

Basics of Organic Chemistry

Practice questions for OCR Chemistry A (H432)

Specification focus	Total marks
4.1.1(b)-(d): organic formulae, core organic terminology and use of general formulae.	60

Instructions

Answer all questions. Show working where a general formula is used. Diagrams do not need to be drawn to scale.

This booklet focuses only on the formulae and terminology content in 4.1.1(b)-(d); it does not assess nomenclature, isomerism or reaction mechanisms.

1 Formulae used in organic chemistry [6]

Four representations are shown below.

A C_nH_{2n+2}	B $CH_3CH_2CH_2CH_3$	C a formula showing every atom and every bond	D a line-angle formula in which H atoms on carbon are omitted
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(a) State the type of formula represented by A, B, C and D. [4]

(b) A student says that C_5H_{12} is a general formula for alkanes. Explain why this statement is incorrect. [1]

(c) Which type of formula is usually the most compact way to show the carbon skeleton and functional groups in a large organic molecule? [1]

2 Changing between formula representations

[7]

The structural formula of compound P is $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$.

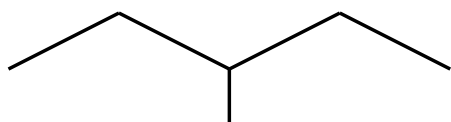
(a) Draw the displayed formula of P.

[2]

(b) Draw the skeletal formula of P.

[2]

The skeletal formula of compound Q is shown below.



(c) Write the structural formula of Q.

[2]

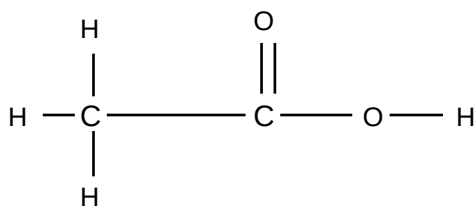
(d) State the number of carbon atoms in Q.

[1]

3 Structural formula conventions

[6]

A displayed representation of compound R is shown below.



(a) Write the structural formula of R using the usual convention for a carboxyl group.

[1]

Compound S contains the arrangement $\text{CH}_3\text{COOCH}_2\text{CH}_3$.

(b) Which three-letter sequence is used to represent the ester group in a structural formula?

[1]

(c) The formula $\text{CH}_3\text{CH}_2\text{OH}$ is a structural formula rather than a displayed formula. State one feature that a displayed formula would show that this formula does not.

[1]

(d) A straight-chain molecule contains four carbon atoms joined only by single bonds. Write two equivalent structural formulae that could be used to represent this same carbon chain.

[2]

(e) In a skeletal formula, which parts of the molecule must still be shown even though hydrogen atoms attached to carbon are omitted?

[1]

4 Homologous series

[6]

(a) Define the term *homologous series*.

[2]

Four successive members of one series can be represented as CH_3OH , $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_3\text{H}_7\text{OH}$ and $\text{C}_4\text{H}_9\text{OH}$.

(b) Give two features of these formulae that are consistent with the compounds belonging to one homologous series.

[2]

(c) Write the formula of the next member of this series.

[1]

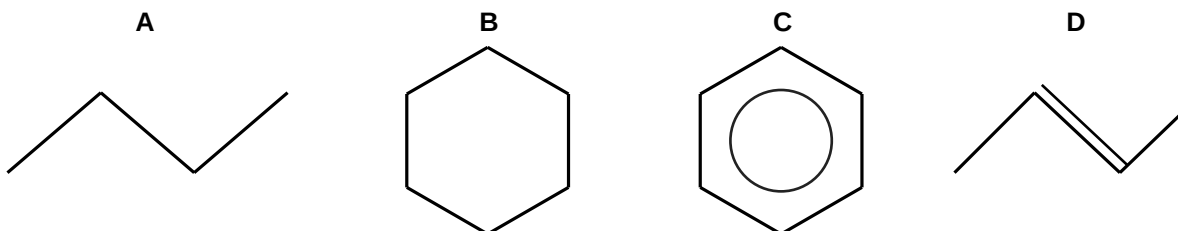
(d) State the overall formula difference between the second and fifth members of the series.

[1]

5 Using organic chemistry terms

[8]

Four carbon structures A-D are shown below.



(a) Which structures are aliphatic? [1]

(b) Which structure is alicyclic? [1]

(c) Which structure is aromatic? [1]

(d) Which structures are unsaturated? [1]

(e) Which structures are saturated? [1]

(f) An alkyl group contains four carbon atoms. Use the general formula $C_n H_{2n+1}$ to give the formula of this alkyl group. [1]

(g) What term is used for the group of atoms in an organic molecule that is responsible for its characteristic reactions? [1]

(h) In organic formulae, the symbol R is often used in place of part of a molecule. What can R represent? [1]

6 Using general formulae [8]

For each part, use the general formula given. Give the formula of the required member.

(a) C_nH_{2n+2} , $n = 7$ [1]

(b) C_nH_{2n} , $n = 6$ [1]

(c) $C_nH_{2n+1}Cl$, $n = 5$ [1]

(d) $C_nH_{2n+2}O$, $n = 4$ [1]

(e) C_nH_{2n-2} , $n = 8$ [1]

(f) $C_nH_{2n+2}O_2$, $n = 3$ [1]

(g) $C_nH_{2n+1}Br$, $n = 12$ [1]

(h) $C_nH_{2n}O$, $n = 15$ [1]

7 Working backwards from a general formula [7]

Show enough working to justify each answer.

(a) A homologous series has the general formula C_nH_{2n+2} . Determine whether C_8H_{18} can be a member of this series. [2]

(b) A second series has the general formula C_nH_{2n} . Determine whether C_6H_{10} can be a member of this series. [2]

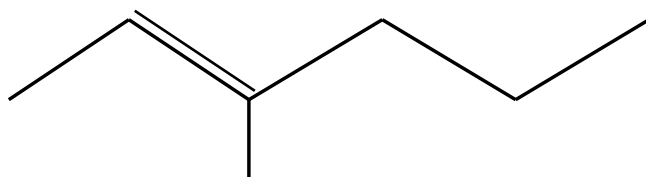
(c) A member of the series $C_nH_{2n+1}Cl$ contains 15 hydrogen atoms. Determine n and hence write its molecular formula. [2]

(d) A member of the series C_nH_{2n-2} has formula C_5H_8 . State the value of n . [1]

8 Interpreting a skeletal formula

[7]

The skeletal formula of compound T is shown below.



- (a) State the number of carbon atoms in T. [1]
- (b) Write the structural formula of T. [2]
- (c) Write the molecular formula of T. [1]
- (d) State whether T is saturated or unsaturated. [1]
- (e) State whether T is aliphatic, alicyclic or aromatic. [1]
- (f) Are hydrogen atoms attached directly to carbon normally written in a skeletal formula? [1]

9 Mixed review

[5]

Series P has the general formula C_nH_{2n+2} . Series Q has the general formula $C_nH_{2n+2}O$. In both formulae, n is the number of carbon atoms.

- (a) Write the formula of the member of series P that contains ten carbon atoms. [1]
- (b) Write the formula of the member of series Q that contains six carbon atoms. [1]
- (c) State the change in molecular formula from one member of a homologous series to the next. [1]
- (d) Explain why $C_4H_{10}O$ alone is not a structural formula. [1]
- (e) A compound contains a benzene ring. Which one of the terms *aliphatic*, *alicyclic* or *aromatic* must apply? [1]

END OF QUESTIONS