Chemistry · Organic Chemistry

Cyclic Hydrocarbons

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Multiple choice questions — 19 questions

1 Which molecular formula may represent a saturated cyclic compound?

(A) C_2H_4 (B) C_2H_2 (C) C_6H_{14} (D) C_6H_{12}

2 In front of you are 4 cyclic hydrocarbon compounds:
Which order expresses the stability of these compounds?



(A) (2) < (1) < (3) < (4)
(B) (4) < (2) < (3) < (1)
(C) (4) < (1) < (3) < (2)
(D) (2) < (3) < (1) < (4)

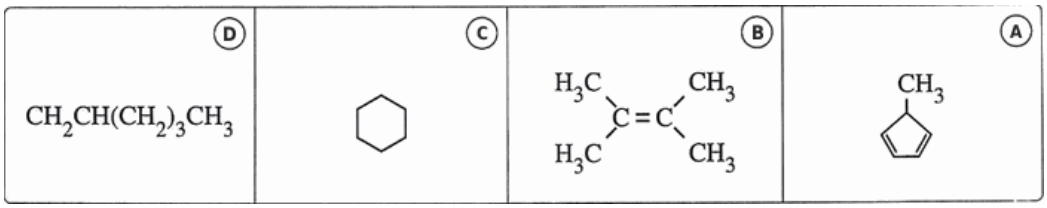
3 Which of the following is correct?

(A) The bond angles in cyclic C_3H_6 are larger than in C_3H_8
(B) The general formula of cyclobutane differs from the general formula of butene.
(C) The boiling point of cyclobutane is higher than that of cyclopropane.
(D) Cyclopropane is more stable than cyclobutane.

4 Which of the following compounds needs the least energy to break its bonds?

(A) Propane. (B) Cyclopropane. (C) Hexane. (D) Cyclohexane.

5 Which of the following compounds is the most stable and has the molecular formula C_6H_{12}?



6 What is the name of the compound that removes the colour of bromine dissolved in CCl_4 when it is passed through it?

(A) Butene. (B) Cyclohexane. (C) Pentane. (D) Cyclopentane.

7 How many atoms are there in a molecule of the simplest cycloalkane?

(A) 8 (B) 9 (C) 10 (D) 12

8 From the opposite table:

Cyclopropane : 2091 kJ/mol

Cyclobutane : 2721 kJ/mol

Cyclopentane : 3291 kJ/mol

Cyclohexane : 3920 kJ/mol

We conclude that the heat of combustion of cycloalkanes .....

(A) increases as the number of methyl and methylene groups in them increases.

(B) increases as the number of carbon atoms and methylene groups in them increases.

(C) decreases as the number of carbon atoms and methyl groups in them increases.

(D) decreases as the number of hydrogen atoms and methylene groups in them increases.

9 Which of the following describes three unbranched saturated cyclic compounds?

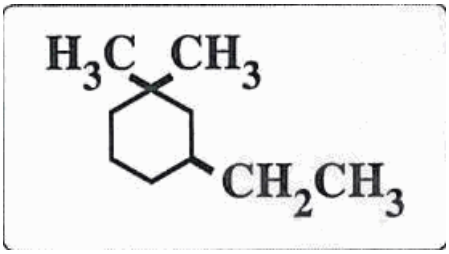
(A) Number of methyl groups in them: none , number of methylene groups in them: not equal

(B) Number of methyl groups in them: equal , number of methylene groups in them: none

(C) Number of methyl groups in them: not equal , number of methylene groups in them: none

(D) Number of methyl groups in them: none , number of methylene groups in them: equal

10 What is the IUPAC name of the opposite compound?



(A) 1-ethyl-3,3-dimethylcyclohexane. (B) 3-ethyl-1,1-dimethylcyclohexane.

(C) 1,1-dimethyl-3-ethylcyclohexane. (D) 1-ethyl-4,4-dimethylcyclohexane.

11 How many isomers does the molecular formula C_4H_8 have?

(A) 3 (B) 4 (C) 5 (D) 6

12 How many cycloalkane isomers have the molecular formula C_5H_{10}?

(A) 5 (B) 4 (C) 3 (D) 2

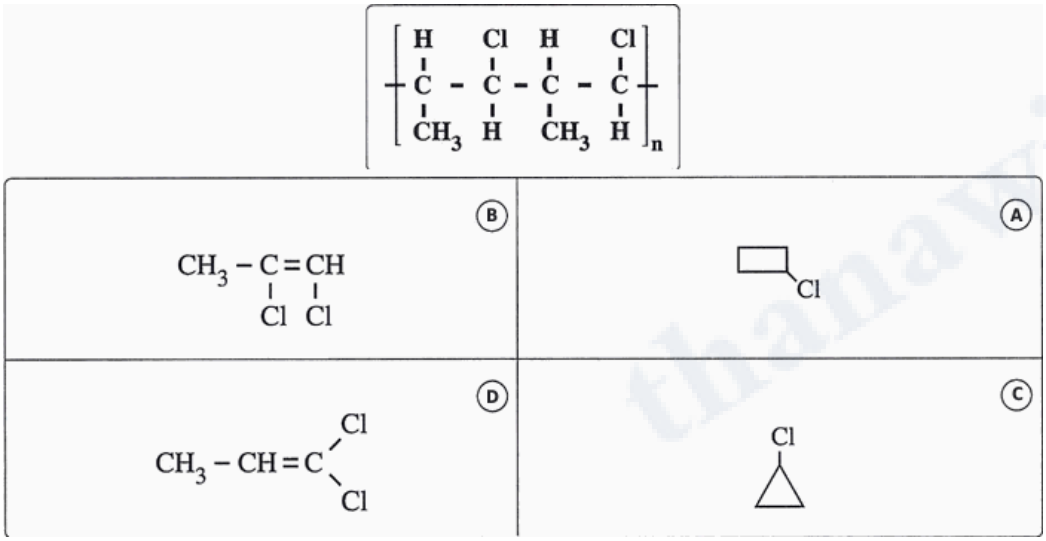
13 The catalytic thermal cracking of decane produced the simplest liquid alkane and compound (X).

How many cyclic isomers does compound (X) have?

(A) 2 (B) 3 (C) 4 (D) 5

14 The polymer shown in the opposite figure is prepared from a monomer.

Which of the following is an isomer of this monomer?



15 All of the following are correct for an isomer of the opposite compound (cyclopropene), except .....



(A) It contains a triple covalent bond.

(B) It reacts with HBr according to Markovnikov's rule.

(C) It needs (1 mol) of hydrogen to saturate (1 mol) of it.

(D) Its catalytic hydration forms a ketone.

16 If the molecular formula of heptadecane is $C_{17}H_{36}$

What are the molecular formulas of normal hexadecane and cyclohexadecane, respectively?

(A) $C_{16}H_{34}$ / $C_{16}H_{30}$ (B) $C_{18}H_{38}$ / $C_{18}H_{36}$ (C) $C_{16}H_{34}$ / $C_{16}H_{32}$ (D) $C_{18}H_{38}$ / $C_{18}H_{34}$

17 1 g of a hydrocarbon burns completely, forming 3.22 g of carbon dioxide gas.
What is the name of this hydrocarbon? [C = 12 , H = 1 , O = 16]

(A) Cyclohexene. (B) Cyclopentane. (C) Ethene. (D) Pentene.

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18 Sodium acetate reacts with sodium hydroxide in the presence of calcium oxide, forming the organic gas (1) and the inorganic compound (2); and 1,3-dibromopropane reacts with sodium to form the cyclic organic compound (3) and 2 mol of NaBr
Which of the following describes compounds (1), (2) and (3)?

(A) Compound (1) is more reactive than compound (3) ✓ , compound (2) can be distinguished from sodium bromide by concentrated sulphuric acid ✓

(B) Compound (1) is more reactive than compound (3) ✗ , compound (2) can be distinguished from sodium bromide by concentrated sulphuric acid ✓

(C) Compound (1) is more reactive than compound (3) ✓ , compound (2) can be distinguished from sodium bromide by concentrated sulphuric acid ✗

(D) Compound (1) is more reactive than compound (3) ✗ , compound (2) can be distinguished from sodium bromide by concentrated sulphuric acid ✗

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19 A student assumed the following in describing the opposite compound: $CH_2C(CH_3)_2$
(1) : the compound $CH_3(CH)_2CH_3$ is an isomer of it.
(2) : it reacts with hydrohalic acids according to Markovnikov's rule.
(3) : it is used as a monomer in addition polymerization.
(4) : cyclobutane is an isomer of it.
Which of the previous assumptions are correct?

(A) (1) ✓ , (2) ✓ , (3) ✓ , (4) ✓ (B) (1) ✓ , (2) ✗ , (3) ✓ , (4) ✓
(C) (1) ✓ , (2) ✗ , (3) ✗ , (4) ✓ (D) (1) ✗ , (2) ✓ , (3) ✓ , (4) ✗

Essay questions — 6 questions

1 From the following formulas:

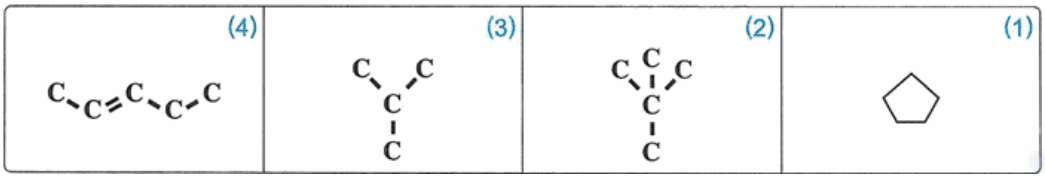
Match each of the following to the previous formulas:

(1) 2-methylpropane.

(2) A compound with the molecular formula C_5H_{12}

(3) Two isomers.

(4) The compound that reacts with $KMnO_4$(aq) in an alkaline medium, forming a dihydric alcohol.



2 The molecular formula C_4H_8 has many structural formulas, including unbranched alkenes and cycloalkanes.

Draw the structural formulas of each of the following:

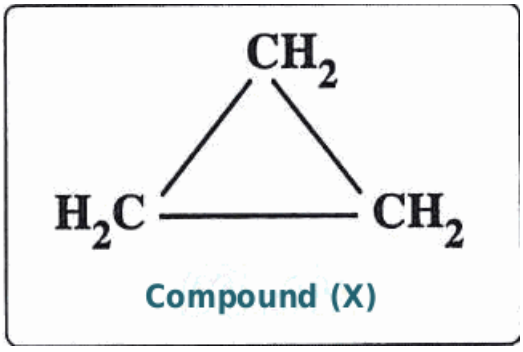
(1) the unbranched alkenes.

(2) the cycloalkanes.

3 The opposite figure shows the structural formula of compound (X):

(1) What is the structural formula of the unsaturated compound (Y) that is an isomer of compound (X)?

(2) Write the combustion equation of compound (X).



4 (A) and (B) are two organic compounds with the molecular formula C_3H_6:

(1) Draw the structural formula of compound (A), and write the IUPAC name of the compound produced by adding HBr to it.

(2) Draw the structural formula of compound (B). Why is this compound more reactive than the corresponding normal alkane?

5 Phenylethene is used as a monomer in addition polymerization:

(1) Draw the structural formula of this monomer.

(2) State 3 conditions needed to convert this monomer into a polymer.

6 The molecular formula C_5H_{10} represents the following cyclic compounds:

- (X): contains no methyl groups.
- (Y): contains one methyl group.
- (Z): contains one methylene group.

Draw the structural formula of each of the three compounds, and write their IUPAC names.

Past exam questions — 9 questions

1 When water is removed from propyl alcohol, compound (X) is produced. (Sample exam 2026)
Which of the following describes an isomer of compound (X)?

(A) Saturated, with 3 methyl groups.
(B) Unsaturated, with 3 methylene groups.
(C) Saturated and chemically reactive.
(D) Unsaturated and chemically reactive.

2 Which of the following compounds, when one mole of it burns completely, produces 5 mol of (CO_2) and 5 mol of water vapour? (Sample exam 2026)

(A) 2-methylbutane.
(B) 2,3-dimethyl-2-butene.
(C) 1,1-dimethylcyclopropane.
(D) 2-pentyne.

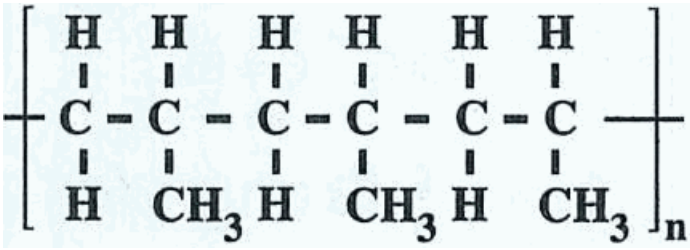
3 Which of the following is a saturated hydrocarbon that contains no methyl groups? (1st session 2021)

(A) C_5H_{12}
(B) C_6H_{12}
(C) C_7H_8
(D) C_7H_{12}

4 All of the following are correct for cyclohexane, except ..... (2nd session 2022)

(A) it is a saturated cyclic compound.
(B) it can be obtained from an aromatic compound.
(C) it is a stable alkane.
(D) its molecule contains 12 atoms.

5 The monomer of the opposite polymer is an isomer of the compound ..... (1st session 2023)



(A) cyclopropane.
(B) cyclobutane.
(C) propane.
(D) propene.

6 Using the following table: (Trial exam / June 2021)

(A) : $C_2HBrClF_3$, (B) : CF_4 , (C) : CBr_2Cl_2 , (D) : C_5H_{10}

Which of the following choices is correct?

(A) (D) : a saturated cyclic compound , (A) : an alkane derivative.

(B) (B) : an alkene derivative , (C) : an alkane derivative.

(C) (C) : an alkyne derivative , (D) : an alkene derivative.

(D) (A) : an alkane derivative , (B) : an alkene derivative.

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7 Which of the following properties of cyclobutane is correct? (2nd session 2021)

(A) It is less reactive than cyclopentane.

(B) It is more stable than normal pentane.

(C) It burns faster than cyclopentane.

(D) It burns more slowly than normal pentane.

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8 The molecular formula (C_5H_{10}) represents three saturated aliphatic hydrocarbons, such that: (1st session 2023)

(A): contains no methyl groups.

(B): contains one methylene group.

(C): contains one methyl group.

The correct order of these compounds according to chemical reactivity is .....

(A) B > C > A (B) C > B > A (C) A > C > B (D) B > A > C

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9 Which of the following compounds, when one mole of it burns in excess oxygen, gives 3 mol of water vapour and 3 mol of carbon dioxide? (Sample exam 2026)

(A) Propane. (B) Cyclopropane. (C) Propanol. (D) Propyne.

Answer key and solutions

Multiple choice questions

1	2	3	4	5	6	7	8	9	10
D	A	C	B	C	A	B	B	A	B

11	12	13	14	15	16	17	18	19
C	A	D	C	C	C	A	B	A

1 **Answer (D)**

Saturated cycloalkanes follow C_nH_{2n} , and C_6H_{12} (cyclohexane) is one of them.

C_2H_4 and C_2H_2 are unsaturated, and C_6H_{14} is an open-chain alkane.

2 **Answer (A)**

The more atoms in the ring, the less the strain in the bond angles and the greater the stability.

Cyclopropene (2) has a double bond, so it is the least stable.

Stability: $(4) > (3) > (1) > (2)$

3 **Answer (C)**

The greater the molecular mass, the higher the boiling point, so cyclobutane is higher than cyclopropane.

4 **Answer (B)**

The angle in cyclopropane is 60° (much less than 109.5°), so its bonds are weak and break with the least energy.

5 **Answer (C)**

The angles of cyclohexane C_6H_{12} are close to 109.5°, so it is the most stable.

(A) has the formula C_6H_{10}, and (B) and (D) are less stable alkenes.

6 **Answer (A)**

Butene is an unsaturated alkene, so it removes the colour of bromine by addition; the rest are saturated.

7 **Answer (B)**

The simplest cycloalkane is cyclopropane C_3H_6, and it has 3 + 6 = 9 atoms.

8 **Answer (B)**

The heat of combustion increases as the number of carbon atoms (and methylene groups $-CH_2-$) in the ring increases.

9 **Answer (A)**

Unbranched cycloalkanes are made of methylene groups only $(CH_2)_n$

So there are no methyl groups, and the number of methylene groups differs with the size of the ring.

10 **Answer (B)**

The two methyl groups are on one carbon atom and the ethyl group is on another atom.

Numbering gives the lowest numbers: 1, 1, 3 (instead of 1, 3, 3)

Name: 3-ethyl-1,1-dimethylcyclohexane.

11 **Answer (C)**

Isomers of C_4H_8: 1-butene, 2-butene, methylpropene, cyclobutane, methylcyclopropane.

Their number is 5

12 **Answer (A)**

Cyclopentane, methylcyclobutane, ethylcyclopropane, 1,1-dimethylcyclopropane, 1,2-dimethylcyclopropane.

Their number is 5

13 **Answer (D)**

$C_{10}H_{22} \rightarrow C_5H_{12}$ (pentane, the simplest liquid alkane) + C_5H_{10} (X)

The number of cyclic isomers of the formula C_5H_{10} is 5

14 **Answer (C)**

The monomer of the polymer is $CH_3-CH=CHCl$ (C_3H_5Cl).

Its isomer has the same formula C_3H_5Cl, and it is chlorocyclopropane (C).

15 **Answer (C)**

The compound is cyclopropene C_3H_4 , and its isomer is propyne $CH_3-C\equiv CH$

Propyne needs 2 mol of hydrogen to saturate 1 mol of it, so statement (C) is wrong.

16 **Answer (C)**

A normal alkane C_nH_{2n+2} : hexadecane $C_{16}H_{34}$

A cycloalkane C_nH_{2n} : cyclohexadecane $C_{16}H_{32}$

17 **Answer (A)**

C_6H_{10} (cyclohexene) = 82 g/mol and gives $6CO_2$ = 264 g

Mass of CO_2 from 1 g = 264 ÷ 82 = 3.22 g

18 **Answer (B)**

(1) CH_4 , (2) Na_2CO_3 , (3) cyclopropane.

Cyclopropane is more reactive than methane because its bonds are weak (60° angle).

Na_2CO_3 effervesces (CO_2) with concentrated H_2SO_4, so it can be distinguished from NaBr

19 **Answer (A)**

The compound $CH_2=C(CH_3)_2$ (methylpropene) has the formula C_4H_8

Its isomers: 2-butene $CH_3CH=CHCH_3$ and cyclobutane.

It is an alkene that reacts with HX according to Markovnikov's rule and undergoes addition polymerization, so all the assumptions are correct.

Essay questions

1 **Model answer**

(1) (3).

(2) (2).

(3) (1) , (4).

(4) (4).

2 **Model answer**

(1) $CH_2=CH-CH_2-CH_3$ (1-butene) , $CH_3-CH=CH-CH_3$ (2-butene).

(2) Cyclobutane (a ring of 4 CH_2 groups) , methylcyclopropane.

3 **Model answer**

(1) $CH_3-CH=CH_2$ (propene).

(2) $2C_3H_6 + 9O_2 \xrightarrow{(\Delta)} 6CO_2 + 6H_2O$

4 **Model answer**

(1) Compound (A): $CH_3-CH=CH_2$, and the product of adding HBr to it: 2-bromopropane.

(2) Compound (B): cyclopropane (a three-membered ring of CH_2 groups).

Because the inner angle in cyclopropane is 60°, while the angle between the carbon bonds in normal propane is 109.5°. The smaller the angle, the weaker the bonding between the carbon atoms and the higher the chemical reactivity.

5 **Model answer**

(1) $C_6H_5–CH=CH_2$ (styrene).

(2) Pressure, heat, catalysts.

6 **Model answer**

(X): cyclopentane.

(Y): methylcyclobutane (a four-membered ring carrying CH_3) or ethylcyclopropane (a three-membered ring carrying C_2H_5).

(Z): 1,2-dimethylcyclopropane (a three-membered ring with one CH_2 group, carrying two CH_3 groups).

Past exam questions

1	2	3	4	5	6	7	8	9
C	C	B	D	A	A	C	A	B

1 **Answer (C)**

Removing water from propanol gives propene (X) C_3H_6

Its isomer is cyclopropane: saturated and chemically reactive (its bond angles are 60°).

2 **Answer (C)**

5 mol of CO_2 and 5 mol of H_2O mean the formula C_5H_{10}

1,1-dimethylcyclopropane has the formula C_5H_{10}

3 **Answer (B)**

Cyclohexane C_6H_{12} is saturated and all its carbons are CH_2 groups, so it contains no methyl.

4 **Answer (D)**

A molecule of cyclohexane C_6H_{12} contains 18 atoms, not 12

5 **Answer (A)**

The monomer of the polymer is propene $CH_2=CH–CH_3$

Its isomer is cyclopropane C_3H_6

6 **Answer (A)**

(D) C_5H_{10} may be cyclopentane (a saturated cyclic compound).

(A) $C_2HBrClF_3$ (halothane) is an alkane derivative.

7 **Answer (C)**

The bond angles of cyclobutane are 90°, so it is less stable and more reactive than cyclopentane.
So it burns faster than it.

8 **Answer (A)**

(A) cyclopentane , (B) 1,2-dimethylcyclopropane , (C) methylcyclobutane.
The smaller the ring, the higher the reactivity: B > C > A

9 **Answer (B)**

The compound has the formula C_3H_6 (3 moles of CO_2 and 3 moles of H_2O).
Propane C_3H_8 gives 4 moles of water; propanol contains oxygen but it is C_3H_8O and gives 4 moles of water; and propyne C_3H_4 gives 2 moles of water.
So the compound is cyclopropane.