive forces between alkane and water molecules are stronger than between water molecules.
- B) Water is a nonpolar solvent.
- C) Alkanes are more soluble in water than in nonpolar solvents.
- D) Attractive forces between alkane molecules are stronger than between the alkane and water molecules.

121. *Which of the following is a characteristic of a nonpolar bond, as described?*

- A) High electronegativity difference.
- B) One atom has a positive charge, the other negative.
- C) Generates strong attraction forces between molecules.
- D) Low electronegativity difference, no charges formed.

122. *What state is water at room temperature, according to the provided table?*

- A) Liquid
- B) Gas
- C) Solid
- D) Plasma

123. *What is the melting point of methane?*

- A) 0°C
- B) -182°C
- C) 100°C
- D) -162°C

124. *What does "immiscibility" mean in the context of alkanes and water?*

- A) They mix perfectly.
- B) They do not mix or dissolve well.
- C) They form a homogeneous solution.
- D) They react chemically to form new compounds.

125. *Why are alkanes described as having "low reactivity"?*

- A) Because they have strong charges.
- B) Because they readily attract ions.
- C) Because their atoms are connected by nonpolar bonds and have no charge.
- D) Because they form many strong chemical bonds.

126. *What is the molecular mass of water?*

- A) 16 amu
- B) 18 amu
- C) -162 amu
- D) 0 amu

127. *What is the boiling point of water?*

- A) -162°C
- B) -182°C
- C) 100°C
- D) 0°C

128. *What is the molecular mass of methane?*

- A) 18 amu
- B) 16 amu
- C) 100 amu
- D) -162 amu

129. *Why are alkanes more soluble in solvents composed of nonpolar molecules, according to the text?*

- A) Because nonpolar solvents are very dense.
- B) Because nonpolar molecules are attracted to polar charges.
- C) Because nonpolar solvents react easily with alkanes.
- D) Because the attractive forces are similar to those between alkane molecules themselves.

130. *What is the state of methane at room temperature?*

- A) Liquid
- B) Solid
- C) Gas
- D) Plasma

Answers:

111) A

112) B

113) C

114) D

115) C

116) B

117) D

118) B

119) C

120) D

121) D

122) A

123) B

124) B

125) C

126) B

127) C

128) B

129) D

130) C

7) Distinguish between alkanes, alkenes, and alkynes in terms of the number of bonds, general formula, number of carbon atoms, number of hydrogen atoms, and examples of each

Alkenes: hydrocarbons that contain one or more double covalent bonds between carbon atoms in a chain.

18) Why do Alkenes considered to be unsaturated hydrocarbons?

Because it contains one or more double covalent bonds between carbon atoms in a chain.

Each alkene has two fewer hydrogen atoms than the corresponding alkane because two electrons now form the second covalent bond and are no longer available for bonding to hydrogen atoms.

Alkenes with only one double bond constitute a homologous series.

Feature	Alkanes	Alkenes	Alkynes
Number of Bonds	Only carbon-carbon single bonds (C-C)	At least one carbon-carbon double bond (C=C)	At least one carbon-carbon triple bond (C≡C)
General Formula	C_nH_{2n+2}	C_nH_{2n}	C_nH_{2n-2}
Number of Carbon Atoms	$n \geq 1$ (e.g., 1 for methane)	$n \geq 2$ (e.g., 2 for ethene)	$n \geq 2$ (e.g., 2 for ethyne)
Number of Hydrogen Atoms	$(2n+2)$ hydrogens	$(2n)$ hydrogens	$(2n-2)$ hydrogens
Examples	Methane (CH_4), Ethane (C_2H_6), Propane (C_3H_8)	Ethene (C_2H_4), Propene (C_3H_6), But-1-ene (C_4H_8)	Ethyne (C_2H_2), Propyne (C_3H_4), But-1-yne (C_4H_6)

131. Which class of hydrocarbons contains only carbon-carbon single bonds?

- A) Alkenes
- B) Alkynes
- C) Alkanes
- D) Aromatic hydrocarbons

132. What is the general formula for an alkane?

- A) C_nH_{2n}
- B) C_nH_{2n+2}
- C) C_nH_{2n-2}
- D) C_nH_n

133. How many hydrogen atoms does an alkene with 5 carbon atoms have?

- A) 12
- B) 10
- C) 8
- D) 6

134. *Why are alkenes considered to be unsaturated hydrocarbons?*

- A) They contain only single covalent bonds between carbon atoms.
- B) They are fully saturated with hydrogen atoms.
- C) They contain one or more double covalent bonds between carbon atoms.
- D) Their general formula is C_nH_{2n+2} .

135. *What is the general formula for an alkyne?*

- A) C_nH_{2n+2}
- B) C_nH_{2n}
- C) C_nH_{2n-2}
- D) C_nH_n

136. *An unknown hydrocarbon has the formula C_6H_{12} . To which class does it most likely belong?*

- A) Alkane
- B) Alkene
- C) Alkyne
- D) Aromatic hydrocarbon

137. *Which of the following is an example of an alkyne?*

- A) Ethane (C_2H_6)
- B) Ethene (C_2H_4)
- C) Ethyne (C_2H_2)
- D) Propane (C_3H_8)

138. *How many hydrogen atoms does an alkane with 4 carbon atoms have?*

- A) 6
- B) 8
- C) 10
- D) 12

139. *Which statement accurately describes the bonding in an alkyne?*

- A) It contains only carbon-carbon single bonds.
- B) It contains at least one carbon-carbon double bond.
- C) It contains at least one carbon-carbon triple bond.
- D) It contains both double and single bonds but no triple bonds.

140. *What is the minimum number of carbon atoms required for an alkene?*

- A) 1 B) 2 C) 3 D) 4

141. *A hydrocarbon with the formula C_3H_4 is most likely a(n):*

- A) Alkane
B) Alkene
C) Alkyne
D) Cycloalkane

142. *How does the number of hydrogen atoms in an alkene compare to the corresponding alkane with the same number of carbon atoms?*

- A) An alkene has two more hydrogen atoms.
B) An alkene has the same number of hydrogen atoms.
C) An alkene has two fewer hydrogen atoms.
D) An alkene has four fewer hydrogen atoms.

143. *What is the general formula for an alkene?*

- A) C_nH_{2n+2}
B) C_nH_n
C) C_nH_{2n-2}
D) C_nH_{2n}

144. *Which of the following is true for a homologous series of alkenes with only one double bond?*

- A) Each member has two more carbon atoms than the preceding one.
B) Each member has a different general formula.
C) Each member has two fewer hydrogen atoms than the corresponding alkane.
D) They are all gases at room temperature.

145. *What is the minimum number of carbon atoms required for an alkyne?*

- A) 1 B) 2 C) 3 D) 4

146. *If an alkane has 7 carbon atoms, how many hydrogen atoms does it have?*

- A) 12
B) 14
C) 16
D) 18

147. Which class of hydrocarbons is defined by containing one or more double covalent bonds between carbon atoms in a chain?

- A) Alkanes
- B) Alkenes
- C) Alkynes
- D) Cycloalkanes

148. A hydrocarbon has the formula C_5H_8 . Which class of hydrocarbon does it belong to?

- A) Alkane
- B) Alkene
- C) Alkyne
- D) Cycloalkane (single ring, one double bond)

149. Which of the following statements about alkanes is correct?

- A) They contain at least one double bond.
- B) They contain at least one triple bond.
- C) They are always gases at room temperature.
- D) They contain only carbon-carbon single bonds.

150. How many hydrogen atoms does an alkyne with 3 carbon atoms have?

- A) 4
- B) 6
- C) 8
- D) 10

Answers:

131) C

141) C

132) B

142) C

133) B

143) D

134) C

144) C

135) C

145) B

136) B

146) C

137) C

147) B

138) C

148) C

139) C

149) D

140) B

150) A

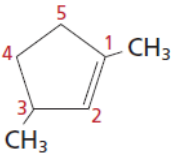
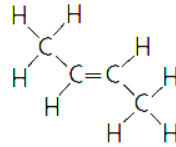
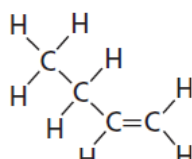
8) Write molecular formulas for examples of alkanes, alkenes, and alkynes using general formulas.

19) Complete the following table.

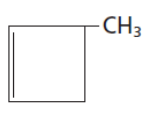
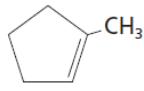
Number of carbon atoms	Molecular formula	Structural formula	Name	General formula
1	There is no alkene at one carbon atom because the alkene contains a double bond between two carbon atoms, so the least member of the alkenes contains two carbon atoms.			
2	C ₂ H ₄	$ \begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array} $	ethene	
3	C ₃ H ₆			
4		$ \begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & = & \text{C} & - \text{C} - \text{H} \\ & & & & & & \\ & \text{H} & & \text{H} & & \text{H} & \end{array} $		
5				
6				
7				

9) Use IUPAC system to name alkenes (straight chain, branched, non-substituted and substituted)

20) Write down the name of the following compounds.

Structural Formula			
The name			

Structural Formula	$\text{CH}_3\text{CH}=\underset{\text{CH}_3}{\text{CH}}\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{CHCH}_3$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_2 \\ \\ \text{CH}_3\text{CHCH}_2\text{CH}=\underset{\text{CH}_3}{\text{CH}}\text{CCH}_3 \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2\text{CHCH}=\text{CHCH}_2\text{CH}_3 \end{array}$
The name			

Structural Formula				
The name	2,4-dimethyl-1-octene	1, 4-diethyl cyclohexene		

Structural Formula	$\begin{array}{c} \text{CH}_3 \quad \text{CH}_2\text{CH}_2\text{CH}_3 \\ \quad \\ \text{C}=\text{C} \\ \quad \\ \text{CH}_2\text{CH}_3 \quad \text{CH}_2\text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_3\text{CH}_2 \\ \\ \text{C}=\text{CH}_2 \\ \\ \text{CH}_3\text{CH}_2 \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{C}=\text{CHCH}_3 \\ \\ \text{CH}_3 \end{array}$
The name			

151. What is the IUPAC name for the compound with the structural formula $\text{CH}_2=\text{CH}_2$?

- A) Ethane
- B) Propene
- C) Ethene
- D) Butene

152. Which of the following is the correct IUPAC name for the compound $\text{CH}_3\text{CH}=\text{CH}_2$?

- A) Butene
- B) Propene
- C) Ethene
- D) Propane

153. What is the IUPAC name for the compound with the structural formula $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$?

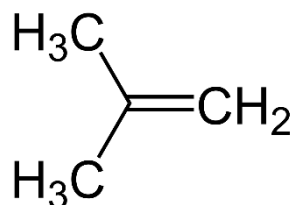
- A) But-2-ene
- B) But-1-ene
- C) Pent-1-ene
- D) Butane

154. Which of the following is the correct IUPAC name for the compound with the structural formula $\text{CH}_3\text{CH}=\text{CHCH}_3$?

- A) But-1-ene
- B) Pent-2-ene
- C) But-2-ene
- D) Prop-1-ene

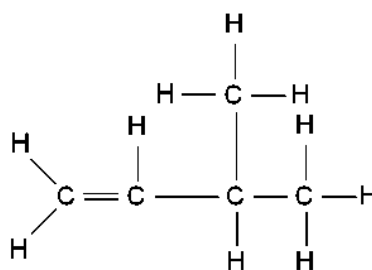
155. What is the IUPAC name for the compound with the structural formula ?

- A) But-2-ene
- B) 2-Methylbut-1-ene
- C) 2-Methylpropene
- D) Propene



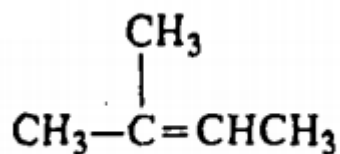
156. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 3-Methylbut-1-ene
- B) 2-Methylbut-1-ene
- C) 3-Methylbut-2-ene
- D) Pent-1-ene



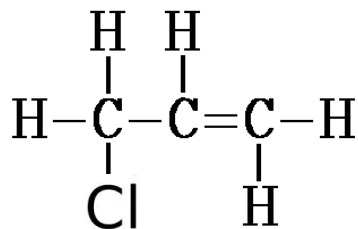
157. What is the IUPAC name for the compound with the structural formula ?

- A) 2,3-Dimethylbut-1-ene
- B) 2-Methylbut-2-ene
- C) 3-Methylbut-2-ene
- D) 2-Methylbut-1-ene



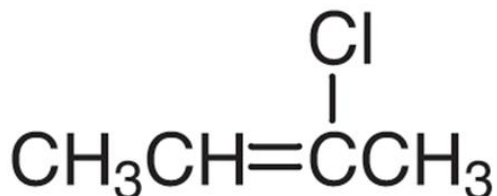
158. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 1-Chloroprop-1-ene
- B) 3-Chloroprop-1-ene
- C) 1-Chloroprop-2-ene
- D) 2-Chloropropene



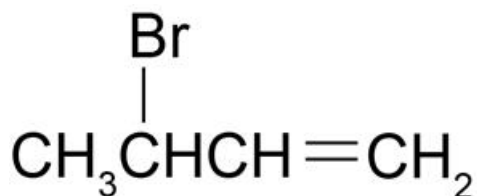
159. What is the IUPAC name for the compound with the structural formula ?

- A) 1-Chlorobut-2-ene
- B) 2-Chlorobut-2-ene
- C) 2-Chlorobut-1-ene
- D) 3-Chlorobut-2-ene



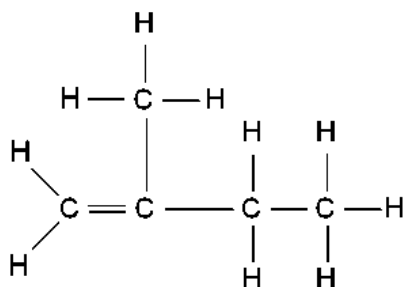
160. Which of the following is the correct IUPAC name for the compound with the structural formula ?

- A) 3-Bromobut-1-ene
- B) 2-Bromobut-3-ene
- C) 1-Bromobut-3-ene
- D) 4-Bromobut-1-ene



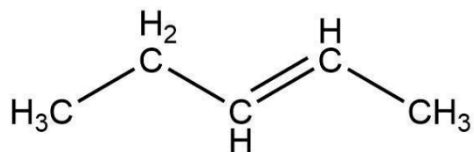
161. What is the IUPAC name for the compound with the structural formula?

- A) 2-Ethylpropene
- B) 2-Methylbut-1-ene
- C) 3-Methylbut-1-ene
- D) 2-Methylbut-2-ene



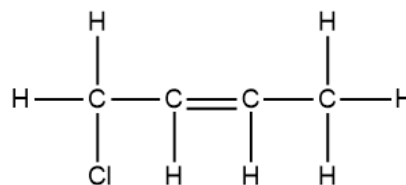
162. Which of the following is the correct IUPAC name for the compound with the structural formula ?

- A) Pent-1-ene
- B) Hex-2-ene
- C) Pent-2-ene
- D) Pent-3-ene



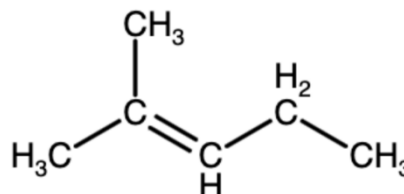
163. What is the IUPAC name for the compound with the structural formula $\text{CH}_2=\text{C}(\text{Cl})\text{CH}_2\text{CH}_3$?

- A) 1-Chlorobut-1-ene
- B) 1-chloro-2-butene
- C) 3-Chlorobut-1-ene
- D) 2-Chlorobut-2-ene



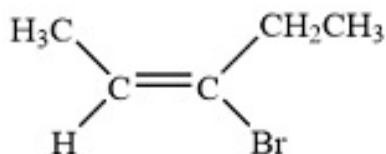
164. Which of the following is the correct IUPAC name for the compound with the structural formula ?

- A) 2-Methylpent-2-ene
- B) 4-Methylpent-2-ene
- C) 2-Methylpent-3-ene
- D) 3-Methylpent-3-ene



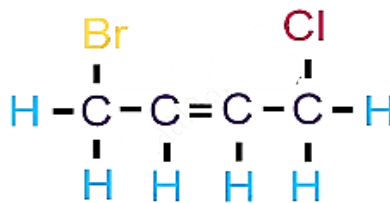
165. What is the IUPAC name for the compound with the structural formula ?

- A) 3-Bromopent-2-ene
- B) 2-Bromopent-2-ene
- C) 3-Bromopent-3-ene
- D) 2-Bromopent-3-ene



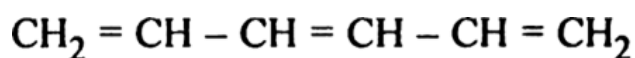
166. What is the IUPAC name for the compound with the structural formula?

- A) 2-bromo-3-chlorobutane
- B) 1-bromo-4-chlorobut-2-ene
- C) 3-bromo-2-chlorobutene
- D) 1-bromo-4-chlorobut-4-ene



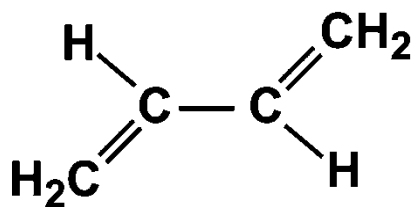
167. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) hexa-3,5-diene
- B) hexta-1,3,5-triene
- C) octata-1,3,5-triene
- D) hepta-1,3,5-triene



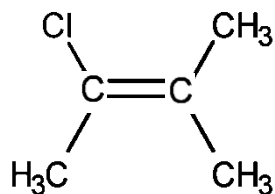
168. What is the IUPAC name for the compound with the structural formula ?

- A) But-1-ene
- B) But-2-ene
- C) Buta-1,3-diene
- D) But-1,4-diene



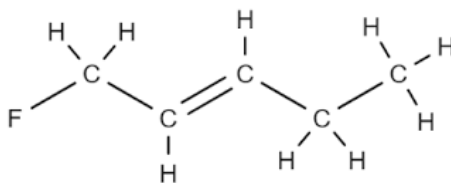
169. Which of the following is the correct IUPAC name for the compound with the structural formula?

- A) 2-Chloro-3-methylbut-2-ene
- B) 3-Chloro-2-methylbut-2-ene
- C) 2-Chloro-2,3-dimethylpropene
- D) 2-Chloro-3-methylbut-1-ene



170. What is the IUPAC name for the compound with the structural formula ?

- A) 1-Fluoropent-1-ene
- B) 3-Fluoropent-1-ene
- C) 2-Fluoropent-1-ene
- D) 1-Fluoropent-2-ene



Answers:

- 151) C
- 152) B
- 153) B
- 154) C
- 155) C
- 156) A
- 157) B
- 158) B
- 159) B
- 160) A

- 161) B
- 162) C
- 163) B
- 164) A
- 165) A
- 166) B
- 167) B
- 168) C
- 169) A
- 170) D

10) Draw the structure of an alkyne given its IUPAC name

Alkynes: unsaturated hydrocarbons that contain one or more triple bonds between carbon atoms in a chain.

Number of carbon atoms	Molecular formula	Structural formula	Name	General formula
1	There is no alkyne at one carbon atom because the alkyne has a triple bond between two carbon atoms, so the least member of the alkyne has two carbon atoms.			
2	C ₂ H ₂	H—C≡C—H	Ethyne "Acetylene"	
3	C ₃ H ₄			
4		$ \begin{array}{c} \text{H} \qquad \qquad \text{H} \\ \qquad \qquad \\ \text{H} - \text{C} - \text{C} \equiv \text{C} - \text{C} - \text{H} \\ \qquad \qquad \\ \text{H} \qquad \qquad \text{H} \end{array} $		
5				
6				
7				

11) Write possible structural isomers of alkanes, alkenes and alkynes

21) Complete the following table,

	$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{-CH-CH}_2\text{-CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{-C-CH}_3 \\ \\ \text{CH}_3 \end{array}$
Name			
General formula			

Isomers are two or more compounds that have the same molecular formula but different molecular structures.

22) Are cyclopentane and pentane isomers? Why?

Types of isomers

Structural isomers

Have the same chemical formula, but their atoms are bonded in different arrangements.

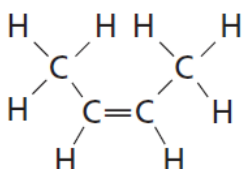
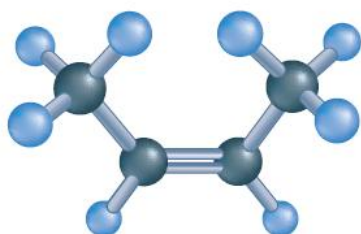
have different chemical and physical properties despite having the same formula.

As the number of carbons in a hydrocarbon increases, the number of possible structural isomers increases. For example, there are nine alkanes with the molecular formula C_7H_{16} . There are more than 300,000 structural isomers with the formula $\text{C}_{20}\text{H}_{42}$.

The structure of a substance determines its properties.

Stereoisomers

Stereoisomers are isomers in which all atoms are bonded in the same order but are arranged differently in space.

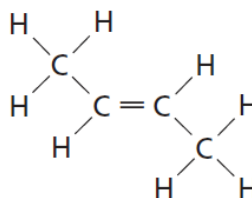
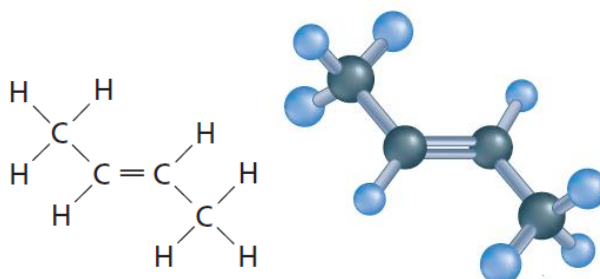


Cis

means *on the same side*

The arrangement in which the two methyl groups are on the same side of the molecule is indicated by the prefix *cis*-

cis-2-Butene (C_4H_8)



Trans

means *across from*.

The arrangement in which the two methyl groups are on the same side of the molecule is indicated by the prefix *cis*-

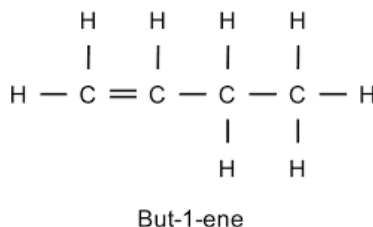
trans-2-Butene (C_4H_8)

171. Which of the following compounds is a structural isomer of pentane (C_5H_{12})?

- A) Butane
- B) 2,2-Dimethylpropane
- C) Hexane
- D) Pent-1-ene

172. Which of the following compounds is a structural isomer of but-1-ene?

- A) But-1-yne
- B) Pent-1-ene
- C) But-2-ene
- D) Butane



173. Which statement is TRUE about structural isomers?

- A) They have the same structural formulas.
- B) They have different molecular formulas.
- C) They have identical physical and chemical properties.
- D) They have the same molecular formula but different connectivity of atoms.

174. Which of the following is a structural isomer of propyne (C_3H_4)?

- A) Propene
- B) propadiene, $\text{CH}_2=\text{C}=\text{CH}_2$
- C) Propan-1-ol
- D) Propane

175. Which of the following alkanes does NOT have any structural isomers?

- A) Butane
- B) Pentane
- C) Hexane
- D) Ethane

176. The number of structural isomers generally _____ as the number of carbon atoms in a hydrocarbon increases.

- A) Decreases
- B) Stays the same
- C) Varies unpredictably
- D) Increases

177. Which two compounds are structural isomers?

- A) Methane and ethane
- B) Ethyne and ethene
- C) Cyclohexane and hex-1-ene
- D) Propane and cyclopropane

Answers:

171) B

172) C

173) C

174) B

175) D

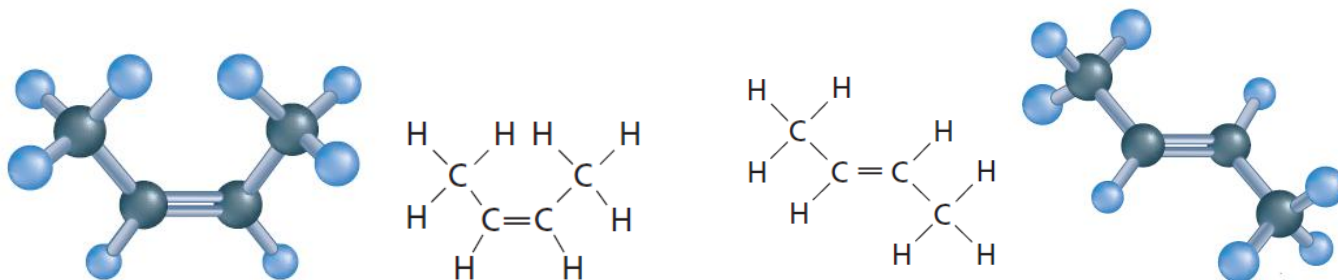
176) D

177) C

12) Describe the difference between cis- and trans- isomers in terms of geometrical arrangements

Stereoisomers

Stereoisomers are isomers in which all atoms are bonded in the same order but are arranged differently in space.



Cis

means *on the same side*

The arrangement in which the two methyl groups are on the same side of the molecule is indicated by the prefix *cis*-
cis-2-Butene (C_4H_8)

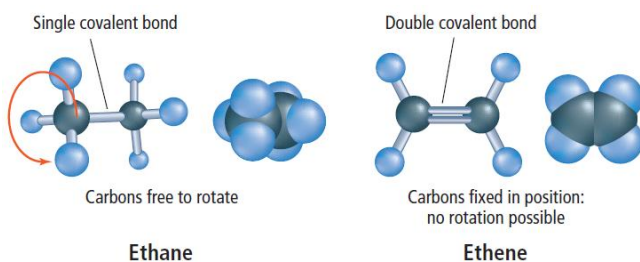
Trans

means *across from*.

The arrangement in which the two methyl groups are on the same side of the molecule is indicated by the prefix *cis*-
trans-2-Butene (C_4H_8)

23) There are no stereoisomers in alkanes, but there are in alkenes, why?

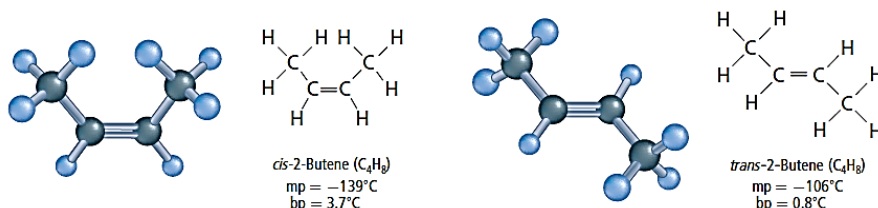
Two carbon atoms with a single bond between them can rotate freely in relationship to each other. However, when a second covalent bond is present, the carbons can no longer rotate; they are locked in place.



Ethane

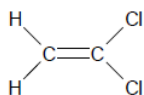
Ethene

- ✓ Variation in molecular geometry affects the physical properties of isomers such as melting point and boiling point.



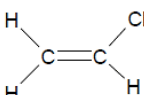
- ✓ Geometric isomers differ in some chemical properties.
- ✓ If the compound is biologically active, trans and cis isomers usually have very different effects.

"Fats with trans isomers are called trans fats. Many pre-packaged foods are made with trans fats because they have a longer shelf life. Evidence suggests that trans-fat increases the unhealthy form of cholesterol and decreases the healthy form, which increases the chance of heart disease."



24) Why: The following compound *does not form geometric isomers?*

Because the substituents are on one side of the bond



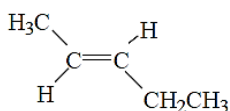
25) Why: The following compound *does not form geometric isomers?*

Because there are no two different groups attached to the two carbon atoms, there is one substituent (one chlorine atom).

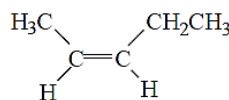
26) Why: The following compound $H-C\equiv C-H$ *does not form geometric isomers?*

Because the arrangement of atoms in space will not form any position (cis nor trans)

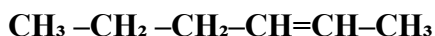
27) Draw the geometric isomers of the next molecules, and determine the state (cis), (trans)



trans



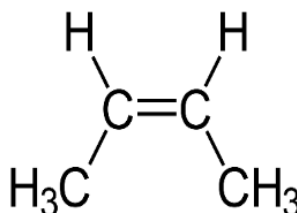
cis



3-methyl-2-pentene

178. What is the correct IUPAC name ?

- A) But-1-ene
- B) But-2-ene
- C) cis-But-2-ene
- D) trans-But-2-ene

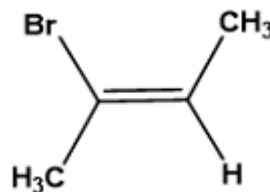


179. Which of the following compounds can exhibit cis-trans isomerism?

- A) But-1-ene ($CH_2=CHCH_2CH_3$)
- B) 1,1-Dichloroethene ($CH_2=CCl_2$)
- C) Propene ($CH_3CH=CH_2$)
- D) 2,3-Dimethylbut-2-ene ($CH_3C(CH_3)=C(CH_3)CH_3$)

180. What is its correct IUPAC name?

- A) 2-Bromo-2-butene
- B) trans-2-Bromo-2-butene
- C) cis-2-Bromo-2-butene
- D) 3-Bromo-2-butene

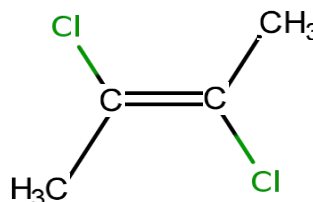


181. Which prefix indicates that two identical groups are on opposite sides of a double bond in a geometric isomer's name?

- A) cis-
- B) iso-
- C) trans-
- D) gem-

182. What is the IUPAC name ?

- A) 2,3-Dichlorobutane
- B) 1,4-Dichlorobut-2-ene
- C) trans-2,3-Dichlorobut-2-ene
- D) cis-2,3-Dichlorobut-2-ene



183. Why can't $\text{CH}_2=\text{CH}_2$ (Ethene) exhibit cis-trans isomerism?

- A) It's an alkane.
- B) It has free rotation around the double bond.
- C) Each carbon atom in the double bond does not have two different groups attached.
- D) It is a cyclic compound.

184. A compound is named *cis*-1,2-Dichloropropene. What does the "*cis*-" indicate about the arrangement of the chlorine atoms?

- A) They are on opposite sides of the double bond.
- B) They are on the same carbon atom.
- C) They are on the same side of the double bond.
- D) They are bonded to different carbons, but not explicitly cis or trans.

185. Which of the following alkanes cannot have cis-trans isomers?

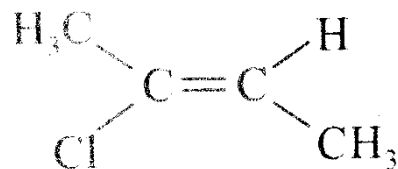
- A) Butane
- B) Pentane
- C) Ethane
- D) All alkanes cannot have cis-trans isomers.

186. Consider the compound trans-1-Bromo-2-chloroethene. What does the "trans-" tell you about the bromine and chlorine atoms?

- A) They are both bonded to the same carbon atom.
- B) They are on the same side of the double bond.
- C) They are on opposite sides of the double bond.
- D) Their positions are not fixed.

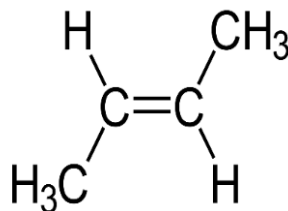
187. What is the correct name?

- A) trans-2-Chloro-2-butene
- B) 1-Chloro-2-butene
- C) cis-2-Chloro-2-butene
- D) 2-Chloro-2-methylpropene



188. What is the correct IUPAC name ?

- A) Butane
- B) trans-But-2-ene
- C) cis-But-2-ene
- D) But-1-ene

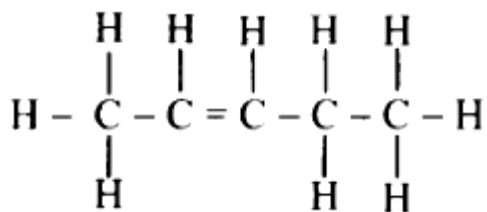


189. Which condition must be met for a compound to exhibit cis-trans isomerism?

- A) It must have only single bonds.
- B) Each carbon atom involved in the double bond must be attached to two different groups.
- C) It must be a cyclic compound.
- D) It must have at least one triple bond.

190. What is the correct IUPAC name?

- A) Pent-1-ene
- B) Pent-2-ene
- C) Pent-3-ene
- D) Hex-2-ene



191. Why can't ethyne ($\text{H}-\text{C}\equiv\text{C}-\text{H}$) form geometric isomers?

- A) It is an alkane.
- B) It has only single bonds.
- C) The linear geometry of the triple bond prevents distinct cis/trans arrangements.
- D) It is a branched compound.

192. If a compound is named *trans*-1,2-Dibromoethene, which describes the arrangement of the bromine atoms?

- A) On the same carbon atom.
- B) On the same side of the double bond.
- C) Across from each other on the double bond.
- D) Not fixed in space.

193. Which of the following alkenes cannot exhibit *cis-trans* isomerism because one of the double-bonded carbons has two identical substituents?

- A) 1-Chloropropene
- B) 2-Chlorobut-2-ene
- C) 2-Methylpropene
- D) 1,2-Dichloroethene

194. How do geometric isomers generally differ in their chemical properties?

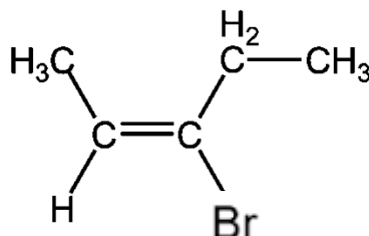
- A) They react identically with all reagents.
- B) They have identical chemical properties due to the same molecular formula.
- C) They differ in some chemical properties.
- D) They only differ in their reaction with water.

195. What prefix is used to indicate that two specified groups are on the same side of a double bond?

- A) trans-
- B) vic-
- C) cis-
- D) gem-

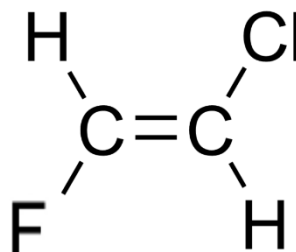
196. A compound has the formula $\text{CH}_3\text{CH}_2\text{C}(\text{Br})=\text{CHCH}_3$, what is the IUPAC name?

- A) 2-Bromo-3-pentene
- B) 3-Bromo-2-pentene
- C) cis-3-Bromo-2-pentene
- D) trans-3-Bromo-2-pentene



197. What is the correct IUPAC name?

- A) 1,2-Dihaloethene
- B) 1-Chloro-1-fluoroethene
- C) trans-1-Chloro-2-fluoroethene
- D) cis-1-Chloro-2-fluoroethene



Answers:

178) C

179) D

180) B

181) C

182) C

183) C

184) C

185) D

186) C

187) A

188) B

189) B

190) B

191) C

192) C

193) C

194) C

195) C

196) C

197) C

13) Use IUPAC system to name the aromatic compounds

Aromatic Compounds


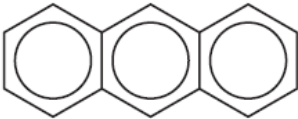
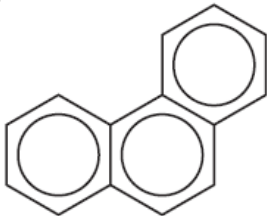

Aromatic compounds: Organic compounds that contain benzene rings.

The term aromatic was originally used because many of the compounds associated with benzene, known in the nineteenth century, were found in the pleasant-smelling oils found in spices, fruits, and other parts of plants.

Aliphatic compounds: Hydrocarbons such as alkanes, alkenes, and alkynes.

The word aliphatic, from the Greek origin, means fat. This is because ancient chemists obtained aliphatic compounds by heating animal fats and lipids.

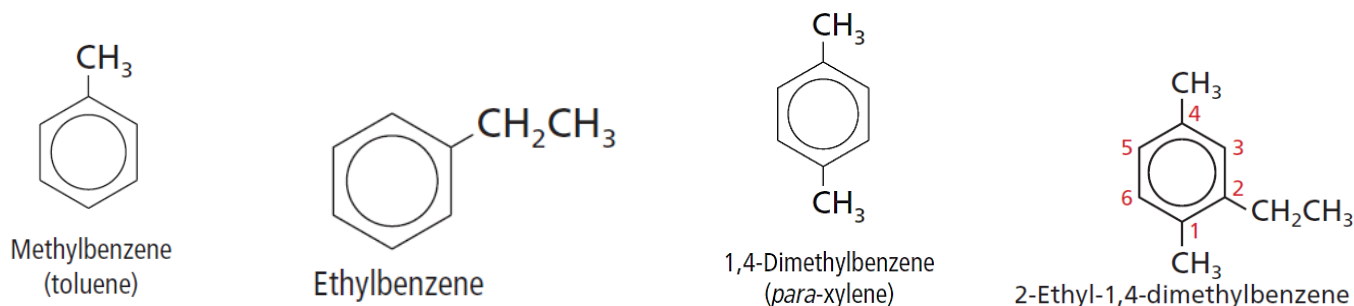
Fused-ring system: An organic compound has two or more cyclic structures with a common side.

			
Naphthalene	Anthracene	Phenanthrene	p-Xylene (1,4-dimethylbenzene)
used to make dyes and as a moth repellent.	used to produce dyes and pigments.	present in the atmosphere due to the incomplete combustion of hydrocarbons.	used to make polyester fibres and fabrics.

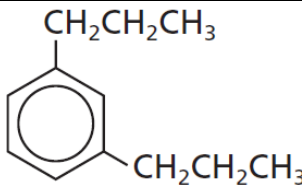
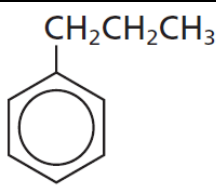
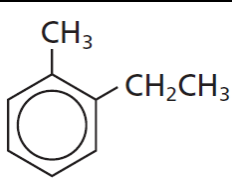
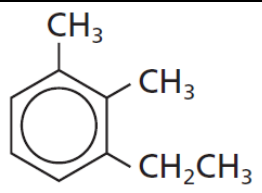
Naming substituted aromatic compounds.

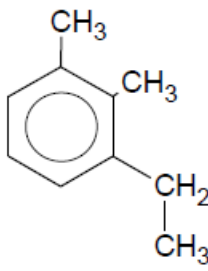
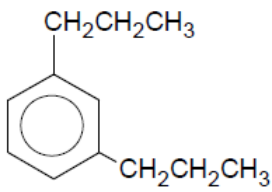
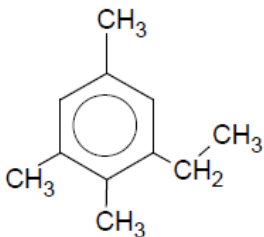
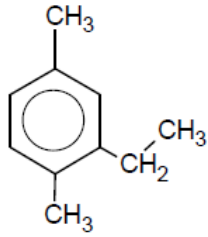
Benzene compounds with substituent groups are named in the same cycloalkane way. For example, ethylbenzene has an ethyl group, which is made of ethyl group attached to the ring, and 4,1-dimethylbenzene, para-xylene, contains two methyl groups attached to sites 1 and 4.

The branched benzene rings are numbered just like the branched cycloalkanes in such a way as to give the smallest possible numbers for the sites of substituent groups or (branches). And because the word ethyl comes before methyl in alphabetical order, it is written first as: 2-ethyl-1, 4-dimethylbenzene.



28) Name the aromatic compound shown.

29) Draw the structure of 1,4-dimethylbenzene.

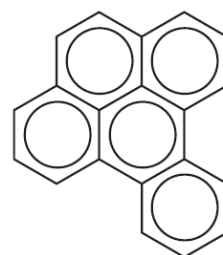
Carcinogens

In the past, some aromatic compounds were used, such as benzene - toluene - xylene (as industrial and laboratory solvents), but There are health risks associated with aromatic compounds such as:

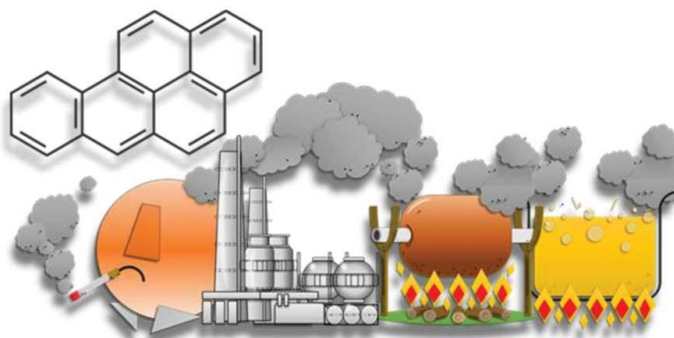
- 1- Respiratory diseases
- 2- Problems related to the liver
- 3 - damage to the nervous system

Note: Some aromatic compounds are carcinogens (causing cancer). An example of the first carcinogen: *benzopyrene*. It is a by-product of combustion of complex mixtures of organic materials (such as wood and charcoal). This substance has been found in chimneys, and smokestacks in Britain.

Some aromatic compounds in gasoline have been known to be carcinogenic.



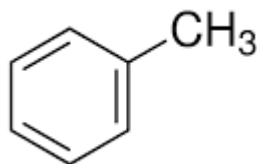
Benzopyrene



Benzo(a)pyrene

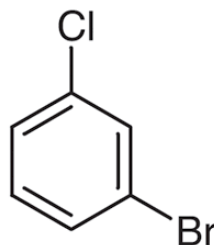
198. What is the correct IUPAC name?

- A) Methylbenzene
- B) Benzenemethyl
- C) Toluene
- D) Phenol



199. What is its correct IUPAC name?

- A) 3-Chloro-1-bromobenzene
- B) 1-Bromo-3-chlorobenzene
- C) 3-Bromo-1-chlorobenzene
- D) 1-Chloro-3-bromobenzene

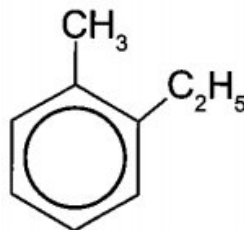


200. What is the IUPAC name for p-Xylene?

- A) 1,4-dimethylbenzene
- B) 1,3-dimethylbenzene
- C) 1,2-dimethylbenzene
- D) 1,1-dimethylbenzene

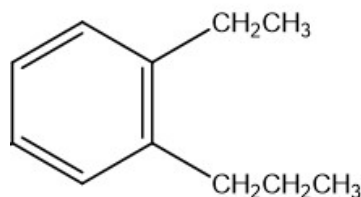
201. What is its correct IUPAC name?

- A) 1-Ethyl-2-methylbenzene
- B) 4-Methyl-1-ethylbenzene
- C) 1-Methyl-5-ethylbenzene
- D) 5-Ethyl-1-methylbenzene



202. What is the IUPAC name ?

- A) 1-ethyl-2-methylbenzene
- B) 1-ethyl-2-propylbenzene
- C) 2-ethyl-1-propylbenzene
- D) 1-Propyl-2-methylbenzene



203. Which rule takes precedence when assigning numbers to substituents on a benzene ring with multiple substituents?

- A) Alphabetical order of substituents.
- B) Giving the lowest possible numbers to the substituent locations.
- C) Assigning number 1 to the most complex substituent.
- D) Numbering clockwise starting from any point.

204. Which of the following terms, according to the text, means "fat" and refers to hydrocarbons like alkanes, alkenes, and alkynes?

- A) Aromatic
- B) Cyclic
- C) Aliphatic
- D) Saturated

205. What is the common name for methylbenzene?

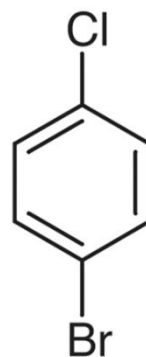
- A) o-Xylene
- B) Toluene
- C) p-Xylene
- D) Anthracene

206. A fused-ring system is defined as an organic compound that has two or more cyclic structures sharing what characteristic?

- A) A common functional group.
- B) A common side.
- C) A common solvent.
- D) A common molecular weight.

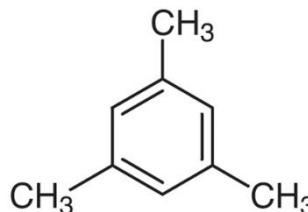
207. What is the IUPAC name ?

- A) 1- Bromo -4-cyclohexene
- B) 1-Bromo-4-chlorobenzene
- C) 1-Chloro-4-bromobenzene
- D) 4-bromo-1-chlorobenzene



208. What is the IUPAC name?

- A) 1,3,5-Methylbenzene
- B) Trimethylbenzene
- C) 1,3,5-Trimethylbenzene
- D) 1,5,3-Trimethylbenzene

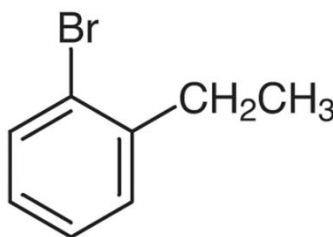


209. The original term "aromatic" for compounds associated with benzene was used because many were found in what?

- A) Highly reactive substances.
- B) Pleasant-smelling oils.
- C) Animal fats and lipids.
- D) Incomplete combustion products.

210. What is the correct IUPAC ?

- A) 2-Ethyl-1-bromobenzene
- B) 1-Bromo-2-ethylbenzene
- C) 1-Ethyl-2-bromobenzene
- D) 2-Bromo-1-ethylbenzene

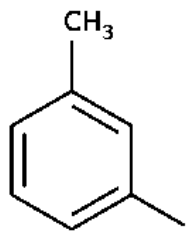


211. Which of the following fused-ring systems is described as being present in the atmosphere due to incomplete combustion of hydrocarbons?

- A) Naphthalene
- B) Anthracene
- C) p-Xylene
- D) Phenanthrene

212. What is the correct IUPAC name ?

- A) 3-Methyl-1-iodobenzene
- B) 1-Iodo-3-methylbenzene
- C) 1-Methyl-3-iodobenzene
- D) 3-Iodo-1-methylbenzene

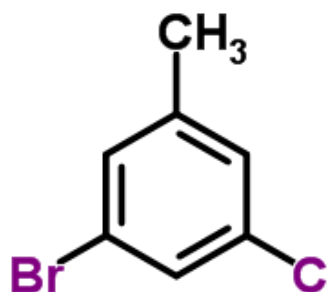


213. Which of the following is a common use for Naphthalene, as stated in the text?

- A) To make polyester fibres.
- B) To produce dyes and pigments.
- C) As a moth repellent.
- D) As an atmospheric pollutant from combustion.

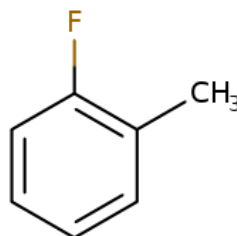
214. What is the IUPAC name ?

- A) 1-Methyl-3-bromo-5-chlorobenzene
- B) 3-bromo-5-chloro-1-methylbenzene
- C) 1-Bromo-3-chloro-5-methylbenzene
- D) 5-Chloro-1-methyl-3-bromobenzene



215. What is the correct IUPAC name ?

- A) 2-Methyl-1-fluorobenzene
- B) 1-Fluoro-2-methylbenzene
- C) 1-Methyl-2-fluorobenzene
- D) 2-Fluoro-1-methylbenzene

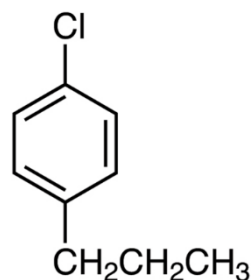


216. Anthracene is described as being used to produce what?

- A) Moth repellent.
- B) Polyester fibres.
- C) Spices and fruits oils.
- D) Dyes and pigments.

217. What is the correct IUPAC name ?

- A) 4-propyl-1-chlorobenzene
- B) 1-propyl-4-chlorobenzene
- C) 4-Chloro-1-propylbenzene
- D) 1-Chloro-4-propylbenzene



Answers:

198) A

199) B

200) A

201) A

202) B

203) B

204) C

205) B

206) B

207) B

208) C

209) B

210) B

211) D

212) B

213) C

214) C

215) B

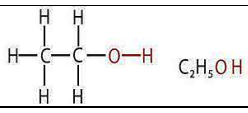
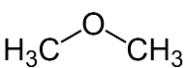
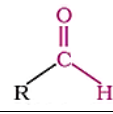
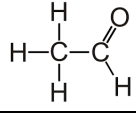
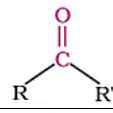
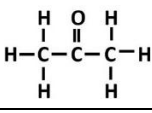
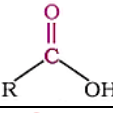
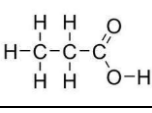
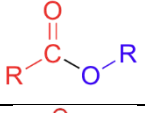
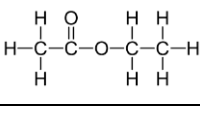

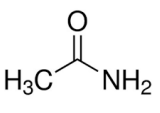
216) D

217) D

14) Identify general formula, molecular formula, structural formula and functional group for different families of organic compounds including alcohols, ethers, carbonyl containing compounds (carboxylic acids, ketones, aldehydes, esters), compounds containing nitrogen (amines and amides)

Functional group: is an atom or group of atoms that always reacts in a certain way.

R, R' : represent carbon chains or rings bonded to the functional group.

Organic compounds and their functional groups				
Compound type	general formula	functional group	Example	
Halocarbon	$R-X$ (X = F, Cl, Br, I)	Halogen	Bromomethane	CH_3Br
Alcohols	$R-OH$	Hydroxyl	Ethanol	 C_2H_5OH
Ethers	$R-O-R'$	Ether	Dimethyl ether	
Amines	$R-NH_2$	Amine	Methylamine	CH_3NH_2
Aldehydes		Carbonyl	Ethanal	
Ketones		Carbonyl	Propanone	
Carboxylic acid		Carboxyl	Propanoic acid	
Esters		Ester	Ethyl ethanoate	
Amides		Amide	Acetamide	

218. According to the table, what is the functional group for Alcohols?

- A) Ether
B) Carbonyl
C) Hydroxyl
D) Amine

219. Which of the following is the general formula for a Ketone?

- A) $R-CHO$
B) $R-CO-R'$
C) $R-COOH$
D) $R-O-R'$

220. The compound "Ethanal" is an example of which type of organic compound?

- A) Ketone
- B) Carboxylic acid
- C) Aldehyde
- D) Amine

221. Based on the table, what is the general formula for a Halocarbon?

- A) R-OH
- B) R-NH₂
- C) R-O-R'
- D) R-X (X = F, Cl, Br, I)

222. What is the functional group named "Amide" associated with?

- A) R-NH₂
- B) R-CO-NH₂
- C) R-OH
- D) R-CHO

223. "Dimethyl ether" is an example of a compound with which general formula?

- A) R-OH
- B) R-O-R'
- C) R-CHO
- D) R-CO-R'

224. Which compound type has a "Carboxyl" functional group, as indicated by the table?

- A) Aldehydes
- B) Ketones
- C) Carboxylic acid
- D) Amine

225. What is the functional group for Amines according to the table?

- A) Hydroxyl
- B) Carbonyl
- C) Amine (functional group name)
- D) Ester

226. If a compound has the general formula $R\text{-CO-NH}_2$, what is its compound type?

- A) Amine
- B) Aldehyde
- C) Amide
- D) Ketone

227. Which compound type, has a "Halogen" functional group?

- A) Alcohols
- B) Ethers
- C) Halocarbon
- D) Amines

228. "Propanone" is listed as an example of which compound type?

- A) Aldehyde
- B) Ketone
- C) Ester
- D) Carboxylic acid

229. The general formula for an Aldehyde is given as:

- A) $R\text{-CO-R'}$
- B) $R\text{-CHO}$
- C) $R\text{-COOH}$
- D) $R\text{-OH}$

230. What is the functional group of an Ester, according to the provided table?

- A) Carbonyl
- B) Carboxyl
- C) Ester (functional group name)
- D) Amide

231. Which compound type has the general formula $R\text{-COOH}$?

- A) Aldehyde
- B) Ketone
- C) Carboxylic acid
- D) Ester

232. "Methylamine" is an example from which family of organic compounds?

- A) Alcohols
- B) Ethers
- C) Amines
- D) Amides

233. The functional group for "Aldehydes" is described as:

- A) Hydroxyl
- B) Ether
- C) Carbonyl
- D) Amine

234. What is the general formula for an Amine?

- A) $R\text{-OH}$
- B) $R\text{-O-R'}$
- C) $R\text{-NH}_2$
- D) $R\text{-CHO}$

235. "Ethyl ethanoate" is an example of which compound type?

- A) Aldehyde
- B) Ketone
- C) Carboxylic acid
- D) Ester

236. What is the functional group found in "Acetamide"?

- A) Amine
- B) Ether
- C) Amide
- D) Hydroxyl

237. Which compound type is associated with the general formula $R-OH$?

- A) Alcohols
- B) Ethers
- C) Halocarbons
- D) Aldehydes

Answers:

218) C

219) B

220) C

221) D

222) B

223) B

224) C

225) C

226) C

227) C

228) B

229) B

230) C

231) C

232) C

233) C

234) C

235) D

236) C

237) A

15) Write the IUPAC name of alkyl halides and aryl halides

Naming halocarbons

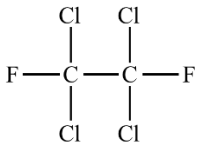
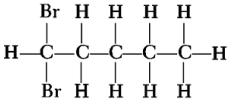
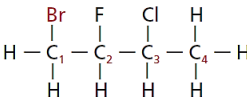
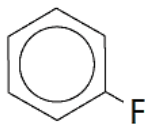
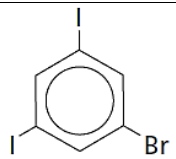
It is based on the main carbon chains of the constituent alkanes.

The prefix in alkyl halide denotes the halogen present in it with the addition of the letter (-o) at the end of it (fluoro - chloro - bromo - iodo).

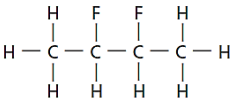
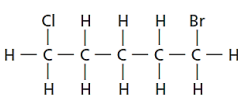
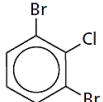
In case that more than one halogen atom are present in the same molecule, the atoms are mentioned in the name according to their alphabetical order.

The main carbon chain should be numbered so that the first carbon atom attached to the functional group has the lowest possible number.

Likewise, the benzene ring is numbered in aryl halide, so that each associated functional group has the lowest possible number.

				
		1-Bromo-3-chloro-2-fluorobutane	Fluorobenzene	1-Bromo-3,5-diiodobenzene

Name the alkyl or aryl halide whose structure is shown.

				
			2-bromo-2-chloro-1,1,1-trifluoroethane	1,4-dichlorobenzene
1,3 - dibromo-2-chlorobenzene	2-Chlorobutane	1,3-Difluorobenzene	1,1,1-trichlorobutane	1-Bromo-4-Chlorobenzene

What is the correct IUPAC prefix for a bromine atom in an alkyl halide name?

- A) Bromo-
- B) Bromido-
- C) Bromyl-
- D) Bromato-

238. According to IUPAC rules for alkyl halides, how should the main carbon chain be numbered?

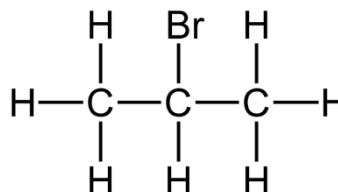
- A) To give the longest possible chain.
- B) To give the first carbon atom attached to the functional group the lowest possible number.
- C) To prioritize alphabetical order of substituents.
- D) To start numbering from the carbon closest to a branching point.

239. If an alkyl halide contains both a chlorine and a fluorine atom, which halogen should be mentioned first in the name?

- A) Chlorine (due to lower atomic number)
- B) Fluorine (due to being a smaller atom)
- C) Chlorine (due to alphabetical order)
- D) Fluorine (due to alphabetical order)

240. What is the IUPAC name for?

- A) Isopropyl bromide
- B) Bromopropane
- C) 2-Bromopropane
- D) Propyl bromide

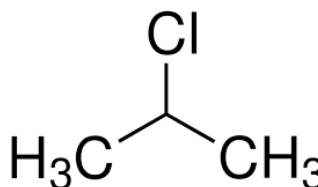


241. How is the benzene ring numbered in an aryl halide?

- A) To give the highest possible numbers for substituents.
- B) Arbitrarily, as long as all groups are listed.
- C) So that each associated functional group has the lowest possible number.
- D) Starting from the methyl group if present.

242. What is the IUPAC name for ?

- A) 1-Chloropropane
- B) 2-Chloropropane
- C) Isopropyl chloride
- D) Propyl chloride

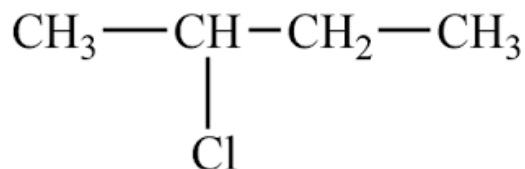


243. A compound is named 1,2-dibromoethane. What does the "dibromo" indicate?

- A) Two different halogens are present.
- B) Two bromine atoms are present.
- C) The bromine atoms are on different carbons.
- D) The compound is an aryl halide.

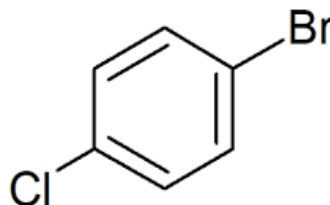
244. What is the correct IUPAC name ?

- A) 1-Chlorobutane
- B) 2-Chlorobutane
- C) Butyl chloride
- D) Sec-butyl chloride



245. If an aryl halide has a bromine at position 1 and a chlorine at position 4 on the benzene ring, what is its IUPAC name?

- A) 4-Chloro-1-bromobenzene
- B) 1-Bromo-4-chlorobenzene
- C) 1-Chloro-4-bromobenzene
- D) 4-Bromo-1-chlorobenzene

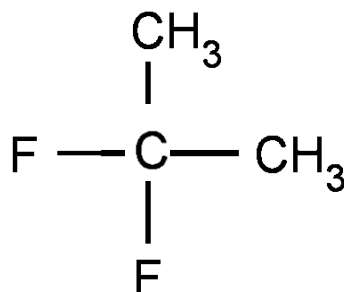


246. What prefix is used for an iodine atom in IUPAC naming of halocarbons?

- A) Iod-
- B) Iodo-
- C) Iodino-
- D) Iodato-

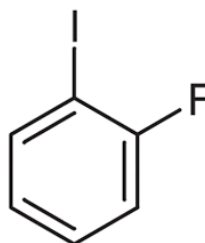
247. What is the IUPAC name ?

- A) 2,2-Difluoropropane
- B) 1,1-Difluoropropane
- C) Difluoroisopropane
- D) Propane difluoride



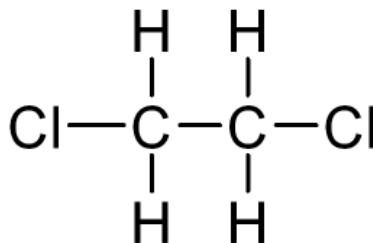
248. What is the IUPAC name?

- A) 2-Iodo-1-fluorobenzene
- B) 1-Fluoro-2-iodobenzene
- C) 1-Iodo-2-fluorobenzene
- D) 2-Fluoro-1-iodobenzene



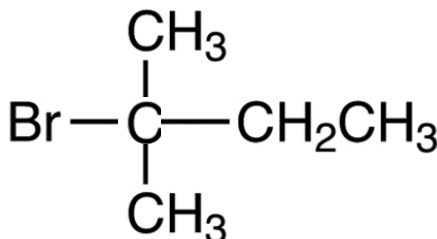
249. What is the IUPAC name?

- A) 1,1-Dichloroethane
- B) 1,2-Dichloroethane
- C) Ethylene dichloride
- D) Vicinal dichloroethane



250. What is the correct IUPAC name?

- A) 1-Bromo-2-methylbutane
- B) 2-Bromo-2-methylbutane
- C) Butyl bromide
- D) butyl bromide butane



251. What is the correct IUPAC prefix for a chlorine atom in an alkyl halide name?

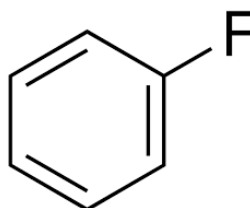
- A) Chlor-
- B) Chloro-
- C) Chlorido-
- D) Chlorato-

252. How are multiple halogen atoms mentioned in the name if present in the same molecule?

- A) In order of increasing atomic number.
- B) Randomly, as long as all are listed.
- C) According to their alphabetical order.
- D) In order of increasing molecular weight.

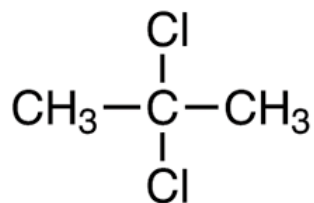
253. What is the IUPAC name?

- A) Phenyl fluoride
- B) Benzyl fluoride
- C) Fluorobenzene
- D) Benzene fluoride



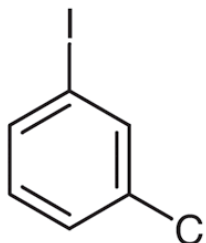
254. What is the IUPAC name for ?

- A) 1,1-Dichloropropane
- B) 2,2-Dichloropropane
- C) Dichloroisopropane
- D) Propane dichloride



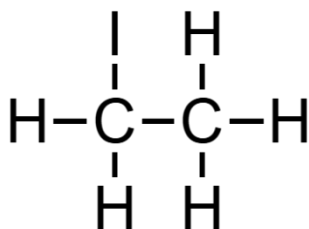
255. What is its IUPAC name?

- A) 3-Iodo-1-chlorobenzene
- B) 1-Chloro-3-iodobenzene
- C) 1-Iodo-3-chlorobenzene
- D) 3-Chloro-1-iodobenzene



256. What is the IUPAC name?

- A) Iodoethane
- B) Ethyl iodide
- C) 1-Iodoethane
- D) Ethane iodide



Answers:

238) B

239) C

240) C

241) C

242) B

243) B

244) B

245) B

246) B

247) A

248) B

249) B

250) B

251) B

252) C

253) C

254) B

255) B

256) A

16) Explains the properties and uses of alkyl halides.

Properties of halocarbons,

boiling point :

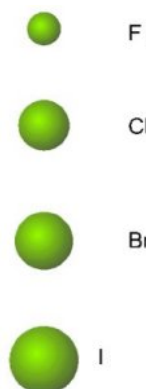
Structure	Name	Boiling Point(°C)	Density (g/mL) in Liquid State
CH ₄	methane	-162	0.423 at -162°C
CH ₃ Cl	chloromethane	-24	0.911 at 25°C (under pressure)
CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	pentane	36	0.626
CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ F	1-fluoropentane	62.8	0.791
CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ Cl	1-chloropentane	108	0.882
CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ Br	1-bromopentane	130	1.218
CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ I	1-iodopentane	155	1.516

Alkyl halides have a higher boiling point than the alkanes with the same number of carbon atoms.

Because the halogen atom has a high electronegativity, and as a result, alkyl halides have temporary dipoles. so, the particles are attracted together and require higher energy to break these attraction forces, which leads to an increase in the boiling point.

Boiling point increases when switching from fluorine to chlorine, bromine, and iodine.

When moving from fluorine to iodine, the size of the halogen atom increases, the number of electrons far from the nucleus increases and their rate of shifting position increases, meaning that these el⁻ electrons change their location easily, this shifting form temporary dipoles that increase the forces of attraction between the molecules, so they need more energy to break these attraction forces.

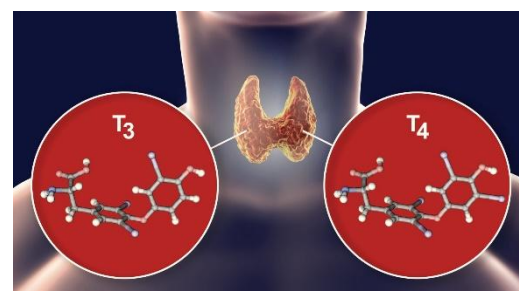


The boiling point of 1-chloropropane is higher than the boiling point of propane,

1-chloropropane is a polar compound that forms dipole-dipole forces. The molecules are bound to each other with strong attractive forces greater than the weak London dispersion forces that arise between non-polar propane molecules.

presence in nature:

Although thyroid hormones are organic iodide, organic halides are seldom present in nature.



Uses of halocarbons,

Alkyl halides are used as raw materials in many chemical industries instead of alkanes.

Because the halogen atoms bonded with the carbon are more active than the substituted hydrogen atoms.

They are used as solvents and detergents because it dissolves non-polar compounds such as fats and oils.

Used in the plastic industry.

Example 1: PTFE (polytetrafluoroethene) is used as a non-stick surface in many kitchen utensils, such as baking dough tools, and it consists of hundreds of units of Tetrafluoroethene.

Example 2: PVC polyvinylchloride. Common name (vinyl) is used in the manufacture of thin flexible or rigid sheets - and in samples.

Plastic : a polymer that can be heated and molded while relatively soft.



Halothane, a halogenated hydrocarbon (2-bromo-2-chloro-1,1,1-trifluoroethane), was first used as a general anesthetic in the 1950s.



257. Why do alkyl halides generally have higher boiling points compared to alkanes with the same number of carbon atoms?

- A) Because alkanes are more polar than alkyl halides.
- B) Because halogen atoms increase the molecular weight significantly, leading to stronger London dispersion forces.
- C) Because halogen atoms have high electronegativity, leading to temporary dipoles and stronger attractions.
- D) Because alkyl halides form hydrogen bonds, unlike alkanes.

258. When comparing 1-fluoro, 1-chloro, 1-bromo, and 1-iodopentane, what is the general trend observed in their boiling points?

- A) Boiling point decreases from fluorine to iodine.
- B) Boiling point increases from fluorine to iodine.
- C) Boiling point remains relatively constant across the halogens.
- D) Boiling point is solely dependent on the carbon chain length, not the halogen type.

259. *The increase in boiling point when moving from a fluorocarbon to an iodocarbon with the same carbon chain is primarily due to:*

- A) A decrease in the size of the halogen atom.
- B) An increase in the number of electrons far from the nucleus, leading to easier shifting and stronger temporary dipoles.
- C) Stronger ionic bonds being formed.
- D) A reduction in intermolecular forces.

260. *How do the attractive forces between molecules in 1-chloropropane compare to the weak London dispersion forces that arise between non-polar propane molecules?*

- A) The attractive forces in 1-chloropropane are weaker.
- B) The attractive forces are about the same strength.
- C) The attractive forces in 1-chloropropane are stronger.
- D) Propane molecules form dipole-dipole forces, while 1-chloropropane forms only London dispersion forces.

261. *Alkyl halides are widely used as raw materials in many chemical industries instead of alkanes primarily because:*

- A) They are less reactive than alkanes.
- B) The hydrogen atoms bonded to carbon are more active than halogen atoms.
- C) The halogen atoms bonded with the carbon are more active than substituted hydrogen atoms.
- D) They are more readily available in nature.

262. *Which property of alkyl halides makes them effective as solvents and detergents?*

- A) Their high melting points.
- B) Their ability to dissolve non-polar compounds such as fats and oils.
- C) Their low density.
- D) Their typically gaseous state at room temperature.

263. *PTFE (polytetrafluoroethene) is specifically mentioned for its use in:*

- A) Pharmaceutical applications as an anesthetic.
- B) Manufacturing of thin, flexible sheets.
- C) Providing a non-stick surface for kitchen utensils.
- D) Creating rigid construction materials.

264. What characteristic makes alkyl halides form temporary dipoles?

- A) The symmetrical structure of the molecule.
- B) The strong covalent bonds between carbon and hydrogen.
- C) The high electronegativity of the halogen atom.
- D) Their inability to form intermolecular forces.

265. Compared to propane, 1-chloropropane is a polar compound. What type of intermolecular forces does it primarily form that propane does not?

- A) Ionic bonds.
- B) Hydrogen bonds.
- C) London dispersion forces.
- D) Dipole-dipole forces.

266. What is a "plastic" generally described as in the context of the provided text?

- A) A material that is always rigid and unyielding.
- B) A compound exclusively used as a solvent.
- C) A natural substance found only in fats.
- D) A polymer that can be heated and molded while relatively soft.

267. What is the general statement made about the natural presence of organic halides, despite thyroid hormones being organic iodides?

- A) They are abundantly present in nature.
- B) They are seldom present in nature.
- C) They are only found in certain marine organisms.
- D) Their natural occurrence is increasing due to human activity.

268. Which of the following is an example of an alkyl halide mentioned as being used in the plastic industry?

- A) Halothane.
- B) Methane.
- C) Chloromethane.
- D) PVC.

269. The text implies that breaking the attractive forces between alkyl halide particles requires more energy because:

- A) The particles are highly unreactive.
- B) The intermolecular forces are very weak.
- C) The temporary dipoles create stronger attractions between molecules.
- D) The covalent bonds within the molecules are exceptionally strong.

270. What specific type of halogenated hydrocarbon was first used as a general anesthetic in the 1950s?

- A) Polyvinylchloride.
- B) Tetrafluoroethene.
- C) 1-Chloropentane.
- D) Halothane.

271. What happens to the "rate of shifting position" of electrons far from the nucleus as the size of the halogen atom increases from fluorine to iodine?

- A) It decreases.
- B) It remains constant.
- C) It increases.
- D) It becomes negligible.

272. How are the attractive forces that bind 1-chloropropane molecules to each other described, relative to the London dispersion forces in non-polar propane?

- A) Weaker attractive forces.
- B) Identical attractive forces.
- C) Non-existent attractive forces in 1-chloropropane.
- D) Stronger attractive forces.

273. The primary reason alkyl halides are preferred over alkanes in chemical industries is related to the activity of which atoms?

- A) Oxygen atoms in the atmosphere.
- B) Carbon atoms in the chain.
- C) Halogen atoms bonded to carbon.
- D) Hydrogen atoms attached to carbon.

274. What is the common name mentioned for polyvinylchloride (PVC)?

- A) Teflon.
- B) Plexiglass.
- C) Vinyl.
- D) Styrofoam.

275. Which of the following best explains why temporary dipoles are significant for alkyl halides' properties?

- A) They decrease the density of the compounds.
- B) They reduce the energy needed for phase changes.
- C) They make the compounds non-polar.
- D) They increase the forces of attraction between molecules.

276. What was a historical use of Halothane, as mentioned in the text?

- A) As a non-stick coating for cookware.
- B) For manufacturing flexible plastic sheets.
- C) As a primary ingredient in detergents.
- D) As a general anesthetic in medicine.

Answers

257) B

258) B

259) B

260) C

261) C

262) B

263) C

264) C

265) D

266) D

267) B

268) D (PVC is polyvinylchloride, a polymer made from vinyl chloride, which is a haloalkane derivative)

269) C

270) D

271) C

272) D

273) C

274) C

275) D

276) D

17) Define substitution reaction while writing the equation for the substitution reaction including halogenation of alkanes, alkyl halide-alcohol reaction and alkyl halide-ammonia reaction

Substitution Reactions

One of the methods used to convert alkanes to other compounds such as alkyl halides, alcohols and amines are substitution reactions by introducing functional groups to alkane.

substitution reaction is one in which one atom or a group of atoms in a molecule is replaced by another atom or group of atoms.

Halogenation : process happens with alkanes, hydrogen atoms can be replaced by atoms of halogens, typically chlorine or bromine.

Iodine does not react well with alkanes.

Generic Reaction		Example	
Substitution Reaction	$\text{R-CH}_3 + \text{X}_2 \rightarrow \text{R-CH}_2\text{X} + \text{HX}$ where X is fluorine, chlorine, or bromine	Substitution Reaction (Halogenation)	$\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{HCl}$ Ethane Chloroethane

Further substitution

The halogen atom in the alkyl halide can be replaced by an atom or group of atoms,

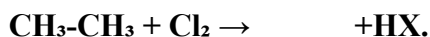
Example 1: Alcohol is the result of replacing the halogen atom in the alkyl halide with an (OH^-) group when the alkyl halide is reacted with a basic solution.

Generic Reaction		Example	
General Alkyl Halide-Alcohol Reaction	$\text{R-X} + \text{OH}^- \rightarrow \text{R-OH} + \text{X}^-$ Alkyl halide Alcohol	Alkyl Halide-Alcohol Reaction	$\text{CH}_3\text{CH}_2\text{Cl} + \text{OH}^- \rightarrow \text{CH}_3\text{CH}_2\text{OH} + \text{Cl}^-$ Chloroethane Ethanol

Example 2: Alkyl amines are formed as a result of replacing the halogen atom with an amine group ($-\text{NH}_2$) when the alkyl halide is reacted with ammonia (NH_3)

Generic Reaction		Example	
General Alkyl Halide-Ammonia Reaction	$\text{R-X} + \text{NH}_3 \rightarrow \text{R-NH}_2 + \text{HX}$ Alkyl halide Amine	Alkyl Halide-Ammonia Reaction	$\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{Br} + \text{NH}_3 \rightarrow \text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{NH}_2 + \text{HBr}$ 1-Bromooctane Octaneamine

277. Consider the reaction: what is the main organic product?



- A) $\text{C}_2\text{H}_6\text{Cl}$
- B) HCl
- C) $\text{C}_2\text{H}_5\text{Cl}$
- D) C_2H_4

278. For the reaction: $\text{CH}_3\text{CH}_2\text{Cl} + \text{OH}^- \rightarrow \quad + \text{Cl}^-$, what organic compound is formed?

- A) Chloroethane
- B) Ethanol
- C) Ethanal
- D) Methane

279. Given the reaction: $\text{R-X} + \text{NH}_3 \rightarrow \text{R-NH}_2 + \text{HX}$. If R-X is 1-Bromooctane and the organic product is Octaneamine ($\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{NH}_2$), what is the inorganic byproduct?

- A) NH_4Br
- B) H_2O
- C) HBr
- D) N_2

280. In the halogenation example shown, $\text{C}_2\text{H}_6 + \text{Cl}_2 \rightarrow [\text{Products}]$. What are the two specific products of this reaction?

- A) $\text{C}_2\text{H}_5\text{Cl}$ and H_2
- B) $\text{C}_2\text{H}_5\text{Cl}$ and HCl
- C) C_2H_4 and HCl
- D) CH_3Cl and CH_3Cl

281. Consider the generic reaction for Alkyl Halide-Alcohol formation: $\text{CH}_3\text{I} + \text{OH}^- \rightarrow \quad$, what organic product would you expect?

- A) Methanal
- B) Methane
- C) Methanol
- D) Methylamine

282. If you react a halocarbon ($R-X$) with ammonia (NH_3), according to the generic reaction $R-X + NH_3 \rightarrow R-NH_2 + HX$, what general class of organic compound is formed?

- A) Alcohols
- B) Amines
- C) Amides
- D) Esters

283. The functional group of a Ketone is a Carbonyl group ($R-CO-R'$). Which of the following is an example of a Ketone?

- A) Ethanal
- B) Propanone
- C) Propanoic acid
- D) Ethyl ethanoate

284. For the reaction $CH_3CH_2Cl + OH^- \rightarrow [Products]$. One of the products is Cl^- . What is the other product?

- A) CH_3CH_2Cl
- B) CH_3CH_2OH
- C) $CH_2=CH_2$
- D) HCl

285. Given the example reaction $Reactant + NH_3 \rightarrow CH_3(CH_2)_6CH_2NH_2 + HBr$. What is the specific organic reactant?

- A) Octaneamine
- B) Ammonia
- C) 1-Bromooctane
- D) Hydrobromic acid

286. What type of functional group is found in a Carboxylic acid?

- A) Hydroxyl
- B) Carboxyl
- C) Carbonyl (at the end of a chain)
- D) Ether

287. According to the "Halogenation" section, which atoms typically replace hydrogen atoms in alkanes during this process?

- A) Oxygen or Nitrogen
- B) Fluorine or Sulfur
- C) Chlorine or Bromine
- D) Carbon or Hydrogen

288. If an alkyl halide is reacted with a basic solution to replace the halogen atom with an OH group, what type of organic product is generally formed?

- A) An amine
- B) An alcohol
- C) An ether
- D) An aldehyde

289. The general formula for an amine is $R-NH_2$. Which of the following is an example of an amine from the table?

- A) Ethanol
- B) Dimethyl ether
- C) Methylamine
- D) Acetamide

290. Consider the conversion of 1-Bromooctane to Octaneamine. This process involves the replacement of a halogen atom with which specific group?

- A) -OH
- B) -COO-
- C) -NH₂
- D) -CHO

291. What is the name of the halocarbon reactant in the Alkyl Halide-Alcohol Reaction example?

- A) Ethanol
- B) Chloroethane
- C) Ethanal
- D) Methanol

292. What is the general formula for an Ether?

- A) R-OH
- B) R-NH₂
- C) R-O-R'
- D) R-CHO

293. If a molecule undergoes a "substitution reaction," what fundamental change occurs?

- A) Two molecules combine into one larger molecule.
- B) A molecule breaks down into smaller fragments.
- C) An atom or group of atoms is replaced by another atom or group of atoms.
- D) Atoms rearrange within the same molecule without replacement.

294. What is the functional group that defines an Amide?

- A) NH_2
- B) CO
- C) $-\text{CONH}_2$
- D) $\text{R-O-R}'$

295. In the reaction $\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{Br} + \text{NH}_3 \rightarrow \text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{NH}_2 + \text{HBr}$, which reactant is an alkyl halide?

- A) NH_3
- B) HBr
- C) $\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{NH}_2$
- D) $\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{Br}$

296. Which compound from the table is an example of an Ester?

- A) Ethanal
- B) Propanone
- C) Propanoic acid
- D) Ethyl ethanoate

Answers:

277) C

278) B

279) C

280) B

281) C

282) B

283) B

284) B

285) C

286) B

287) C

288) B

289) C

290) C

291) B

292) C

293) C

294) C

295) D

296) D

18) Explains the properties and uses of alcohols.

Alcohols

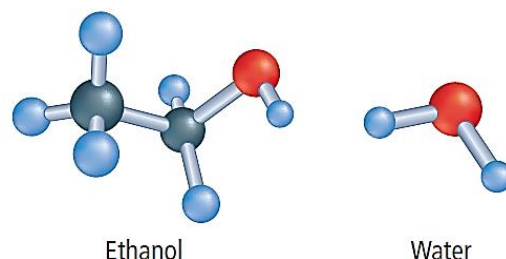
Hydroxyl group (–OH): An oxygen-hydrogen group covalently bonded to a carbon atom.

Alcohol: An organic compound in which a hydroxyl group replaces a hydrogen atom of a hydrocarbon.

The general formula for an alcohol is ROH.

Alcohol can be produced naturally; Ethanol is produced by yeasts when they ferment sugars, such as those in grapes and bread dough and carbon dioxide is produced as a by-product.

If we compare the ethanol molecule and the water molecule, we will notice that the covalent bond angle of oxygen in ethanol is approximately equal to the angle of the covalent bond of oxygen in water, so the hydroxyl group is moderate-polar in alcohol molecules as in water molecules, and hydrogen bonds can be formed with hydroxyl groups in other alcohol molecules, and because of these bonds, the boiling point of the alcohols is higher than the boiling point of hydrocarbons of similar shape and size.



Alcohol's properties

boiling point :

The boiling point of alcohols is higher than the boiling point of hydrocarbons similar to them in shape and size because the alcohols contain a moderate-polar hydroxyl group that can form hydrogen bonds between its molecules, which makes it require high energy to break it down and convert it from liquid to gas.

Solubility in water:

Alcohols are miscible with water and once they are mixed it is difficult to completely separate them from each other because alcohol molecules contain polar hydroxyl groups that can form hydrogen bonds with water molecules.

The distillation process is used to separate ethanol from water, but after completing the separation process, about 5% of the alcohol remains in the mixture.

Alcohols are used as organic solvents for other polar organic compounds because they contain the polar hydroxyl group and can dissolve other polar compounds.

Denatured alcohol: is ethanol to which small amounts of noxious materials, such as aviation gasoline or other organic solvents, have been added.

Ethanol is denatured in order to make it unfit to drink.



Alcohol uses

Alcohol	uses
<i>Methanol</i>	<ul style="list-style-type: none">✓ The simplest alcohol.✓ Manufacture of paint removers.
<i>Ethanol</i>	<ul style="list-style-type: none">✓ Effective antiseptic, ethanol can be used to swab skin before an injection is given.✓ Added to gasoline to increase its effectiveness.✓ Raw material for the manufacture of more complex organic compounds.
<i>2-Butanol</i>	<ul style="list-style-type: none">✓ Dyes industry.✓ Varnish industry.
<i>Cyclohexanol</i>	<ul style="list-style-type: none">✓ Toxic compound.✓ Manufacture of insecticides.✓ A solvent for many plastics.
<i>Glycerol</i>	<ul style="list-style-type: none">✓ Antifreeze in aviation fuel.

297. *What is the functional group present in an alcohol, as identified in the "Organic compounds and their functional groups" table?*

- A) Hydroxyl group
- B) Carbonyl group
- C) Ether linkage
- D) Amine group

298. *According to the text, what is produced by yeasts as a by-product when they ferment sugars to produce ethanol?*

- A) Methane
- B) Carbon dioxide
- C) Water
- D) Oxygen

299. *Alcohols have a higher boiling point than hydrocarbons of similar shape and size primarily because:*

- A) Hydrocarbons have stronger London dispersion forces.
- B) Alcohols are less dense than hydrocarbons.
- C) The moderate-polar hydroxyl group in alcohols allows for hydrogen bonding between molecules.
- D) Alcohols have a higher molecular weight due to oxygen.

300. Which alcohol is described as the "simplest alcohol" in the "Alcohol uses" table?

- A) Glycerol
- B) 2-Butanol
- C) Ethanol
- D) Methanol

301. Why is ethanol typically denatured?

- A) To improve its solubility in water.
- B) To make it unfit to drink.
- C) To enhance its antiseptic properties.
- D) To increase its effectiveness as a fuel.

302. Based on the "Alcohol uses" table, which alcohol is an effective antiseptic and can be used to swab skin before an injection is given?

- A) Methanol
- B) Ethanol
- C) 2-Butanol
- D) Cyclohexanol

303. What is the general formula for an alcohol, as stated in the text and "Organic compounds and their functional groups" table?

- A) R-CHO
- B) R-O-R'
- C) R-OH
- D) R-NH₂

304. What is one of the listed uses for 2-Butanol according to the "Alcohol uses" table?

- A) Manufacture of paint removers.
- B) Used in the dyes industry.
- C) Antifreeze in aviation fuel.
- D) Solvent for many plastics.

305. *Alcohols are miscible with water because their molecules contain polar hydroxyl groups that can form what kind of bonds with water molecules?*

- A) Ionic bonds
- B) Metallic bonds
- C) Hydrogen bonds
- D) Covalent bonds

306. *Which alcohol is described as a "toxic compound" and is used in the manufacture of insecticides according to the "Alcohol uses" table?*

- A) Ethanol
- B) Cyclohexanol
- C) Methanol
- D) 2-Butanol

307. *What is the approximate covalent bond angle of oxygen in ethanol when compared to the angle of the covalent bond of oxygen in water?*

- A) It is much smaller.
- B) It is much larger.
- C) It is approximately equal.
- D) It is irrelevant to its properties.

308. *The distillation process is used to separate ethanol from water, but after completing the separation process, about what percentage of the alcohol remains in the mixture?*

- A) 1%
- B) 5%
- C) 10%
- D) 15%

309. *What term is used for ethanol to which small amounts of noxious materials, such as aviation gasoline or other organic solvents, have been added?*

- A) Absolute alcohol
- B) Pure alcohol
- C) Denatured alcohol
- D) Industrial alcohol

310. *What is a listed use for Glycerol in the provided table?*

- A) Raw material for complex organic compounds.
- B) Solvent for many plastics.
- C) Manufacture of paint removers.
- D) Antifreeze in aviation fuel.

311. *What type of bond do alcohol molecules form with hydroxyl groups in other alcohol molecules, making them require higher energy to convert from liquid to gas?*

- A) Ionic bonds
- B) Metallic bonds
- C) Hydrogen bonds
- D) Covalent bonds

312. *What is a primary use of Methanol, according to the "Alcohol uses" table?*

- A) Swabbing skin before injection.
- B) Manufacturing of paint removers.
- C) As antifreeze in aviation fuel.
- D) In the varnish industry.

313. *How is an alcohol defined in the text?*

- A) An organic compound that contains only carbon and hydrogen.
- B) An organic compound in which a carbonyl group replaces a hydrogen atom of a hydrocarbon.
- C) An organic compound with an ether linkage.
- D) An organic compound in which a hydroxyl group replaces a hydrogen atom of a hydrocarbon.

314. *What characteristic of alcohol molecules allows them to act as organic solvents for other polar organic compounds?*

- A) Their large size.
- B) Their non-polar nature.
- C) The presence of the polar hydroxyl group.
- D) Their ability to form metallic bonds.

315. *Besides its use as an effective antiseptic, Ethanol is also added to gasoline for what purpose?*

- A) To decrease its toxicity.
- B) To increase its density.
- C) To increase its effectiveness.
- D) To change its color.

316. *Which alcohol from the "Alcohol uses" table is specifically mentioned as a solvent for many plastics?*

- A) Methanol
- B) Ethanol
- C) 2-Butanol
- D) Cyclohexanol

Answers:

297) A

298) B

299) C

300) D

301) B

302) B

303) C

304) B

305) C

306) B

307) C

308) B

309) C

310) D

311) C

312) B

313) D

314) C

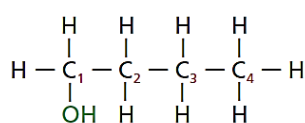
315) C

316) D

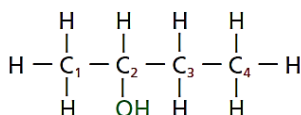
19) Draw the structure of an alcohol given its name

Naming of alcohols according to the IUPAC system:

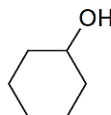
- Alcohols are named according to their corresponding alkanes (chain – cycle), as for alkyl halides. For example, CH_4 is methane and CH_3OH is methanol; CH_3CH_3 is ethane and $\text{CH}_3\text{CH}_2\text{OH}$ is ethanol.
- The nomenclature for simple alcohols depends on the number of carbon atoms in the corresponding alkane chain.
- Alkane is named first, then the syllable (*ol*) is added to indicate the presence of the hydroxyl group.
- When alcohols consist of three(3) or more carbon atoms, the location of the hydroxyl group must be indicated by a number.
- If the carbon chain contains more than one hydroxyl group, the di, tri or tetra syllable is added before the name, then the name of alkane is added followed by the syllable (*ol*) at the end of the name.



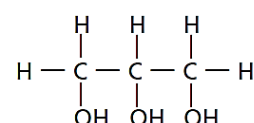
1-Butanol



2-Butanol



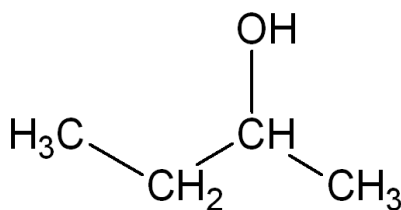
Cyclohexanol



**1,2,3-Propanetriol
(glycerol)**

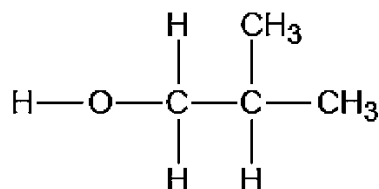
317. What is the correct IUPAC name for the following compound?

- A) 2-Butanol
- B) 1-Butanol
- C) Butan-4-ol
- D) Butyl alcohol



318. What is the correct IUPAC name for the following compound?

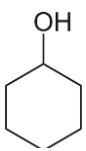
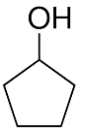
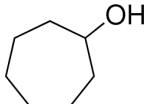
- A) 2-methylpropan-1-ol
- B) 2-methylpropan-2-ol
- C) 1-methylpropan-1-ol
- D) 1-methylpropan-2-ol



319. What is the common name for CH_3OH ?

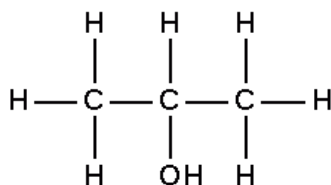
- A) Ethanol
- B) Isopropyl alcohol
- C) Methyl alcohol
- D) Methanol

320. Which of the following structures corresponds to cyclohexanol?

- A) 
- B) $\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{OH}$
- C) 
- D) 

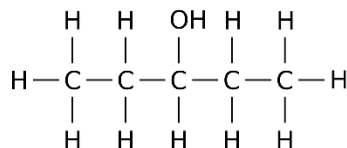
321. What is the correct IUPAC name for?

- A) Propan-1-ol
- B) 2-Propanol
- C) Isopropanol
- D) 1-Methylethanol



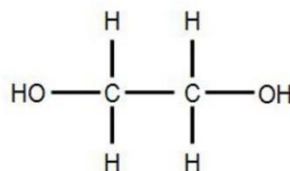
322. What is the correct IUPAC name for?

- A) 3-pentanol
- B) 3-Methyl-3-pentanol
- C) 3-Methyl-1-pentanol
- D) 3-butanol



323. What is the correct IUPAC name for the following compound?

- A) 1,2-Ethanediol
- B) Ethylene glycol
- C) Ethanol
- D) 1,1-Ethanediol

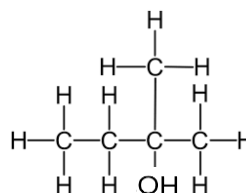


324. Which name is NOT an IUPAC name for an alcohol?

- A) Butan-2-ol
- B) 2-Methylpropan-2-ol
- C) Isopropyl alcohol
- D) Cyclopentanol

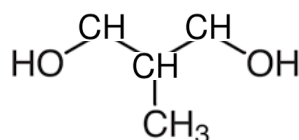
325. Which of the following represents the structure?

- A) butan-2-ol
- B) 2-methylbutan-2-ol
- C) pentan-2-ol
- D) 1-methylbutan-2-ol



326. What is the correct IUPAC name for?

- A) 2-Methyl-1,3-propanediol
- B) 2-Methylpropan-1,1-diol
- C) 1,3-Dihydroxy-2-methylpropane
- D) propyl glycol

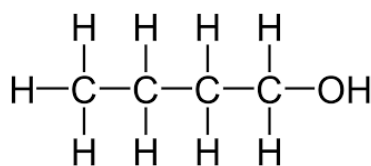


327. Which alcohol is commonly known as rubbing alcohol?

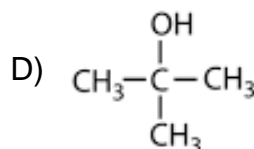
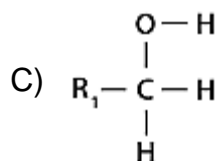
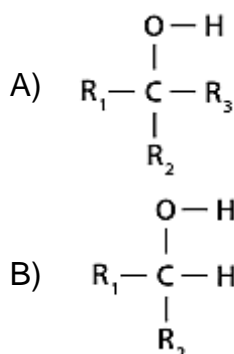
- A) Methanol
- B) Ethanol
- C) 1-Propanol
- D) Isopropanol

328. What is the correct IUPAC name for the compound with the formula $\text{CH}_3(\text{CH}_2)_3\text{OH}$?

- A) Butanol
- B) Butan-4-ol
- C) n-Butyl alcohol
- D) 1-Butanol

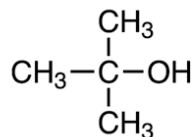


329. Which of the following is a primary alcohol?



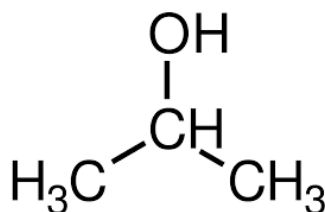
330. What is the correct IUPAC name for?

- A) Butan-2-ol
- B) 2-Methyl-2-propanol
- C) tert-Butyl alcohol
- D) 2,2-Dimethylethanol



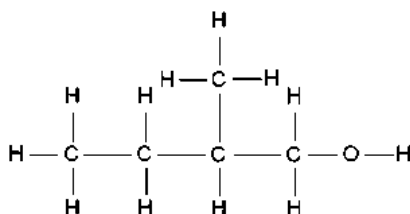
331. Which of the following represents the structure?

- A) 2,2-Dimethylethanol
- B) 2-propanol
- C) 3-Methylbutanol
- D) Butanol



332. What is the correct IUPAC name for the following compound?

- A) 3-Methyl-1-butanol
- B) 2-Methyl-4-butanol
- C) 2-Ethyl-1-propanol
- D) 2-Methyl-1-butanol

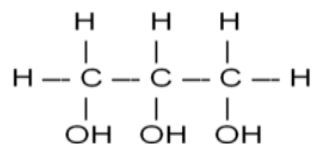


333. Which of the following is a tertiary alcohol?

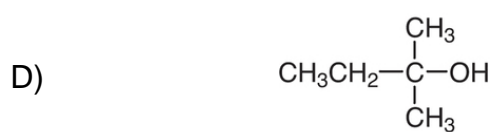
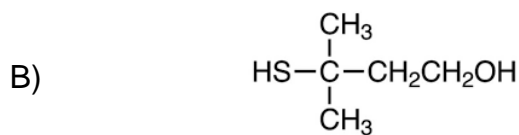
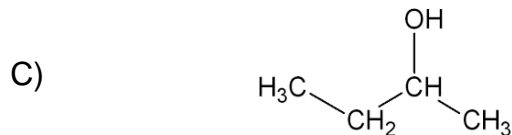
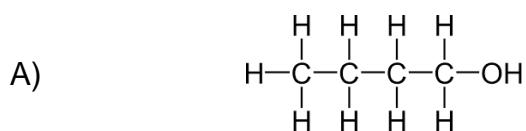
A)	$\begin{array}{c} \text{OH} \\ \\ \text{H}_3\text{C} - \text{CH} - \text{CH}_3 \end{array}$	C)	$\begin{array}{c} \text{O} - \text{H} \\ \\ \text{R}_1 - \text{C} - \text{H} \\ \\ \text{H} \end{array}$
B)	$\begin{array}{c} \text{O} - \text{H} \\ \\ \text{R}_1 - \text{C} - \text{H} \\ \\ \text{R}_2 \end{array}$	D)	$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$

334. What is the correct IUPAC name for the compound commonly known as glycerol?

- A) Propan-1-ol
- B) 1,2-Propandiol
- C) 1,2,3-Propantriol
- D) Propan-2-ol



335. Which of the following represents the structure of 1-butanol?



336. What is the correct IUPAC name for the compound with an -OH group attached to a benzene ring?

A) Benzenol

B) Phenyl alcohol

C) Phenol

D) Benzyl alcohol

Correct Answers:

317) A

318) A

319) D

320) A

321) B

322) A

323) A

324) C

325) B

326) A

327) D

328) D

329) C

330) B

331) B

332) D

333) D

334) C

335) A

336) C

20) Define ether while classifying it into symmetrical and asymmetrical ethers

An ether: is an organic compound containing an oxygen atom bonded to two carbon atoms.

Ethers have the general formula ROR' .

The term *ether* was used for the first time in chemistry as a name for the compound $C_2H_5-O-C_2H_5$ ethyl ether.

The term *ether* is applied to compounds that consist of two hydrocarbon chains bonded by the same oxygen atom.

- **Symmetrical Ethers:** These have two identical alkyl or aryl groups attached to the oxygen atom.
- **Asymmetrical Ethers (or Mixed Ethers):** These have two different alkyl or aryl groups attached to the oxygen atom.

Examples:

- **Diethyl ether ($CH_3CH_2-O-CH_2CH_3$)**
 - Groups attached to oxygen: Ethyl (CH_3CH_2) and Ethyl (CH_3CH_2).
 - Are they the same? Yes.
 - **Classification: Symmetrical Ether**
- **Dimethyl ether (CH_3-O-CH_3)**
 - Groups attached to oxygen: Methyl (CH_3) and Methyl (CH_3).
 - Are they the same? Yes.
 - **Classification: Symmetrical Ether**
- **Methyl propyl ether ($CH_3-O-CH_2CH_2CH_3$)**
 - Groups attached to oxygen: Methyl (CH_3) and Propyl ($CH_2CH_2CH_3$).
 - Are they the same? No.
 - **Classification: Asymmetrical Ether**
- **Anisole (Methyl phenyl ether) ($CH_3-O-C_6H_5$)**
 - Groups attached to oxygen: Methyl (CH_3) and Phenyl (C_6H_5).
 - Are they the same? No.
 - **Classification: Asymmetrical Ether**
- **Diphenyl ether ($C_6H_5-O-C_6H_5$)**
 - Groups attached to oxygen: Phenyl (C_6H_5) and Phenyl (C_6H_5).
 - Are they the same? Yes.
 - **Classification: Symmetrical Ether**

21) Mention some uses of amines and uses of amides.

Amines uses

Amine	uses
Aniline	✓ In the production of dyes with deep shades of color. (The common name aniline is derived from the plant in which it was historically obtained.)
Cyclohexylamine and ethylamine	✓ Production of pesticides ✓ Plastic ✓ pharmaceutical ✓ Rubber
Amines Generally	✓ Trained police dogs infer through their distinct and unpleasant smell on dead and decomposing organisms such as the remains of the dead after disasters. ✓ Used in criminal investigations

Uses of Amides.

- ✍ Acetaminophen is used as a nonaspirin pain reliever containing.

Urea

- ✍ Urea is an end product in the metabolic breakdown of proteins in mammals.
- ✍ It is found in the blood, bile, milk, and perspiration of mammals.
- ✍ When proteins are broken down, amino groups (NH_2) are removed from the amino acids. The amino groups are then converted to ammonia (NH_3) that are toxic to the body.
- ✍ The toxic ammonia is converted to nontoxic urea in the liver. The urea is filtered out of the blood in the kidneys and passed from the body in urine.
- ✍ Because of the high nitrogen content of urea and because it is easily converted to ammonia in the soil, urea is a common commercial fertilizer.
- ✍ Urea is also used as a protein supplement for ruminant animals, such as cattle and sheep. These animals use urea to produce proteins in their bodies.

337. What is the defining characteristic of an ether?

- A) An oxygen atom double-bonded to a carbon atom.
- B) An oxygen atom bonded to two hydrogen atoms.
- C) An oxygen atom bonded to two carbon atoms.
- D) A carbon atom bonded to three hydrogen atoms.

338. Which of the following is the general formula for an ether?

- A) R-OH
- B) R-CHO
- C) R-O-R'
- D) R-COOH

339. *The compound $\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3$ is classified as a:*

- A) Carboxylic acid
- B) Symmetrical ether
- C) Asymmetrical ether
- D) Alcohol

340. *The term "ether" was first used in chemistry to name which compound?*

- A) Dimethyl ether
- B) Methyl propyl ether
- C) Diethyl ether
- D) Diphenyl ether

341. *An ether in which the two hydrocarbon chains bonded to the oxygen atom are different is called a(n):*

- A) Symmetrical ether
- B) Primary ether
- C) Asymmetrical ether
- D) Secondary ether

342. *Which of the following is an example of an asymmetrical ether?*

- A) $\text{CH}_3\text{-O-CH}_3$
- B) $\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3$
- C) $\text{CH}_3\text{-O-CH}_2\text{CH}_2\text{CH}_3$
- D) $\text{C}_6\text{H}_5\text{-O-C}_6\text{H}_5$

343. *What is the classification of Dimethyl ether ($\text{CH}_3\text{-O-CH}_3$)?*

- A) Asymmetrical ether
- B) Unsaturated ether
- C) Symmetrical ether
- D) Cyclic ether

344. *The term "ether" is applied to compounds that consist of:*

- A) A single hydrocarbon chain bonded to an oxygen atom.
- B) Two hydrocarbon chains bonded by a single oxygen atom.
- C) An oxygen atom double-bonded to two carbon atoms.
- D) A hydroxyl group bonded to a hydrocarbon chain.

345. *Which of the following compounds is Anisole (Methyl phenyl ether)?*

- A) $\text{CH}_3\text{-O-CH}_3$
- B) $\text{C}_6\text{H}_5\text{-O-C}_6\text{H}_5$
- C) $\text{CH}_3\text{-O-C}_6\text{H}_5$
- D) $\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3$

346. *If an ether has two identical alkyl or aryl groups attached to the oxygen atom, it is known as a:*

- A) Mixed ether
- B) Asymmetrical ether
- C) Simple ether
- D) Symmetrical ether

347. *What is the name of the ether with the formula $\text{C}_6\text{H}_5\text{-O-C}_6\text{H}_5$?*

- A) Methyl phenyl ether
- B) Benzyl phenyl ether
- C) Diphenyl ether
- D) Phenoxybenzene

348. *Which of the following is an asymmetrical ether?*

- A) Diethyl ether
- B) Dimethyl ether
- C) Ethyl methyl ether
- D) Diphenyl ether

349. The compound $\text{CH}_3\text{-O-CH}_2\text{CH}_2\text{CH}_3$ is classified as a(n):

- A) Symmetrical ether
- B) Ketone
- C) Asymmetrical ether
- D) Alcohol

350. What does the 'R' in the general formula R-O-R' for ethers represent?

- A) Reactive group
- B) Any hydrogen atom
- C) Alkyl or aryl groups
- D) A specific type of oxygen atom

351. Diethyl ether ($\text{C}_2\text{H}_5\text{-O-C}_2\text{H}_5$) is an example of a:

- A) Mixed ether
- B) Asymmetrical ether
- C) Symmetrical ether
- D) Polyether

352. Which of these compounds has the general formula ROR' ?

- A) Alcohol
- B) Ether
- C) Carboxylic acid
- D) Amine

353. If the two hydrocarbon chains in an ether are different, it is also known as a:

- A) Complex ether
- B) Simple ether
- C) Mixed ether
- D) Primary ether

354. What distinguishes a symmetrical ether from an asymmetrical ether?

- A) The presence of a double bond in the symmetrical ether.
- B) Symmetrical ethers have two identical alkyl/aryl groups attached to oxygen.
- C) Asymmetrical ethers contain only aromatic groups.
- D) Symmetrical ethers contain only aliphatic groups.

355. Which of the following is an incorrect classification for the ether $\text{CH}_3\text{CH}_2\text{-O-CH}_2\text{CH}_3$?

- A) Symmetrical ether
- B) Diethyl ether
- C) Mixed ether
- D) Organic compound

356. The oxygen atom in an ether molecule is bonded to how many carbon atoms?

- A) One
- B) Two
- C) Three
- D) Four

Answers:

337) C

338) C

339) B

340) C

341) C

342) C

343) C

344) B

345) C

346) D

347) C

348) C

349) C

350) C

351) C

352) B

353) C

354) B

355) C

356) B

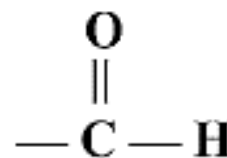
22) Compare and contrast aldehydes and ketones

Carbonyl group: The arrangement in which an oxygen atom is double bonded to a carbon atom.

Aldehydes

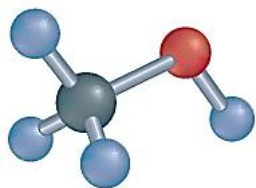
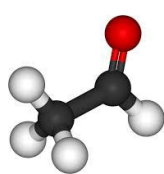
An aldehyde: is an organic compound in which a carbonyl group located at the end of a carbon chain is bonded to a carbon atom on one side and a hydrogen atom on the other.

Aldehydes have the general formula -CHO.



Aldehyde's properties

Boiling point

	Alcohol	Aldehyde
Example	 Methanol	 Ethanal
Boiling point	Higher 65°C	Lower (volatile) 20.2 °C
Reason	Alcohols contain polar hydroxyl groups that form hydrogen bonds between their molecules.	An aldehyde molecule contains a polar, reactive structure. Aldehyde molecules cannot form hydrogen bonds among themselves because the molecules have no hydrogen atoms bonded to an oxygen atom.

Solubility in water:

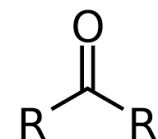
Water can form hydrogen bonds with oxygen atoms in the Aldehyde molecule, so they are more soluble in water compared to alkanes, but not as soluble as alcohols or amines.

Ketones

A ketone: is an organic compound in which the carbon of the carbonyl group is bonded to two other carbon atoms.

The carbonyl group is located within a carbon chain rather than at the end.

The simplest and most common ketone is 2-propanone (acetone)



Ketone General formula

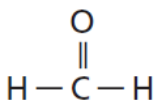
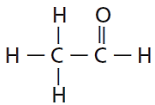
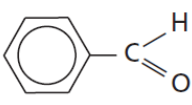
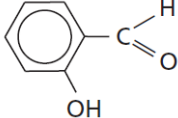
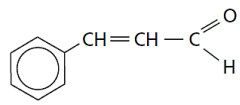
Properties of ketones

- ✦ Ketones and aldehydes share many physical and chemical properties due to the similarity of their structures.
- ✦ Its molecules are polar.
- ✦ Less active than aldehydes.
- ✦ Good solvents for medium-polar organic compounds such as wax, plastic, paint, varnish, and glue.
- ✦ It cannot form hydrogen bonds with each other as in aldehydes because there is no hydrogen atom attached to the oxygen atom.
- ✦ They can form hydrogen bonds with water molecules so, they are moderate soluble in water. Acetone is soluble in water.

23) Use the IUPAC system to name aldehydes and ketones

Naming Aldehydes

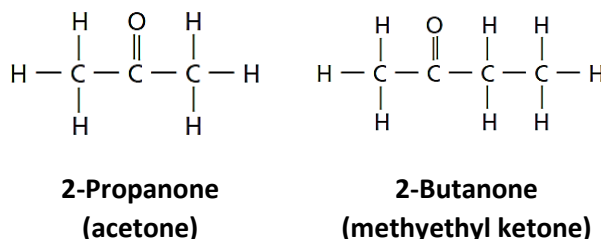
- It is named by adding the syllable (-al) to the name of alkane that has the same number of carbon atoms.
- the carbonyl group is always terminal, no need to use numbers in the name.
- There is no need to use numbers in the name unless there are branches or other functional groups.
- Scientists often use the common names for organic compounds because they are familiar to them.

Aldehyde					
Name	Methanal	Ethanal	Phenylmethanal	2-Hydroxybenzaldehyde	3-phenylprop-2-enal
Common name	formaldehyde	acetaldehyde	Benzaldehyde	Salicylaldehyde	Cinnamaldehyde

Naming ketones

The syllable (-on) is added to the alkane name.

A number is placed before the name to indicate the location of the carbonyl group.



357. Which of the following is common to both aldehydes and ketones?

- A) A terminal hydroxyl group
- B) A carbonyl group
- C) The ability to form hydrogen bonds with each other
- D) A carbon-carbon double bond

358. What is the defining characteristic of an aldehyde's structure?

- A) The carbonyl carbon is bonded to two alkyl groups.
- B) The carbonyl carbon is bonded to at least one hydrogen atom.
- C) The carbonyl group is located centrally in the carbon chain.
- D) It always forms a ring structure.

359. *How do aldehydes and ketones compare in terms of polarity?*

- A) Aldehydes are polar, but ketones are non-polar.
- B) Both are non-polar due to their hydrocarbon chains.
- C) Both are polar due to the electronegativity difference in the C=O bond.
- D) Only ketones exhibit strong polarity.

360. *Which of the following is the simplest example of an aldehyde?*

- A) Acetone
- B) Propanone
- C) Formaldehyde
- D) Ethanal

361. *Which statement accurately describes the general reactivity of aldehydes in oxidation reactions?*

- A) They are resistant to oxidation.
- B) They are readily oxidized to carboxylic acids.
- C) They require strong reducing agents for oxidation.
- D) They primarily undergo reduction to alcohols.

362. *What is the general formula for a ketone?*

- A) R-CHO
- B) R-COOH
- C) R-CO-R'
- D) R-OH

363. *Why do lower molecular weight aldehydes and ketones show moderate solubility in water?*

- A) They can form strong ionic bonds with water.
- B) They have very low molecular weights.
- C) The carbonyl oxygen can form hydrogen bonds with water molecules.
- D) They are completely non-polar.

364. Which of these compounds is a ketone?

- A) $\text{CH}_3\text{CH}_2\text{CHO}$
- B) HCHO
- C) $\text{CH}_3\text{COCH}_2\text{CH}_3$
- D) CH_3OH

365. Why are aldehydes generally more reactive than ketones in nucleophilic addition reactions?

- A) Aldehydes experience more steric hindrance.
- B) Aldehydes have two alkyl groups providing electron density.
- C) Aldehydes have less steric hindrance and a more electrophilic carbonyl carbon.
- D) Ketones have a weaker carbonyl bond.

366. What is the defining structural characteristic of a ketone?

- A) The carbonyl group is at the end of the carbon chain.
- B) The carbonyl carbon is bonded to at least one hydrogen atom.
- C) The carbonyl carbon is bonded to two other carbon atoms.
- D) It contains a hydroxyl group.

367. Both aldehydes and ketones have lower boiling points than alcohols of comparable molecular weight because:

- A) They are less dense.
- B) They cannot form intermolecular hydrogen bonds with each other.
- C) They have weaker carbon-oxygen bonds.
- D) They are non-polar compounds.

368. Which of the following is the common name for propan-2-one?

- A) Acetaldehyde
- B) Formaldehyde
- C) Acetone
- D) Propanal

369. What is the general formula for an aldehyde?

- A) R-COOH
- B) R-OH
- C) R-CHO
- D) R-CO-R'

370. Which property is shared by both aldehydes and ketones?

- A) Both give a positive Tollen's test.
- B) Both are good solvents for medium-polar organic compounds.
- C) Both contain a hydroxyl group.
- D) Both primarily form intermolecular hydrogen bonds with each other.

371. Which of the following compounds is the simplest ketone?

- A) Ethanal
- B) Methanal
- C) Acetone
- D) Propanal

372. Which of the following would be correctly classified as an aldehyde?

- A) Butanone
- B) Propanone
- C) Acetaldehyde
- D) Cyclohexanone

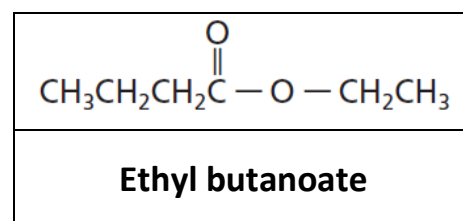
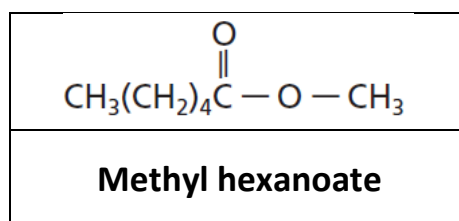
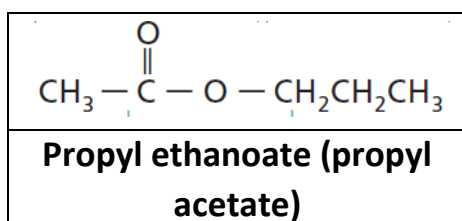
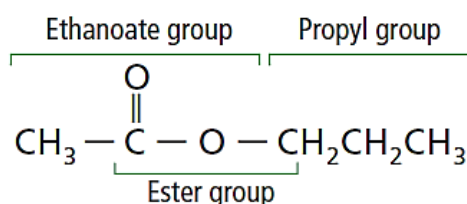
Answers:

- 357) B
- 358) B
- 359) C
- 360) C
- 361) B
- 362) C
- 363) C
- 364) C
- 365) C
- 366) C
- 367) B
- 368) C
- 369) C
- 370) B
- 371) D
- 372) A

24) Use the IUPAC system to name esters

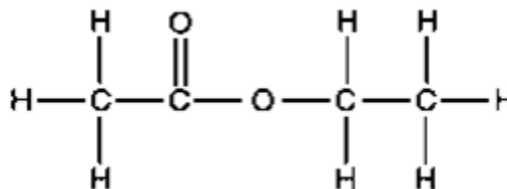
Naming esters

The name of the alkyl group is written first followed by the carboxylic acid, then the syllable (-ic) is replaced by the syllable (-ate) .

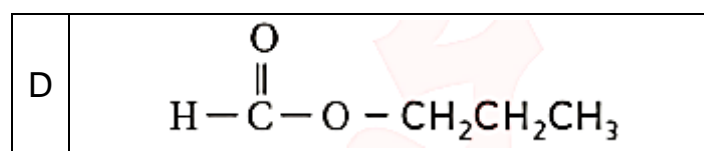
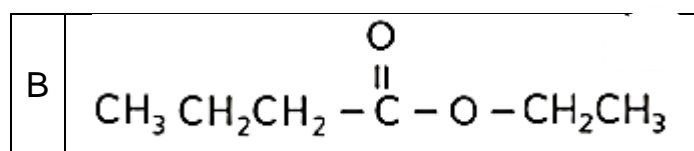
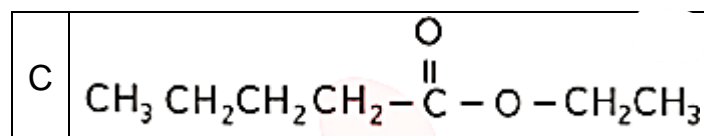
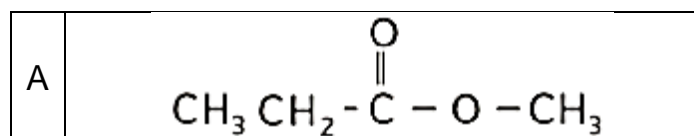


373. What is the correct IUPAC name for the ester with the formula $\text{CH}_3\text{COOCH}_2\text{CH}_3$?

- A) Methyl acetate
- B) Ethyl methanoate
- C) Ethyl ethanoate
- D) Propyl methanoate

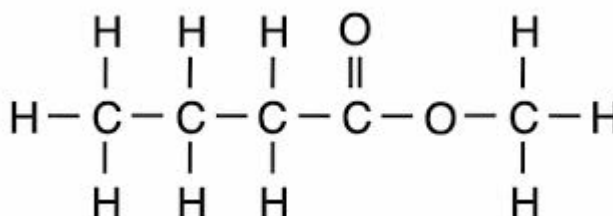


374. Which of the following is the correct formula for Methyl propanoate?

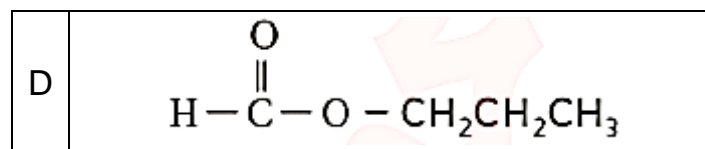
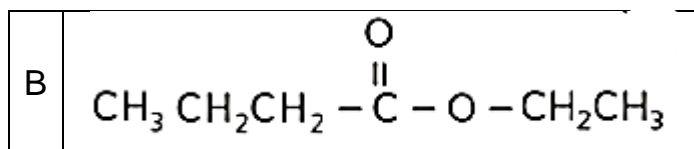
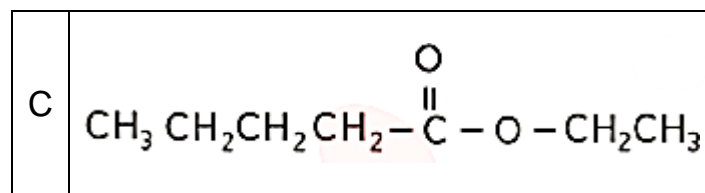
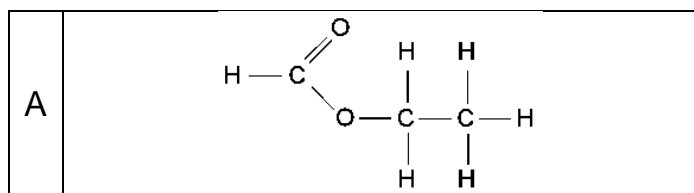


375. Name the ester with the formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_3$.

- A) Methyl butanoate
- B) Propyl methanoate
- C) Ethyl propanoate
- D) Methyl propanoate

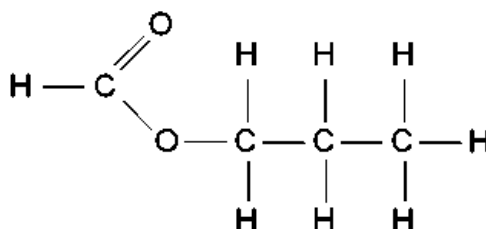


376. Which formula represents Ethyl methanoate?

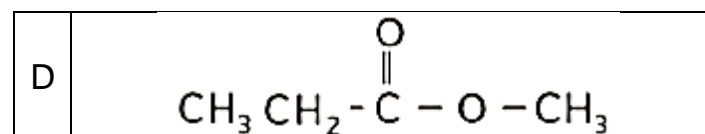
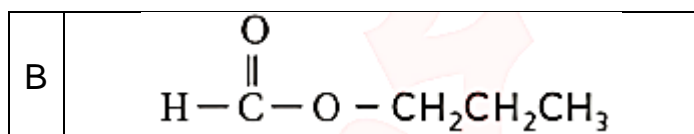
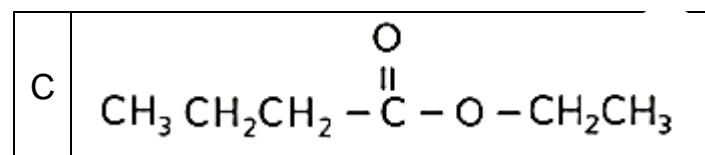
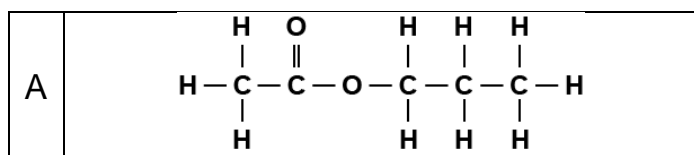


377. What is the IUPAC name for $\text{HCOOCH}_2\text{CH}_2\text{CH}_3$?

- A) Propyl ethanoate
- B) Propyl methanoate
- C) Methyl propanoate
- D) Butyl ethanoate

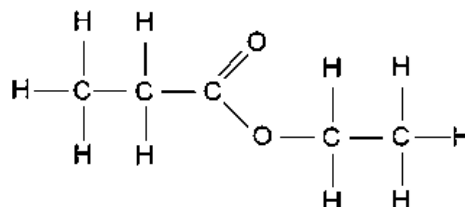


378. Which of the following is the correct formula for Propyl ethanoate?

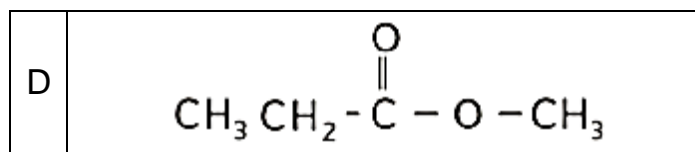
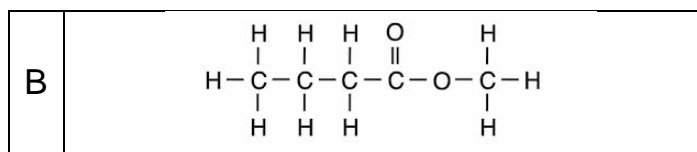
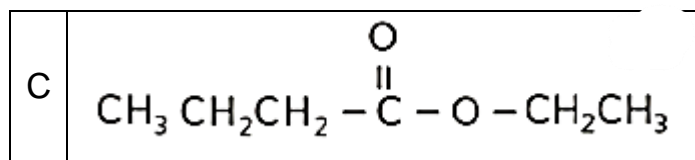
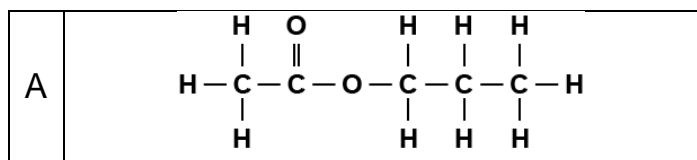


379. Name the ester with the formula $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$.

- A) Ethyl propanoate
- B) Propyl ethanoate
- C) Ethyl butanoate
- D) Methyl propanoate

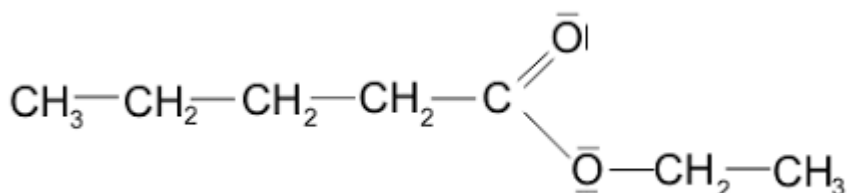


380. Which formula represents Methyl butanoate?

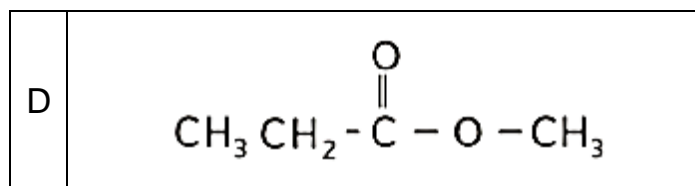
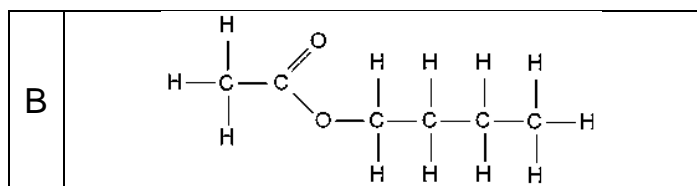
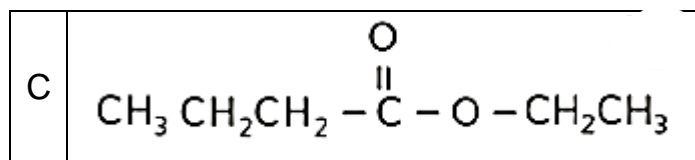
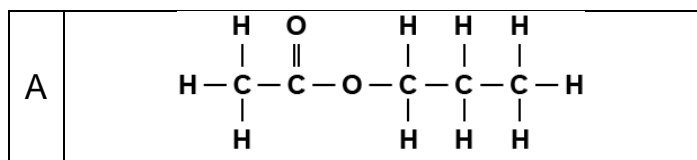


381. What is the IUPAC name for $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$?

- A) Ethyl butanoate
- B) Ethyl pentanoate
- C) Propyl hexanoate
- D) Methyl pentanoate

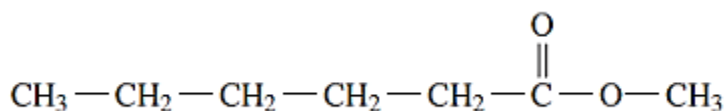


382. Which of the following is the correct formula for Butyl ethanoate?

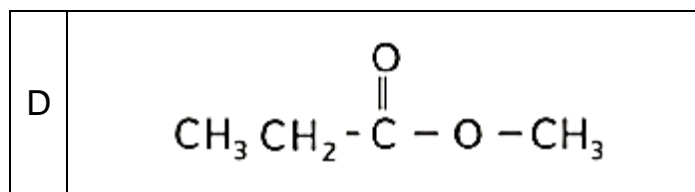
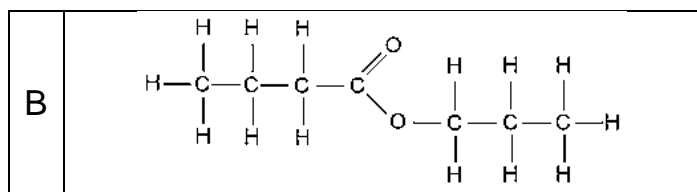
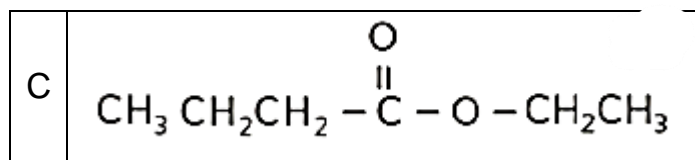
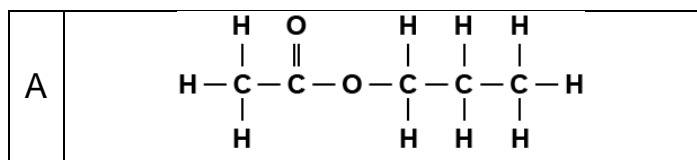


383. Name the ester with the formula $\text{CH}_3(\text{CH}_2)_4\text{COOCH}_3$.

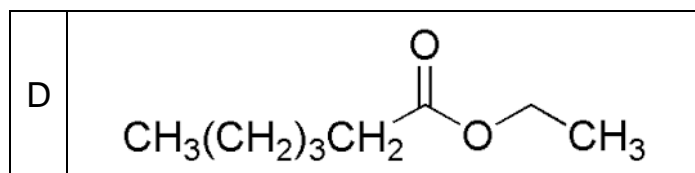
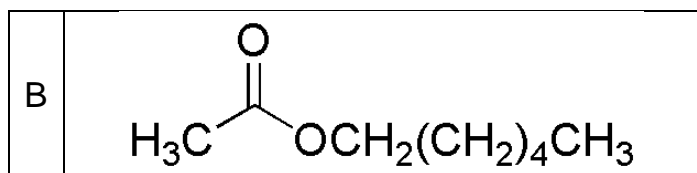
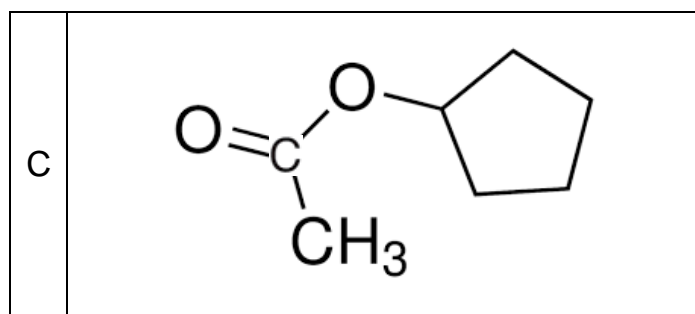
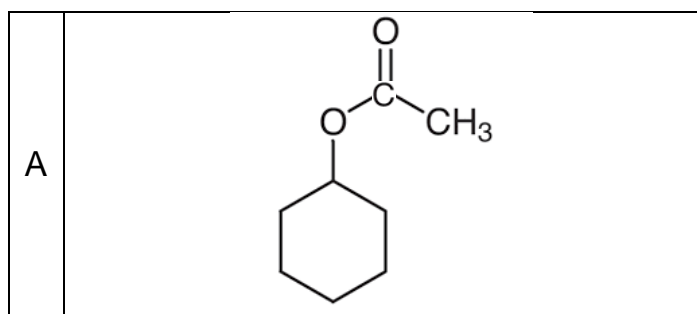
- A) Methyl pentanoate
- B) Methyl hexanoate
- C) Hexyl methanoate
- D) Pentyl ethanoate



384. Which formula represents Propyl butanoate?



385. Which formula represents Cyclohexyl ethanoate?



Answers:

373) C

374) A

375) A

376) A

377) B

378) A

379) A

380) B

381) B

382) B

383) B

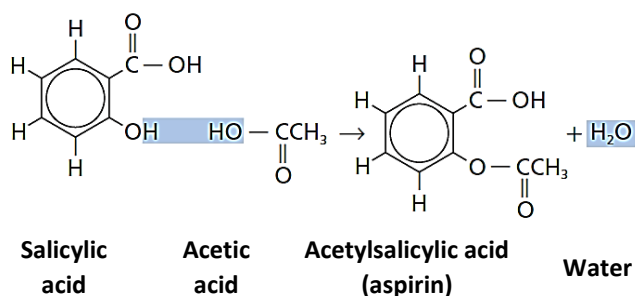
384) B

385) A

25) Write an equation for the reaction of alcohols with carboxylic acids to form esters(condensation reaction)

Condensation Reactions

Condensation Reaction: two smaller organic molecules combine to form a more complex molecule, accompanied by the loss of a small molecule such as water.



The common way for preparing ester involves a condensation reaction between the carboxylic acid and the alcohol,



386. What type of reaction occurs when an alcohol reacts with a carboxylic acid to form an ester?

- A) Hydrolysis reaction
- B) Addition reaction
- C) Condensation reaction
- D) Oxidation reaction

387. In the general esterification reaction, what is the role of the -OH group from the carboxylic acid?

- A) It forms part of the ester linkage.
- B) It combines with a hydrogen from the alcohol to form water.
- C) It acts as a catalyst.
- D) It remains as a hydroxyl group in the ester.

388. Consider the reaction: $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \rightleftharpoons \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$.

What is the IUPAC name for CH_3COOH in this reaction?

- A) Methanoic acid
- B) Propanoic acid
- C) Ethanoic acid
- D) Butanoic acid

389. Which of the following is typically used as a catalyst for the esterification reaction?

- A) A strong base like NaOH
- B) A strong acid like H_2SO_4
- C) A neutral salt like NaCl
- D) Water

390. The reaction of butanoic acid with methanol produces what ester?

- A) Methyl propanoate
- B) Methyl butanoate
- C) Butyl methanoate
- D) Butyl ethanoate

391. Observe the reaction: $\text{R-COOH} + \text{R}'\text{-OH} \rightleftharpoons \text{Ester} + \text{Water}$.

Which part of the ester ($\text{R-COOR}'$) originates from the alcohol?

- A) R-CO-
- B) -OR'
- C) R-
- D) -COO-

392. What is the main byproduct formed during the esterification reaction between an alcohol and a carboxylic acid?

- A) Hydrogen gas
- B) Carbon dioxide
- C) Water
- D) Oxygen gas

393. Complete the following reaction: $\text{CH}_3\text{CH}_2\text{COOH} + \text{CH}_3\text{OH} \rightleftharpoons ? + \text{H}_2\text{O}$.

- A) Methyl ethanoate
- B) Ethyl methanoate
- C) Methyl propanoate
- D) Propyl methanoate

394. Consider the reaction: $\text{CH}_3\text{CH}_2\text{COOH} + \text{X} \rightleftharpoons \text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$.

What is the identity of reactant X?

- A) Methanol
- B) Propanol
- C) Ethanol
- D) Butanol

395. The reaction $\text{CH}_3\text{COOH} + \text{CH}_3\text{OH} \rightleftharpoons \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$ is an example of:

- A) Hydrolysis
- B) Oxidation
- C) Saponification
- D) Esterification

396. In the reaction: $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \rightleftharpoons \text{Y} + \text{H}_2\text{O}$.

What is the IUPAC name of the ester Y formed?

- A) Propyl propanoate
- B) Propyl butanoate
- C) Butyl propanoate
- D) Butyl butanoate

397. Consider the equilibrium: $\text{HCOOCH}_2\text{CH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{Z} + \text{CH}_3\text{CH}_2\text{OH}$.

What is the identity of compound Z?

- A) Methanol
- B) Ethanoic acid
- C) Methanoic acid
- D) Propanoic acid

398. For the reaction: $\text{CH}_3(\text{CH}_2)_3\text{COOH} + \text{CH}_3\text{OH} \rightleftharpoons \text{Ester} + \text{H}_2\text{O}$.

What is the correct IUPAC name of the ester produced?

- A) Methyl butanoate
- B) Pentyl methanoate
- C) Methyl pentanoate
- D) Butyl methanoate

399. Identify the alcohol (P) in the following reaction:



- A) Methanol
- B) Ethanol
- C) Propan-1-ol
- D) Propan-2-ol

Correct Answers:

- | | |
|------|---|
| 386) | C |
| 387) | B |
| 388) | C |
| 389) | B |
| 390) | B |
| 391) | B |
| 392) | C |
| 393) | C |
| 394) | C |
| 395) | D |
| 396) | B |
| 397) | C |
| 398) | C |
| 399) | C |