Unit 13 · Fundamental Principles of Organic Chemistry

WORKSHEET

Full marks 34

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 34

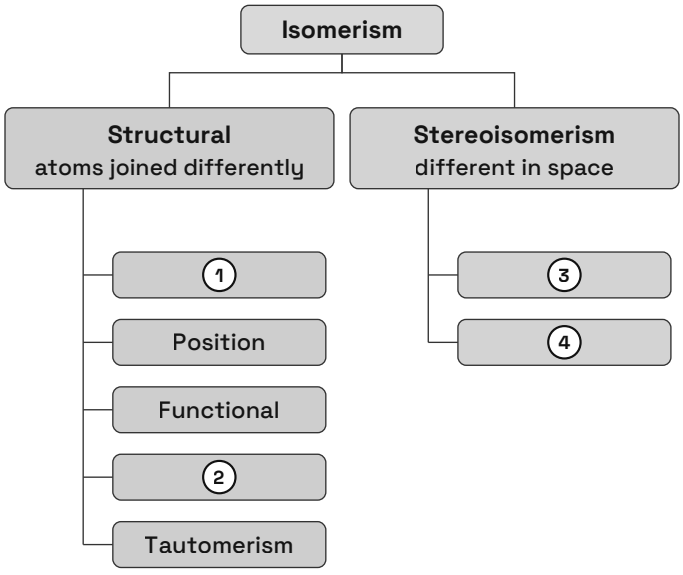
1 Match the columns [3]

Match each term in Column A with its meaning in Column B. One meaning in Column B is not needed. Each carries 0.5 mark.

Column A		Column B
1. substrate	☐	**a.** the group that goes off with the bonding pair, as Br^- does from bromoethane
2. electrophile	☐	**b.** an atom or group of atoms with an unpaired electron
3. nucleophile	☐	**c.** a negative ion with the charge on a carbon atom
4. free radical	☐	**d.** the organic compound that is changed in a reaction
5. carbocation	☐	**e.** a reagent short of electrons, which accepts a pair of electrons
6. leaving group	☐	**f.** a reagent rich in electrons, which gives a pair of electrons to make a bond
		g. a positive ion with the charge on a carbon atom

2 Label the diagram [2]

The chart shows the kinds of isomerism. Write the kind that belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The IUPAC name of $CH_3–CH(CH_3)–CH(CH_3)–CH_3$ is: [1]

a. hexane
b. 2,2-dimethylbutane
c. 2,3-dimethylbutane
d. 1,2,3-trimethylpropane

ii. In the test for halogens, the sodium extract is boiled with dilute nitric acid before silver nitrate is added. Why? [1]

a. to turn the halogen into a halide ion
b. to drive off cyanide and sulphide, which would also give precipitates with silver nitrate
c. to dissolve the silver halide
d. to make the extract alkaline

iii. Which of these shows geometrical (cis–trans) isomerism? [1]

a. propene
b. but-1-ene
c. 2-methylpropene
d. but-2-ene

iv. Which alkyl group has the strongest positive inductive effect (+I)? [1]

a. $CH_3–$
b. $CH_3CH_2–$
c. $(CH_3)_2CH–$
d. $(CH_3)_3C–$

v. The Prussian blue formed in the test for nitrogen is: [1]

a. $Na_4[Fe(CN)_6]$
b. $Fe_4[Fe(CN)_6]_3$
c. $Fe(SCN)_3$
d. $Fe(CN)_2$

4 Short answers [9]

Write short answers to the following questions.

a. Write the IUPAC name of $CH_3–CH(OH)–CH_2–CHO$. Which group gives the suffix, and why? [2]

b. Draw the structures of i. 3-methylbut-1-ene and ii. methyl propanoate. [2]

c. Write two differences between homolytic and heterolytic fission. [2]

d. The sodium extract of a compound gives a blood red color, not Prussian blue, in the test for nitrogen. What does this show? Why does it happen, and how would you make the nitrogen and sulphur tests work separately? Write equations. **[3]**

5 Long answer **[4]**

Write a long answer to the following question.

Arrange these acids in order of increasing strength, and explain the order using the inductive effect: CH_3COOH, $Cl_3C–COOH$, CH_3CH_2COOH, $ClCH_2–COOH$.

6 Numerical problems **[8]**

Solve the following problems. Show your working. Take C = 12, H = 1, O = 16.

a. An organic compound contains 64.9% carbon and 13.5% hydrogen by mass, the rest oxygen, and its molecular mass is 74. i. Find its empirical and molecular formulas. ii. Draw and name one alcohol and one ether with this formula. What kind of isomers are they? iii. Which alcohol with this formula is optically active? Mark its chiral carbon. **[4]**

Answer:

b. A compound contains 62.1% carbon, 10.3% hydrogen and 27.6% oxygen, and its molecular mass is 58. i. Find its molecular formula. ii. Name two compounds with this formula that are functional isomers. iii. One of them is a ketone. Draw its enol tautomer, and say which form is present almost entirely. **[4]**

Answer: _____

7 Think [3]

2-chloropropanoic acid, CH_3–CHCl–COOH, is a stronger acid than 3-chloropropanoic acid, Cl–CH_2–CH_2–COOH. Explain why. Which of the two can exist as a pair of enantiomers, and why?

8 Activity: Hands and molecules (not marked)

You need: clay or dough in three or four colors, and toothpicks. Make a carbon ball with four toothpicks pointing to the corners of a tetrahedron. Put four different colored balls on it (H, F, Cl, Br, for bromochlorofluoromethane). Make a second model that is its mirror image. Then make two models of a carbon with two balls of the same color.

Model	Four different groups?	Can it be laid exactly on its mirror image?
CHBrClF		
CH_2Cl_2 (two H the same)		

What property must a carbon have before a molecule can show optical isomerism?