



CrackingCHEM

GCSE | A-LEVEL

UNDERSTAND • APPLY • SUCCEED

OCR A H432

Introduction to Organic Chemistry

Original exam questions | TEST IT → EXAM STYLE → HARDER MIXED → STRETCH

SPECIFICATION-LED. PROGRESSIVE. EXAM-FOCUSED.

OCR A SPECIFICATION

4.1.1(a-e) | Basic concepts of organic chemistry

TEST IT	EXAM STYLE	HARDER MIXED	STRETCH
8	10	5	1

24 ORIGINAL QUESTIONS

184 TOTAL MARKS

FINAL NOTES-ALIGNED EDITION | FORMULAE • NOMENCLATURE • ISOMERISM

Independent practice material. Every question is original and stays within OCR A 4.1.1(a-e).



START HERE

How to use this pack

Read the carbon skeleton first, then prove the formula, name and relationship

- 1 Complete TEST IT without the notes. Correct formula-language errors before moving on.
- 2 For each structure, trace the longest valid parent chain and number from the correct end.
- 3 For every drawing, count carbon atoms, restore enough hydrogen for valency four, then check the molecular formula.
- 4 When judging isomers, compare molecular formulae first and connectivity second; rotated copies are not new isomers.

✓ **OCR A boundary:** This pack covers 4.1.1(a-e): nomenclature, formula representations, homologous series and functional groups, OCR introductory terminology and structural isomerism.

Held for Topic II: Bond fission, radicals, curly arrows, mechanisms and E/Z stereoisomerism are deliberately excluded.

Skeletal routine: Count every line end and corner once. Carbon symbols and hydrogen atoms bonded to carbon are omitted; heteroatoms and hydrogen bonded to them remain visible.

Naming routine: Parent chain → principal suffix → numbering → substituents → alphabetical order → punctuation.

Notes alignment: All questions map directly to the final CrackingChem OCR A Introduction to Organic Chemistry I notes and OCR A H432 4.1.1(a-e).



SECTION A

TEST IT

Eight direct checks of the finished-notes mastery outcomes

QUESTION 1 | TEST IT

(a) State what is meant by a hydrocarbon.

[1 mark]

(b) Define homologous series using precise OCR A terminology.

[2 marks]

(c) State what is meant by a functional group.

[1 mark]

(d) Distinguish saturated from unsaturated compounds.

[2 marks]

(e) Classify cyclohexane as aliphatic, alicyclic or aromatic, and justify your choice.

[2 marks]

QUESTION 2 | TEST IT

Match each description to one formula type: molecular, empirical, general, structural, displayed or skeletal.

Description	Formula type
actual number of each atom in one molecule	
simplest whole-number ratio of atoms	
algebraic formula for a homologous series	
minimal detail showing atom arrangement	
relative positions of atoms and every bond	
carbon skeleton with C and C-H omitted	

[6 marks]

(b) State two conventions used in a skeletal formula.

[2 marks]

**QUESTION 3** | **TEST IT**

Identify the functional group or homologous series shown in each structure A-H.

Structures A-H**A****B****C****D****E****F****G****H**

[8 marks]

QUESTION 4 | **TEST IT**

(a) State the general formula for acyclic alkanes, acyclic alkenes containing one C=C, saturated monohydric alcohols, and acyclic aldehydes or ketones.

[4 marks]

(b) Deduce the molecular formula of a seven-carbon alkane and a six-carbon acyclic alkene containing one C=C.

[2 marks]

(c) Explain how aldehydes and ketones can share a general formula but belong to different homologous series.

[2 marks]

**QUESTION 5** | **TEST IT**

Complete the first-ten-alkanes table. Give both the alkane and corresponding alkyl-group name.

C atoms	Alkane	Alkyl group
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

[10 marks]**QUESTION 6** | **TEST IT****Skeletal structure A**

(a) State the number of carbon atoms and the molecular formula.

[2 marks]

(b) Give the systematic name.

[2 marks]

(c) Write the structural formula.

[2 marks]

(d) State whether the compound is saturated or unsaturated.

[1 mark]

**QUESTION 7** | **TEST IT**

Give the systematic name of structures A-D.

A**B****C****D**

.....
.....
.....

[4 marks]

(b) For structure B, explain the numbering direction and the order in which the substituents are written.

.....
.....
.....

[2 marks]

**QUESTION 8** | **TEST IT**

Draw a skeletal or displayed formula for each named compound: 3-methylpentane; 2-bromobutan-1-ol; pent-2-ene; ethyl ethanoate.

FOUR STRUCTURE DRAWINGS

[8 marks]



SECTION B

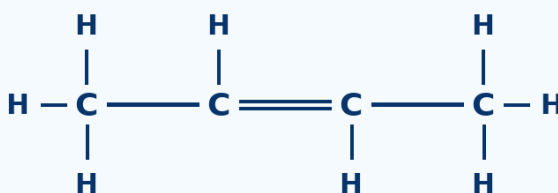
EXAM STYLE

Ten original structured questions using OCR A nomenclature and formula conventions

✓ **Route check:** Count the carbon skeleton, identify the suffix group, choose the parent, number it, then check valency and formula.

QUESTION 9 | EXAM STYLE

Displayed formula of compound P



(a) State the molecular formula and empirical formula of P.

[2 marks]

(b) Write the structural formula of P.

[1 mark]

(c) Draw the skeletal formula of P.

DIAGRAM SPACE

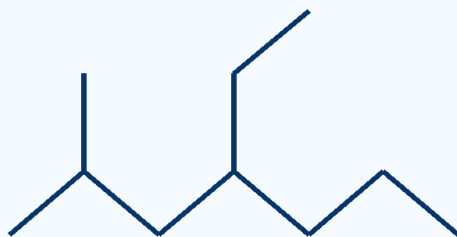
[2 marks]

(d) State the general formula of the homologous series containing P and identify the functional group.

[2 marks]

**QUESTION 10** | EXAM STYLE

Skeletal structure Q



(a) Give the systematic name of Q.

[3 marks]

(b) Explain why the parent is heptane and why numbering begins from the left-hand end as drawn.

[3 marks]

QUESTION 11 | EXAM STYLE

Name compounds A-C.

A



B



C



[3 marks]

(b) For B, explain which part of the name is written first.

[2 marks]

(c) For A, explain whether the carbon in $\text{C}\equiv\text{N}$ is included in the parent-chain carbon count.

[2 marks]

**QUESTION 12** | EXAM STYLE

Draw a correct structure for each name: 4-methylhex-2-ene; 3-methylbutan-2-ol; 2-bromobutanoic acid; methyl propanoate.

FOUR STRUCTURE DRAWINGS

[8 marks]

**QUESTION 13** | EXAM STYLE

Draw all structural isomers of C_5H_{12} and give the systematic name of each.

THREE UNIQUE STRUCTURAL ISOMERS

[6 marks]

(b) State how systematic names help you avoid counting a rotated copy as a new isomer.

[1 mark]

**QUESTION 14** | EXAM STYLE

C_4H_8O has three acyclic structural isomers containing one carbonyl group and no other functional group. Draw and name all three.

TWO ALDEHYDES AND ONE KETONE

[6 marks]

(b) State why all three can have the same molecular formula.

[1 mark]

QUESTION 15 | EXAM STYLE

Propanal has structural formula CH_3CH_2CHO . Propanone has structural formula CH_3COCH_3 .

(a) State the molecular formula of each compound.

[2 marks]

(b) Explain why propanal and propanone are structural isomers.

[2 marks]

(c) State the homologous series of each compound.

[2 marks]

**QUESTION 16** | **EXAM STYLE**

Each student name below contains an error. Give the correct name and identify the rule the student has broken.

A

student name: 3-methylbutane

B

student name: 2-ethylbutane

C

student name: propyl methanoate

D

student name: pent-3-ene

(a) Correct name and broken rule

.....

.....

.....

[2 marks]

(b) Correct name and broken rule

.....

.....

.....

[2 marks]

(c) Correct name and broken rule

.....

.....

.....

[2 marks]

(d) Correct name and broken rule

.....

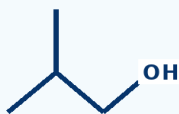
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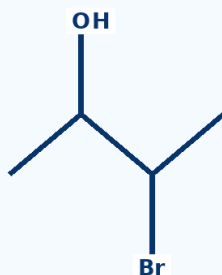
[2 marks]

**QUESTION 17** | EXAM STYLE

For each structure A-C, give its systematic name, molecular formula and homologous series.

A**B****C**

[9 marks]

QUESTION 18 | EXAM STYLE**Compound R**

(a) Give the systematic name of R.

[3 marks]

(b) State the molecular formula of R.

[2 marks]

(c) Write a structural formula for R.

[2 marks]



SECTION C

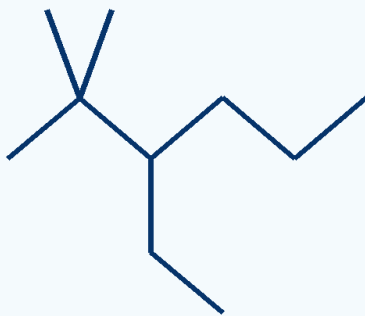
HARDER MIXED

Five less-scaffolded applications combining representation, naming and isomerism

Independent thinking: A correct answer must survive all three checks: longest parent, carbon valency four and the stated molecular formula.

QUESTION 19 | HARDER MIXED

Unfamiliar skeletal structure S



(a) Give the systematic name of S.

[3 marks]

(b) Deduce the molecular formula of S.

[2 marks]

(c) Explain how you selected the parent chain and ordered the substituent names.

[2 marks]

**QUESTION 20** | **HARDER MIXED**

Draw and name all five structural isomers of C_6H_{14} . Use a systematic route and do not include rotated duplicates.

FIVE UNIQUE STRUCTURAL ISOMERS

[8 marks]

**QUESTION 21 | HARDER MIXED**

For each pair A-D, decide whether the structures represent the same compound or structural isomers. Justify each decision using molecular formula and connectivity.

A

and

**B**

and

**C**

and

**D**

and



(a) Decision and justification

[2 marks]

(b) Decision and justification

[2 marks]

(c) Decision and justification

[2 marks]

(d) Decision and justification

[2 marks]

**QUESTION 22 | HARDER MIXED**

Evaluate each student's statement. State whether it is correct and use a general formula or structural feature to justify your answer.

(a) C_8H_{16} is the molecular formula of an acyclic saturated alkane.

.....

.....

.....

[2 marks]

(b) C_6H_{12} can be the molecular formula of an acyclic alkene containing one $C=C$.

.....

.....

.....

[2 marks]

(c) $C_5H_{10}O$ can be the molecular formula of a saturated acyclic aldehyde or ketone.

.....

.....

.....

[2 marks]

(d) $C_4H_8O_2$ can represent either a carboxylic acid or an ester.

.....

.....

.....

[2 marks]

**QUESTION 23 | HARDER MIXED**

For each requirement, draw one valid structural formula and give its systematic name.

(a) an aldehyde with molecular formula $C_5H_{10}O$

DIAGRAM SPACE

[2 marks]

(b) a ketone that is a structural isomer of your answer to (a)

DIAGRAM SPACE

[2 marks]

(c) a carboxylic acid with molecular formula $C_4H_8O_2$

DIAGRAM SPACE

[2 marks]

(d) an ester that is a structural isomer of your answer to (c)

DIAGRAM SPACE

[2 marks]



SECTION D

STRETCH / SYNOPTIC

One final structure puzzle using only OCR A 4.1.1(a-e)

QUESTION 24 | STRETCH / SYNOPTIC

Structure puzzle: Compound X is a saturated acyclic alcohol. It contains seven carbon atoms. The longest chain containing -OH has five carbons; -OH is on C1; and C2 carries two methyl groups.

(a) Deduce the molecular formula of X.

[2 marks]

(b) Give the systematic name of X.

[3 marks]

(c) Draw a skeletal formula of X.

DIAGRAM SPACE

[2 marks]

(d) Draw and name one other alcohol that is a structural isomer of X.

DIAGRAM SPACE

[2 marks]

(e) Explain why your compound in (d) is a structural isomer of X.

[1 mark]



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UNDERSTAND • APPLY • SUCCEED

OCR A H432

Introduction to Organic Chemistry

Fully worked answers | OCR A-style marking guidance

FULLY WORKED. PRECISELY MARKED. BUILT FOR IMPROVEMENT.

OCR A SPECIFICATION

4.1.1(a-e) | Basic concepts of organic chemistry

TEST IT	EXAM STYLE	HARDER MIXED	STRETCH
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24 QUESTIONS MARKED

184 MARKS EXPLAINED

FINAL NOTES-ALIGNED EDITION | FORMULAE • NOMENCLATURE • ISOMERISM

Independent practice material. Every question is original and stays within OCR A 4.1.1(a-e).



OCR A MAP

How this pack matches the finished notes

Full coverage of 4.1.1(a-e), with Topic II deliberately held back

Specification area	Recurring OCR A demand	Frequent trap	Questions
Organic language	Use hydrocarbon, homologous series, functional group, aliphatic, alicyclic, aromatic, saturated and unsaturated precisely.	Using everyday descriptions instead of specification terminology.	1, 3-4, 9, 15, 17, 22
Formula representations	Convert molecular, empirical, general, structural, displayed and skeletal formulae.	Missing hidden carbons/hydrogens or showing carbon with five bonds.	2, 6, 8-9, 12, 17-18, 23-24
Nomenclature	Choose the longest valid parent, number correctly, use locants, alphabetical order and punctuation.	Choosing the horizontal chain or numbering from the nearest branch instead of the suffix group.	5-8, 10-12, 16-19, 23-24
Structural isomerism	Same molecular formula, different structural formula; generate unique candidates systematically.	Counting rotated duplicates or comparing compounds with different molecular formulae.	13-15, 20-24

Research basis: Checked against the final CrackingChem OCR A Introduction to Organic Chemistry I notes, the Year 12 master specification map and OCR A Chemistry H432 specification Version 3.1. Every question is original.

Assessment boundary: No bond fission, radicals, curly arrows, reaction mechanisms or E/Z stereoisomerism are assessed.

Step	Self-marking action
1 Count	Recount every carbon and infer hydrogen from valency four.
2 Name	Check parent, suffix, numbering, substituents, alphabet and punctuation.
3 Compare	For isomers, verify the same molecular formula and different connectivity.
4 Improve	Redraw or rename the full compound without looking at the model.



SECTION A

TEST IT answers

Direct retrieval with exact OCR A terminology and checked structures

TEST IT 1

- (a) A hydrocarbon contains carbon and hydrogen only [1].
- (b) A homologous series is a series of organic compounds with the same functional group [1], in which each successive member differs by CH_2 [1]. [2]
- (c) A functional group is the group of atoms responsible for the characteristic reactions of a compound [1].
- (d) Saturated compounds contain carbon-carbon single bonds only [1]; unsaturated compounds contain multiple carbon-carbon bonding [1]. [2]
- (e) Cyclohexane is alicyclic [1] because it is an aliphatic, non-aromatic ring [1]. [2]

TEST IT 2

- Descriptions in order: molecular [1]; empirical [1]; general [1]; structural [1]; displayed [1]; skeletal [1]. [6]
- Skeletal formulae omit carbon symbols and hydrogen atoms bonded to carbon [1]; every unlabelled line end or vertex represents carbon, while heteroatoms and any H attached to them are shown [1]. [2]

TEST IT 3

- A alkene [1]; B haloalkane [1]; C alcohol [1]; D nitrile [1]; E aldehyde [1]; F ketone [1]; G carboxylic acid [1]; H ester [1]. [8]

Structures A-H

A $\text{CH}_3\text{CH}=\text{CH}_2$	B $\text{CH}_3\text{CH}_2\text{Br}$	C $\text{CH}_3\text{CH}_2\text{OH}$	D $\text{CH}_3\text{CH}_2\text{C}\equiv\text{N}$
E $\text{CH}_3\text{CH}_2\text{CHO}$	F CH_3COCH_3	G $\text{CH}_3\text{CH}_2\text{COOH}$	H $\text{CH}_3\text{COOCH}_2\text{CH}_3$

TEST IT 4

- (a) Alkanes $\text{C}_n\text{H}_{2n+2}$ [1]; alkenes C_nH_{2n} [1]; alcohols $\text{C}_n\text{H}_{2n+1}\text{OH}$ [1]; aldehydes/ketones $\text{C}_n\text{H}_{2n}\text{O}$ [1]. [4]
- (b) Seven-carbon alkane C_7H_{16} [1]; six-carbon alkene C_6H_{12} [1]. [2]
- (c) Both contain one $\text{C}=\text{O}$ and fit $\text{C}_n\text{H}_{2n}\text{O}$ [1], but an aldehyde has a terminal $-\text{CHO}$ arrangement whereas a ketone has $\text{C}=\text{O}$ within the chain [1]. [2]

TEST IT 5

- One mark per complete pair: 1 methane/methyl [1]; 2 ethane/ethyl [1]; 3 propane/propyl [1]; 4 butane/butyl [1]; 5 pentane/pentyl [1]; 6 hexane/hexyl [1]; 7 heptane/heptyl [1]; 8 octane/octyl [1]; 9 nonane/nonyl [1]; 10 decane/decyl [1]. [10]

**TEST IT 6**

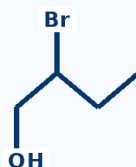
- (a) Seven carbon atoms [1]; C_7H_{16} [1]. [2]
- (b) 3-methylhexane: longest chain six carbons and methyl at C3 [2]. [2]
- (c) $CH_3CH_2CH(CH_3)CH_2CH_2CH_3$ [2]. [2]
- (d) Saturated: it contains only C-C single bonds [1]. [1]

Skeletal structure A**TEST IT 7**

- (a) A 2-methylbutane [1]; B 3-ethyl-2-methylhexane [1]; C butan-2-ol [1]; D 3-bromobutan-2-one [1]. [4]
- (b) B is numbered to give the lowest set of locants, 2,3 rather than 4,5 [1]; ethyl is written before methyl alphabetically [1]. [2]

TEST IT 8

- Each answer earns one mark for the correct carbon skeleton/functional-group position and one for complete valency and connectivity [2 each]. [8]

3-methylpentane**2-bromobutan-1-ol****pent-2-ene****ethyl ethanoate**



SECTION B

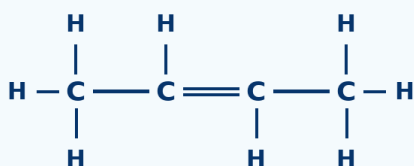
EXAM STYLE answers

Complete routes, precise names and model structural formulae

EXAM STYLE 9

- (a) Molecular formula C_4H_8 [1]; empirical formula CH_2 [1]. [2]
- (b) Structural formula $CH_3CH=CHCH_3$ [1]. [1]
- (c) Four-carbon skeletal chain with $C=C$ between C2 and C3 [2]. [2]
- (d) General formula C_nH_{2n} [1]; functional group $C=C$ [1]. [2]

displayed formula



structural formula



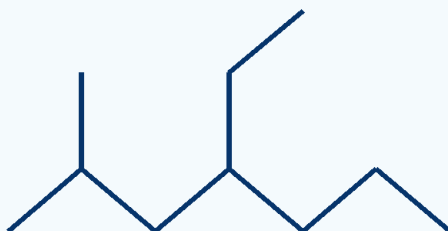
skeletal formula



EXAM STYLE 10

- (a) 4-ethyl-2-methylheptane [3]: heptane parent [1], locants 2 and 4 [1], substituents in alphabetical order [1].
- (b) The longest continuous carbon path contains seven carbon atoms [1]. Numbering from the left gives 2,4 rather than 4,6 [1], so it gives the lowest set of locants [1]. [3]

Skeletal structure Q



EXAM STYLE 11

- (a) A propanenitrile [1]; B ethyl ethanoate [1]; C butanal [1]. [3]
- (b) In an ester name, the alkyl group attached to oxygen is named first [1], followed by the acid-derived alkanoate part [1]. [2]
- (c) The nitrile carbon is included in the parent-chain carbon count [1], giving propan- rather than ethan- [1]. [2]

EXAM STYLE 12

- Award [2] for each: correct parent/functional-group position [1] and correct substituent/connectivity/valency [1]. [8]
- Accept: $CH_3CH=CHCH(CH_3)CH_2CH_3$; $CH_3CH(OH)CH(CH_3)CH_3$; $CH_3CH_2CH(Br)COOH$; $CH_3CH_2COOCH_3$.

**EXAM STYLE 13**

- The three isomers are pentane, 2-methylbutane and 2,2-dimethylpropane. Award one structure and one name mark for each [6].
- Systematic naming reveals duplicates because rotated or redrawn copies have the same systematic name [1]. [1]

pentane**2-methylbutane****2,2-dimethylpropane****EXAM STYLE 14**

- Butanal $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ [2]; 2-methylpropanal $\text{CH}_3\text{CH}(\text{CH}_3)\text{CHO}$ [2]; butan-2-one $\text{CH}_3\text{COCH}_2\text{CH}_3$ [2]. [6]
- They have different atom connectivity but all contain four C, eight H and one O, so they share $\text{C}_4\text{H}_8\text{O}$ [1]. [1]

butanal**2-methylpropanal****butan-2-one****EXAM STYLE 15**

- (a) Propanal $\text{C}_3\text{H}_6\text{O}$ [1]; propanone $\text{C}_3\text{H}_6\text{O}$ [1]. [2]
- (b) They have the same molecular formula [1] but different structural formulae/connectivity [1]. [2]
- (c) Propanal is an aldehyde [1]; propanone is a ketone [1]. [2]

EXAM STYLE 16

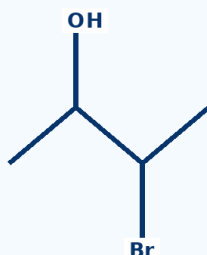
- (a) 2-methylbutane [1]; number from the end that gives the substituent the lowest locant [1]. [2]
- (b) 3-methylpentane [1]; the longest continuous chain has five carbons, not four [1]. [2]
- (c) Methyl butanoate [1]; the O-side alkyl group is methyl and the acid-derived chain is butanoate [1]. [2]
- (d) Pent-2-ene [1]; number from the end that gives C=C the lowest locant [1]. [2]

EXAM STYLE 17

- A hex-2-ene [1], C_6H_{12} [1], alkene [1].
- B 2-methylpropan-1-ol [1], $\text{C}_4\text{H}_{10}\text{O}$ [1], alcohol [1].
- C ethyl propanoate [1], $\text{C}_5\text{H}_{10}\text{O}_2$ [1], ester [1]. [9]

EXAM STYLE 18

- (a) 3-bromobutan-2-ol [3]: butan-2-ol parent [1], bromo at C3 [1], complete correct name [1].
- (b) $\text{C}_4\text{H}_9\text{BrO}$ [2]. [2]
- (c) $\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{Br})\text{CH}_3$ [2]. [2]

Compound R



SECTION C

HARDER MIXED answers

Less-scaffolded structures, formula tests and complete isomer sets

HARDER MIXED 19

- (a) 3-ethyl-2,2-dimethylhexane [3]: hexane parent [1], locants 2,2 and 3 [1], alphabetical order and punctuation [1].
- (b) $C_{10}H_{22}$ [2]: ten carbon atoms [1] and saturated acyclic alkane formula $H = 2n + 2 = 22$ [1].
- (c) The longest path contains six carbons [1]; ethyl precedes methyl alphabetically and the multiplier di- is ignored for alphabetising [1]. [2]

HARDER MIXED 20

- All five carbon skeletons: hexane; 2-methylpentane; 3-methylpentane; 2,2-dimethylbutane; 2,3-dimethylbutane [5]. Award a further [3] for all names correct, no duplicate and complete valency. [8]

hexane



2-methylpentane



3-methylpentane



2,2-dimethylbutane



2,3-dimethylbutane



HARDER MIXED 21

- A same compound: both are butane with identical connectivity [2].
- B structural isomers: but-1-ene and cyclobutane both have C_4H_8 but different connectivity [2].
- C structural isomers: propanal and propanone both have C_3H_6O but different connectivity [2].
- D structural isomers: propan-1-ol and propan-2-ol both have C_3H_8O but the -OH group is attached to a different carbon [2]. [8]

HARDER MIXED 22

- (a) Incorrect [1]; an acyclic saturated alkane with eight carbons is C_8H_{18} from C_nH_{2n+2} [1]. [2]
- (b) Correct [1]; an acyclic alkene with one $C=C$ follows C_nH_{2n} , giving C_6H_{12} [1]. [2]
- (c) Correct [1]; an acyclic aldehyde or ketone follows $C_nH_{2n}O$, giving $C_5H_{10}O$ [1]. [2]
- (d) Correct [1]; both monocarboxylic acids and esters can follow $C_nH_{2n}O_2$, giving $C_4H_8O_2$ [1]. [2]

**HARDER MIXED 23**

- One valid set is pentanal [2], pentan-2-one [2], butanoic acid [2] and ethyl ethanoate [2]. Each pair has the same molecular formula but a different functional-group arrangement. Alternative chemically correct structures and systematic names are acceptable. [8]

pentanal | $C_5H_{10}O$ **pentan-2-one** | $C_5H_{10}O$ **butanoic acid** | $C_4H_8O_2$ **ethyl ethanoate** | $C_4H_8O_2$ 



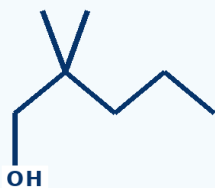
SECTION D

STRETCH / SYNOPTIC answers

One final structure puzzle solved from formula, parent-chain and isomer evidence

STRETCH / SYNOPTIC 24

- (a) $C_7H_{16}O$ [2]: a saturated acyclic monohydric alcohol follows $C_nH_{2n+1}OH$ [1], so $n = 7$ gives $C_7H_{16}O$ [1].
- (b) 2,2-dimethylpentan-1-ol [3]: five-carbon chain containing -OH [1], -OH at C1 [1], two methyl groups at C2 [1].
- (c) Correct five-carbon skeleton with -OH at C1 and two methyl branches at C2 [2].
- (d) Example: heptan-1-ol, with a correct structure [1] and name [1]. [2]
- (e) Both compounds have molecular formula $C_7H_{16}O$ but different structural formulae/connectivity [1]. [1]

2,2-dimethylpentan-1-ol**one structural isomer: heptan-1-ol**

Final check: A defensible organic answer agrees in three places: the picture, the systematic name and the molecular formula.