AQA A-Level Chemistry

Organic analysis mark scheme · goes with “Organic analysis” · whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions

# Mark schemes

Organic analysis · 14 questions

**Q1 · June 2023 · AS Paper 2 · Q1 · [9 marks]**

**(a)** M1 Tollens' reagent or ammoniacal silver nitrate

M2 silver mirror

M3 no reaction / no (visible) change / colourless

Alternative

M1 sodium

M2 no reaction / no (visible) change

M3 fizzing / bubbles / effervescence

OR

M1 Fehling's solution

M2 orange/brick/red solid/precipitate

M3 no reaction / no (visible) change

*Do not allow acidified potassium dichromate(VI)*

*If no reagent or incorrect reagent in M1, then no marks can score in M2/3*

*Allow name or formula of suitable reagent for M1. Penalise incorrect formula of correct reagent in M1 (even if correct name also given) but mark on for M2/3*

For Tollens': ignore $AgNO_3$ or $[Ag(NH_3)_2]^+$ or silver mirror test or “Tollings' reagent” on their own, but mark on for M2/3. Allow silver/black precipitate/solid/deposit for M2.

*For Fehling's (or Benedict's): ignore $Cu^{2+}(aq)$ or $CuSO_4$ or “Fellings” on their own, but mark on for M2/3*

*Ignore “nothing (happens)” / “no observation”*

**[3 marks]**

**(b)** M1 bromine (water) / $Br_2$ / $Br_2(aq)$

M2 orange/yellow / no reaction / no (visible) change

M3 colourless / decolourised

Alternative

M1 acidified potassium manganate(VII) / $KMnO_4/H^+$

M2 no reaction / no (visible) change / purple

M3 colourless / decolourised

*If no reagent or incorrect reagent in M1, then no marks can score in M2/3*

*Allow name or formula of suitable reagent for M1. Penalise incorrect formula of correct reagent in M1 (even if correct name also given) but mark on for M2/3.*

*Allow brown-red or brown for M2. (Ignore red)*

*Ignore clear for M3*

**[3 marks]**

**(c)** M1 H = 1.0078

M2 C = 12.0096

M3 $M_r$= (6 × M1) + (6 × M2) = 78.1044

*M2 Allow ECF from M1*

*M3 Allow ECF from M1 and M2*

*Penalise not giving answers to 4dp once only (on the first occasion it would score otherwise)*

*(providing answers are given to at least 2dp)*

**[3 marks]**

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**Q2 · June 2024 · Paper 2 · Q5 · [5 marks]**

**(a)** M1 Misty / white / steamy fumes

M1 (immediate) White precipitate forms

M2 No visible change

*M2 White precipitate forms slowly*

**[2 marks]**

**(b)** M1 Propanal AND (blue solution gives a brick) red precipitate

*If M1 incorrect, allow ECF for suitable tests on remaining liquids*

| | | | | |
|---|---|---|---|---|
| M2 | (Warm with) acidified potassium dichromate (VI) | add Na | warm with a named carboxylic acid with conc $H_2SO_4$ | (Warm with) acidified potassium manganate (VII) |
| M3 | Propan-1-ol/alcohol AND (orange solution) goes green | Propan-1-ol/alcohol AND effervescence | Propan-1-ol/alcohol AND fruity smell | Propan-1-ol/alcohol AND (purple solution) goes colourless |

**[3 marks]**

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**Q3 · June 2023 · Paper 3 · Q33 · [1 mark]**

Answer: **A**

comparing fingerprint regions of their infrared spectra

**Q4 · June 2024 · AS Paper 2 · Q1 · [6 marks]**

**(a)** Row 1 = no (visible) change/reaction / stays orange/yellow

*Row 1 - allow stays brown (ignore red)*

Row 2 = name or formula of a (hydrogen)carbonate (e.g. $Na_2CO_3$, $NaHCO_3$, $CaCO_3$)

OR

name or formula of reactive metal (e.g. Mg, Na)

Row 2 - name or formula, but formula must be correct if given (even if correct name also given); allow bicarbonate for hydrogencarbonate; ignore reference to limewater for a (hydrogen)carbonate

Row 3 = no (visible) change/reaction/stays blue

*Do not allow nothing/no observation for Row 1/3*

**[3 marks]**

**(b)** M1 mass of H = 0.50 - 0.45 (= 0.05(0)) (g)

*Correct answer scores 3 marks*

M2

$$C\ \frac{0.45}{12(.0)} = 0.0375,\ \ H = \frac{0.05}{1(.0)} = 0.05$$

*Allow ECF from M1 to M2*

*Allow ECF from M2 (if an attempt at moles) to M3*

M3 $C_3H_4$

Alternative M1/2

M1 10% H, 90% C

M2

$$C\ \frac{90}{12(.0)} = 7.5,\ \ H = \frac{10}{1(.0)} = 10$$

**[3 marks]**

**Q5 · June 2024 · AS Paper 2 · Q18 · [1 mark]**

Answer: **D**

Prop-2-enoic acid

**Q6 · June 2017 · AS Paper 2 · Q12 · [1 mark]**

Answer: **A**

**Q7 · June 2019 · AS Paper 2 · Q23 · [1 mark]**

Answer: **B**

4-hydroxybutanone

**Q8 · June 2019 · Paper 3 · Q23 · [1 mark]**

Answer: **B**

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**Q9 · June 2025 · AS Paper 2 · Q5 · [7 marks]**

**05.1**

M1 butane (and propanone) have different $M_r$ to several/more decimal places

M2 prop-2-en-1-ol (and propanone) have the same molecular formula or are isomers

*M1 ignore reference to fragmentation and/or same molecular formula*

**[2 marks]**

**05.2**

M1 $n = \frac{(PV)}{(RT)}$

M2 converting V to $272 \times 10^{-6}$ and T to 373

M3 $n = \frac{(102000 \times 272 \times 10^{-6})}{(8.31 \times 373)}$ (= 0.00895)

M4 mass of X = 106.633 – 105.872 (=0.761 (g))

M5 $M_r = \frac{(M4)}{(M3)}$ = 85.0 (at least 2 sf)

*If expression not written out, M1 could score from a substituted correct expression later on (even if any unit conversions are incorrect)*

*Allow ECF from M1 to M3, M2 to M3; M3 and/or M4*

to M5

*If 373.15 used as T, then $M_r$ = 85.055 (scores 5)*

*If 100 used as T, then $M_r$ = 22.79.... (scores 4)*

Alternative method

M3 $M_r = \frac{(mRT)}{(PV)}$

M5 $M_r = \left( \frac{(0.761 \times 8.31 \times 373)}{(102000 \times 272 \times 10^{-6})} \right)$ = 85.0 (at least 2 sf)

**[5 marks]**

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**Q10 · June 2022 · AS Paper 2 · Q2 · [6 marks]**

This question is marked using levels of response.

| | |
|---|---|
| **Level 3 5-6 marks** | **All stages are covered and each stage is generally correct and virtually complete. (6 v 5) Answer is well structured, with no repetition or irrelevant points, and covers all aspects of the question. Accurate and clear expression of ideas with no errors in use of technical terms.** |
| Level 2 3-4 marks | **All stages are covered but stage(s) may be incomplete or may contain inaccuracies OR two stages are covered and are generally correct and virtually complete**. (4 v 3) Answer has some structure and covers most aspects of the question. Ideas are expressed with reasonable clarity with, perhaps, some repetition or some irrelevant points. If any, only minor errors in use of technical terms. |
| Level 1 1-2 marks | **Two stages are covered but stage(s) may be incomplete or may contain inaccuracies OR only one stage is covered but is generally correct and virtually complete**. (2 v 1) Answer includes statements which are presented in a logical order and / or linked. |
| 0 marks | Insufficient correct chemistry to gain a mark. |

Stage 1

Identifying aldehyde / 2-methylpropanal

1a Tollens' or Fehling's

1b silver mirror or orange-red precipitate

Stage 2

Identifying alcohol / 2-methylpropan-1-ol

2a acidified potassium dichromate

2b (orange to) green

2c tests done in suitable sequence to distinguish aldehyde from alcohol, or to state that aldehyde would give same result if this test is done first

*If aldehyde is identified, alcohol may be identified by elimination of the other two as acids using $Na_2CO_3$/$NaHCO_3$/Mg/indicator (2a = appropriate reagent, 2b = correct observations, 2c = in a suitable sequence)*

Stage 3

Distinguishing the acids

3a using IR spectroscopy to distinguish the two acids (or other suitable technique)

3b use finger-print region of IR spectrum (feature of spectrum to use)

3c look for exact match to spectra of known compounds (what the difference is)

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**Q11 · June 2023 · AS Paper 2 · Q14 · [1 mark]**

Answer: **B**

but-2-en-1-ol

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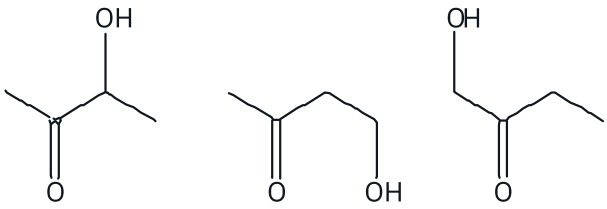
**Q12 · November 2020 · Paper 3 · Q24 · [1 mark]**

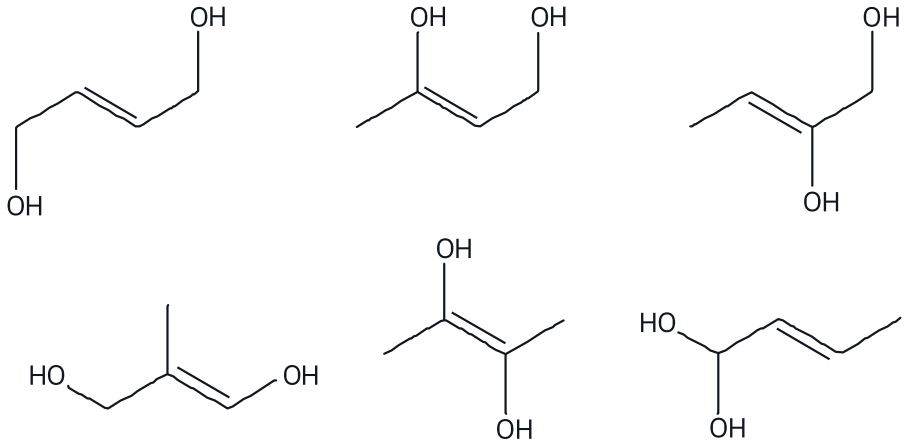
Answer: **D**

**Q13 · June 2024 · AS Paper 2 · Q2 · [5 marks]**

**(a)** Compound A - structural formula of any compound with formula $C_4H_8O_2$ containing C=O and alcohol O-H group, e.g.




Compound B - structural formula of any compound with formula $C_4H_8O_2$ containing C=C and two alcohol O-H groups, e.g.

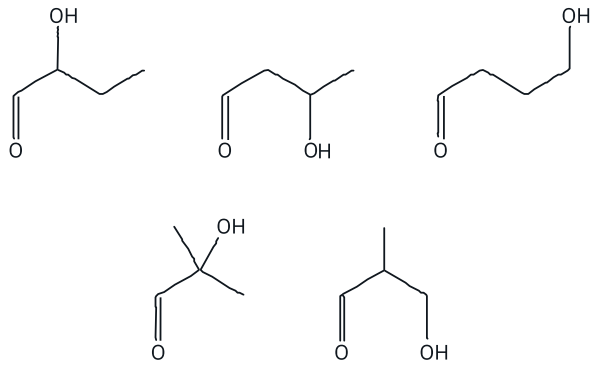



Answers may be given by the spectra.

*Ignore (in)correct name.*

Compound A:

- Do NOT allow carboxylic acids
- Allow compounds with aldehyde and alcohol OH groups




Compound B:

- The C=C must be shown in the structure
- Allow compounds with one C=C, one alcohol OH and an ether group

**[2 marks]**

**(b)** M1 use fingerprint region

M1 Allow region below 1500 $cm^{-1}$ for fingerprint region

M2 look for (exact) match to known spectrum

M1 If values are quoted the top number must be 1500 $cm^{-1}$

**[2 marks]**

**(c)** Methane/it absorbs IR (radiation/light) or

Methane/it absorbs (radiation/light) around 3000 and/or 1200 ($cm^{-1}$)

Answer must have idea of absorbing/taking in IR (or wavenumbers that correspond to IR)

*Allow (C-H) bonds absorbing IR radiation (penalise reference to bonds other than C-H)*

*Ignore re-emission of (IR) radiation by methane*

**[1 mark]**

**Q14 · November 2020 · AS Paper 2 · Q13 · [1 mark]**

Answer: **B**

Fingerprint region of infrared spectrum

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