Carbon and its Compounds

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer 8 × 1 = 8 marks

1. The formula of propane is:
(a) C_3H_8 **(b)** C_3H_7Cl **(c)** C_2H_6 **(d)** C_2H_5COOH

2. The compound CH_3CH_2Cl belongs to the homologous series of:
(a) aldehydes **(b)** carboxylic acids
(c) alkanes **(d)** haloalkanes

3. Carbon forms bonds mainly by:
(a) gaining electrons **(b)** losing electrons
(c) sharing electrons (covalent bonds) **(d)** forming ions

4. The next higher homologue of propanoic acid (C_2H_5COOH) is:
(a) C_3H_7COOH **(b)** C_4H_{10} **(c)** C_4H_8 **(d)** C_3H_7CHO

5. The molecular mass of heptene (C_7H_{14}) is: (C = 12 u, H = 1 u, O = 16 u, Cl = 35.5 u)
(a) 100 u **(b)** 112 u **(c)** 98 u **(d)** 96 u

6. How many covalent bonds are there in a molecule of pentane (C_5H_{12})?
(a) 17 **(b)** 15 **(c)** 16 **(d)** 22

7. Which of these will decolourise bromine water?
(a) C_4H_6 **(b)** C_4H_9Cl **(c)** C_4H_{10} **(d)** CH_3Cl

8. Assertion (A): C_3H_7OH and $C_5H_{11}OH$ are successive members of the same homologous series.
Reason (R): Successive members of a homologous series differ by a CH_2 unit.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer 8 × 2 = 16 marks

9. Write the name and formula of the fourth member of the aldehyde series.

10. Write the balanced equation for the complete combustion of pentanol ($C_5H_{11}OH$).

11. Find the molecular masses of chloromethane (CH_3Cl) and chlorobutane (C_4H_9Cl). By how much do they differ? (C = 12 u, H = 1 u, O = 16 u, Cl = 35.5 u)

12. Why can carbon form a very large number of compounds?

13. Write the condensed structural formula of ethanol and name its functional group.

14. For ethane (C_2H_6), how many C–H bonds and carbon–carbon bonds of each kind are there? How many covalent bonds (shared pairs) in all?

15. Write the equation for the reaction of butane with chlorine in sunlight, when one hydrogen atom is replaced. Name the organic product.

16. Name the compound CH_3CH_2OH, and write the formula and name of its next higher homologue.

Section C — Word problems — 4 × 4 = 16 marks

17. A compound X ($C_2H_4O_2$) turns blue litmus red and gives a gas with sodium carbonate that turns lime water milky. Identify X and write the equation.

18. 46 g of ethanol burns completely in oxygen. Write the balanced equation, and find the masses of oxygen used and of carbon dioxide and water formed. (Atomic masses: H = 1 u, C = 12 u, O = 16 u)

19. An organic compound X has the molecular formula C_5H_8. It decolourises bromine water, and one molecule adds two molecules of hydrogen in the presence of nickel. Identify X and its homologous series, and write the name and formula of its next higher homologue.

20. For the carboxylic acids: write the names and formulas of the members with 3, 4, 5 carbon atoms, the general formula of the series, and the difference in molecular mass between successive members.

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Answer key

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Q	Answer	Working
1	**(a) C_3H_8**	alkanes, 3 carbon atoms
2	**(d) haloalkanes**	functional group: –Cl (halo group)
3	**(c) sharing electrons (covalent bonds)**	—
4	**(a) C_3H_7COOH**	add one CH_2 unit
5	**(c) 98 u**	—
6	**(c) 16**	4 C–C + 12 C–H
7	**(a) C_4H_6**	unsaturated compounds (C=C or C≡C) add bromine
8	**(d) A is false, but R is true.**	A is false: they differ by C_2H_4 (28 u), two CH_2 units, so they are not successive. R is true.
9	**Butanal, C_3H_7CHO**	the aldehydes start at 1 carbon atom
10	**$2C_5H_{11}OH + 15O_2 \rightarrow 10CO_2 + 12H_2O$**	products are carbon dioxide and water
11	**50.5 u and 92.5 u; they differ by 42 u**	3 CH_2 units × 14 u
12	**Catenation: it links with other carbon atoms into chains, branches and rings. Tetravalency: it bonds with four other atoms, such as carbon, hydrogen, oxygen, nitrogen and chlorine.**	—
13	**CH_3CH_2OH; –OH (alcohol)**	—
14	**C–H: 6; C–C single: 1; 7 shared pairs**	a double bond is 2 shared pairs, a triple bond 3
15	**$C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$; chlorobutane**	substitution: Cl replaces H
16	**Ethanol; next: C_3H_7OH, propanol**	alcohols; add CH_2
17	**X is ethanoic acid: $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$.**	—
18	**$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$; oxygen 96 g; carbon dioxide 88 g; water 54 g**	C_2H_5OH = 46 u; 1 mol; ratio 1 : 3 : 2 : 3
19	**X is pentyne (C_5H_8), one of the alkynes; next: hexyne, C_6H_{10}**	—
20	**propanoic acid C_2H_5COOH; butanoic acid C_3H_7COOH; pentanoic acid C_4H_9COOH; general formula $C_nH_{2n}O_2$; 14 u (one CH_2)**	—

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