Unit 9 · Organic Compounds

WORKSHEET

Full marks 51

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 51

1 Key words [4]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

addition	**alicyclic**	**aliphatic**	**delocalization**	**elimination**	**heterocyclic**	**isomers**
polymerization	**saturation**	**substitution**				

Organic compounds whose carbon atoms form open chains are called _____ compounds. Rings of carbon atoms that behave like open-chain compounds are _____, while a ring containing an atom other than carbon is _____. In benzene the six π electrons are spread evenly round the ring, which is called _____. Compounds with the same molecular formula but different structural formulas are _____. In a reaction at a double bond, two molecules join into one: this is _____. A reaction in which an atom or group is replaced by another is _____, and one in which atoms leave neighboring carbons to form a multiple bond is _____.

2 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The length of each carbon–carbon bond in benzene is: [1]

a. 120 pm **b.** 134 pm
c. 139 pm **d.** 154 pm

ii. According to Hückel's rule, an aromatic ring contains: [1]

a. 4n π electrons **b.** (4n + 2) π electrons
c. (4n + 1) π electrons **d.** (2n + 4) π electrons

iii. Butan-1-ol and butan-2-ol are: [1]

a. chain isomers **b.** position isomers
c. functional isomers **d.** the same compound

iv. Which of these is aromatic? [1]

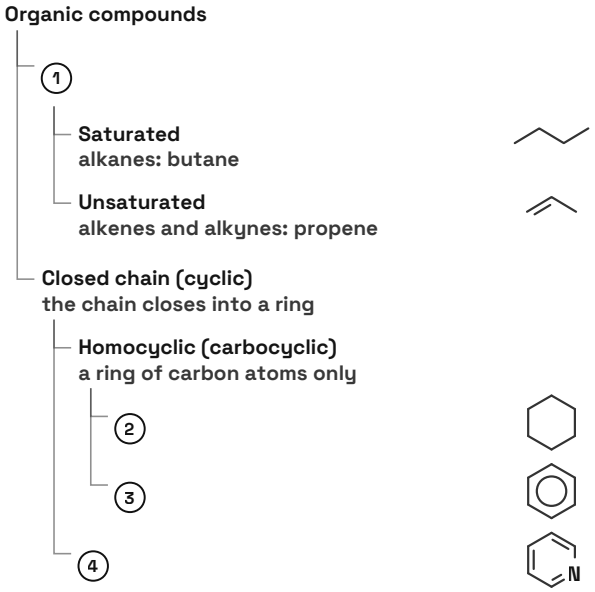
a. cyclobutadiene, C_4H_4 **b.** cyclooctatetraene, C_8H_8
c. the cyclopentadienyl anion, $C_5H_5^-$ **d.** cyclohexane, C_6H_{12}

v. Which reaction is an elimination? [1]

a. $CH_2{=}CH_2 + H_2 \rightarrow CH_3CH_3$ **b.** $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$
c. $CH_3CH_2Br + KOH\ (alc) \rightarrow CH_2{=}CH_2 + KBr + H_2O$ **d.** $CH_3CH_2Br + KOH\ (aq) \rightarrow CH_3CH_2OH + KBr$

3 Label the diagram [4]

The diagram sorts organic compounds by their carbon skeleton. In place of 1 to 4, write the name of each kind. Each carries 1 mark.



1. _____ **2.** _____

3. _____ **4.** _____

4 Very short answers [4]

Write very short answers to the following questions.

a. What is the general formula of the cycloalkanes? [1]

_____

_____

b. What is the angle between the bonds round each carbon in ethyne? [1]

_____

_____

c. How many σ and π bonds join the two carbon atoms of ethene? [1]

_____

_____

d. Write the functional isomer of propanal, CH_3CH_2CHO. [1]

_____

_____

5 Short answers [8]

Write short answers to the following questions.

a. Benzene is an unsaturated compound, yet it doesn't decolorize bromine water. Give a reason. [2]

b. Butane and 2-methylpropane are isomers, but they have different boiling points. Give a reason. [2]

c. Aldehydes don't show position isomerism of the functional group. Give a reason. [2]

d. Chlorination of methane is carried out in diffused sunlight, not in the dark or in bright sunlight. Give a reason. [2]

6 Long answers [12]

Write long answers to the following questions.

a. State Hückel's rule. Use it to show that benzene and naphthalene are aromatic. [4]

b. What is isomerism? Describe chain, position and functional isomerism with one example each. **[4]**

c. A hydrocarbon X, C_2H_4, decolorizes bromine water. X adds hydrogen in the presence of nickel to give Y. Y reacts with chlorine in diffused sunlight to give Z and hydrogen chloride. Identify X, Y and Z, write the equations, and name the kind of each reaction. **[4]**

7 Numerical problems **[11]**

Solve the following problems. Show your working.

a. A cycloalkane has a molecular mass of 84. Find its molecular formula and name it. (C = 12, H = 1) **[2]**

Answer:

b. The cycloheptatrienyl cation, $C_7H_7^+$, is a flat ring of seven carbons with three double bonds; the seventh carbon carries the positive charge (an empty orbital). Count its π electrons and decide whether it is aromatic. **[3]**

Answer:

c. When 8 g of methane reacts with chlorine in diffused sunlight to give chloromethane only, what mass of chloromethane and what volume of hydrogen chloride at STP form? (C = 12, H = 1, Cl = 35.5; 1 mole of gas at STP = 22.4 L) **[3]**

Answer: _____

d. An alkyne has a molecular mass of 40. Find its formula, draw its structure and name it. How many σ and π bonds does it contain? (C = 12, H = 1) **[3]**

Answer: _____

8 Think **[3]**

Cyclohexane and hex-1-ene are both C_6H_{12}. You are given one of them in an unlabeled bottle. How would you tell which it is? Why can't its molecular mass tell you? How are the two related?

9 Activity: All the structural isomers of C_5 (not marked)

Build pentane from clay balls and toothpicks (five carbons, twelve hydrogens). Move a carbon to make branches. For each attempt, find the longest chain and name it. Try to make a fourth isomer.

Attempt	Longest chain	IUPAC name	Boiling point
no branch			
methyl on carbon 2			
methyl on carbon 3			
two methyls on carbon 2			