Amount of substance mark scheme · goes with “Amount of substance” · whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/

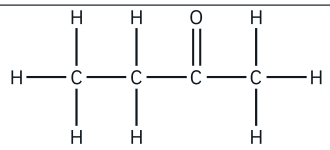
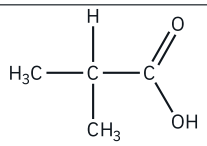
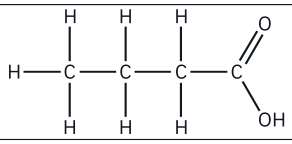
Mark schemes

Amount of substance · 9 questions

Q1 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q25 · [9 marks]

OCR MARK SCHEME

25(a)

Alcohol	Organic product
D	
E	
F	No reaction
G	

ALL 4 responses correct → 3 marks ✓✓✓

3 responses correct → 2 marks ✓✓

2 responses correct → 1 marks ✓

[3 marks]

25(b)

D ✓

[1 mark]

25(c)

For CALCULATION, check the volume of CO_2 on answer line

MUST be derived from pV = *nRT*,

Award 5 marks for calculation for:

- **answer = 2.89 × 10^4 (cm^3) OR 28900 (cm^3)**

Calculation of number of moles, *n* of CO_2 produced

EXAMINER GUIDANCE

ALLOW *any combination of skeletal* ***OR*** *structural* ***OR*** *displayed formula as long as unambiguous*

DO NOT ALLOW *structure if H(s) are missing from ONE structural formula*

……. BUT ALLOW any further omissions as ECF

Take care with numbers of carbons, the branches and the position of branching …. especially for E

IGNORE *connectivity for methyl groups*

BUT penalise incorrect connectivity for OH once

e.g. –HO

ALLOW *structure of alcohol F for ‘no reaction’*

Check entire response for credit worthy working

If there is an alternative answer, check to see if there is any ECF credit possible using working

Marking point 3 can be awarded by direct substitution of values.

$n(\text{Alcohol F}) = \frac{g}{M} = \frac{25.9}{74.0} = 0.35(0)\ (\text{g mol}^{-1})$ ✓

$n(CO_2) = 4 \times 0.35(0) = 1.4(0)$ mol ✓

Rearranging ideal gas equation to make V subject

$V = \frac{nRT}{p}$ ✓

Conversion of 100°C to 373K, and substituting all values into rearranged ideal gas equation

$V = \frac{1.40 \times 8.314 \times 373}{1.50 \times 10^5}$ **OR** 0.02894380... (m^3) ✓

V conversion of $m^3 \rightarrow cm^3$ **AND** 3 SF (most appropriate)

$V = 0.02894 \times 10^6 = 2.89 \times 10^4\ cm^3$ **OR** 28900 cm^3 ✓

[5 marks]

ALLOW *150 (kPa) for 1.50×10^5 (conversion is assessed in marking point 4)*

ALLOW *use of 8.31 for R → 0.02892988*

DO NOT ALLOW *use of 150 (kPa)*

ALLOW *3 SF up to calculator value, correctly rounded*

(use of 8.31 for R gives same answer)

Note use of 373.15 → 29000

Fine for all 5 marks

Common errors:

No use of ratio x4

7240 → 4 marks

Not appropriate SF

28943.8 → 4 marks

No temp conversion

7760 → 4 marks

Use of 25.9 as n in pV=nRT

535000 → 3 marks

Q2 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q3 · [1 mark]

Answer: **C**

7.224×10^{23}

Q3 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q4 · [1 mark]

Answer: **D**

$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

Q4 · June 2025 · AS Paper 1 (Breadth in chemistry) · Q5 · [1 mark]

Answer: **A**

PO_2

Q5 · June 2025 · AS Paper 2 (Depth in chemistry) · Q2 · [12 marks]

OCR MARK SCHEME

2(a)(i)

$Ca^+(g) \rightarrow Ca^{2+}(g) + e^-$

EXAMINER GUIDANCE

ALLOW *$Ca^+(g) - e^- \rightarrow Ca^{2+}(g)$*

ALLOW *e for electron (i.e. charge omitted)*

[1 mark]

__IGNORE__ states on the electron

2(a)(ii)

Level 3 (5-6 marks)

Covers all 3 areas A, B and C in detail with very few omissions or errors

There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Level 2 (3–4 marks)

Covers at least 2 areas in detail with very few omissions or errors

OR

Covers all 3 areas in some detail

There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.

Level 1 (1–2 marks)

Covers 1 area in detail with very few omissions or errors

OR

Covers 2 areas in some detail

There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.

0 marks No response or no response worthy of credit

[6 marks]

Indicative scientific points may include:

A Difference in Reactivity and Explanation

***ORA** is allowed for the following:*

- Ca more reactive than Mg.
- Atomic radius of Ca is greater or more shells/shielding.
- Attraction of outer electrons to the nucleus is less.
- Ionisation energies of Ca are less.

OR Easier to remove Ca outer electrons.

B Observations and equation

- Effervescence/fizzing/bubbles
- Ca/solid disappears/dissolves

OR

Forms a white ppt/solid

- $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ (**IGNORE** state symbols)

C Redox

- Both oxidation and reduction take place.
- Ca is oxidised
- Oxidation number of Ca increases from 0 to +2

OR

Ca loses 2 electrons (to form Ca^{2+} ions)

- H is reduced
- Oxidation number of H decreases from +1 to 0

OR

H gains 1 electron (per H atom)

Aspects of the communication statement might typically have been met for all levels when:

- All information given is correct using appropriate scientific language, for example (in A) comparison of Mg and Ca not just trend down group and (in C) directly links redox to oxidation and reduction.
- There are no errors, for example incorrect balancing, using +2 as initial oxidation state for H.

2(b)(i)

FIRST CHECK THE ANSWER ON ANSWER LINE

IF *vol = 184 cm^3 award 2 marks*

$n(BaCO_3) = \frac{1.51}{197.3}$ **OR** $7.6533.... \times 10^{-3}$ ✓

$vCO_2 = 7.6533.... \times 10^{-3} \times 24000 = 184\ cm^3$ ✓

[2 marks]

ALLOW *3SF up to calculator value $7.653319818 \times 10^{-3}$*

IGNORE *rounding errors past 3SF*

ALLOW ECF *from incorrect $n(BaCO_3)$*

Answer must be 3 SF and in cm^3

ALLOW *use of ideal gas equation with an appropriate temperature (290–298K) and pressure (100/101/101325 kPa)*

e.g.

e.g. At 293K and 100 kPa,

$V = (7.65... \times 10^{-3} \times 8.314 \times 293) / 100 \times 10^3$

$V = 186\ cm^3$

2(b)(ii)

Any two from ✓✓

- (Gas lost /escapes) when the bung is replaced
- Some CO_2 / gas dissolves (in the water)
- Conditions / T/ P not at RTP

[2 marks]

IGNORE *Incomplete reaction*

IGNORE *human errors e.g. unsealed apparatus, gas escaping the measuring cylinder*

ALLOW *'when $BaCO_3$ is added to flask'*

ALLOW *not standard conditions*

2(b)(iii)

Use a gas syringe (in place of the upturned measuring cylinder)

OR

IGNORE *gas cylinder*

Place the barium carbonate inside a small tube and release it into the acid without removing the stopper OWTTE ✓

[1 mark]

ALLOW *use a water bath set at room temperature*

Q6 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q2 · [1 mark]

Answer: **C**

6

Q7 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q2 · [1 mark]

Answer: **B**

6.39

Q8 · June 2025 · Paper 2 (Synthesis and analytical techniques) · Q3 · [1 mark]

Answer: **C**

OCR MARK SCHEME

17

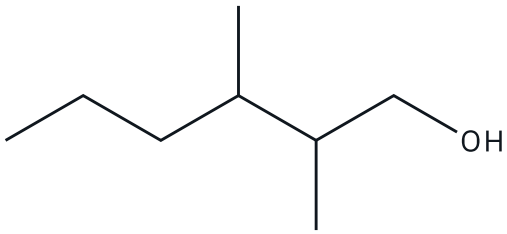
EXAMINER GUIDANCE

ALLOW *17*

Q9 · June 2025 · Paper 3 (Unified chemistry) · Q2 · [14 marks]

OCR MARK SCHEME

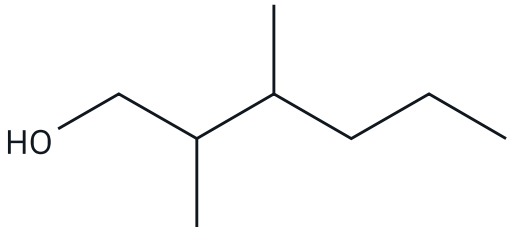
2(a)(i)



✓

Count main carbon chain first (watch for only 5 or 7 Cs)

Watch for correct reversed orientation:



[1 mark]

EXAMINER GUIDANCE

Structure MUST be skeletal (NO CH_3).

BUT

ALLOW *O–H*

DO NOT ALLOW *OH–*

ALLOW *any vertical bond to the OH group*

i.e. **ALLOW**



OR



IGNORE *any structural formulae, etc*

Treat as working

2(a)(ii)

FIRST, CHECK ANSWER

ALLOW ECF *throughout*

***IF** answer = **7.04 × 10^23 OR 7.05 × 10^23**, award 3 marks*

$n(C_8H_{18}O) = \frac{8.45}{130.0}$ **OR** 0.065(0) (mol) ✓

n(H atoms) = 18 × 0.0650 **OR** 1.17 ✓

H atoms = 1.17 × 6.02 × 10^{23}

= 7.04 × 10^{23} ✓

3 SF and standard form required

***ALLOW** use of 6.022 × 10^23 → 7.05 × 10^23*

[3 marks]

Alternative working

18 and 6.02 × 10^{23} in different order

0.0650 × 6.02 × **10^{23} OR**

3.913 × 10^{22} ✓

3.913 × 10^{22} × 18 = 7.04 × 10^{23} ✓

Common errors		
3.91 × 10^{22}	→ 2 marks	No × 18
2.17 × 10^{21}	→ 2 marks	÷18
7.0434 × 10^{23}	→ 2 marks	Not 3 SF
5.42 × 10^{21}	→ 2 marks	÷130 twice

***ALLOW** 5.40–5.42 × 10^21 (intermediate rounding)*

2(b)(i)

Assume that 'It' means paracetamol

It is a phenol

OR

It is not a carboxylic acid/no carboxyl group/no carboxylic

OR

It does not contain COOH ✓

A correct functional group must be in answer

[1 mark]

IGNORE

It is too weak an acid/not strong enough

It is a weak acid *So is COOH*

It does not react with Na_2CO_3 *In Q*

It contains amide **OR** benzene ring

***IGNORE** reference to an alcohol/hydroxyl group*

***DO NOT ALLOW** It is not acidic It is!*

It is a phenol which is not acidic is a CON

It contains ketone **OR** amine CON

2(b)(ii)

FIRST, CHECK ANSWER

***IF** Mass ibuprofen = 206 mg*

AND mass paracetamol = 494 mg award 4 marks

ECF throughout

Alternative order for 1st 3 marks:

$n(CO_2) = \frac{48.0}{24000} = 2 \times 10^{-3}$ (mol) ✓

n(ibuprofen) = $2 \times 2 \times 10^{-3} = 4 \times 10^{-3}$ (mol) ✓

In 4 tablets

Mass of ibuprofen = $4 \times 10^{-3} \times 206 = 0.824$ g ✓

In 1 tablet (÷4)

Mass ibuprofen = 206 mg

AND mass paracetamol = 494 mg ✓

***NOTE**: Mass ibuprofen + mass paracetamol in 1 tablet = 700 mg*

Mass ibuprofen + mass paracetamol in 4 tablets = 2800 mg

[4 marks]

2(c)

FIRST, CHECK ANSWER

IF pH = 13.04 award 5 marks

$[Ba(OH)_2]$

$\frac{46.80}{171.3}$ **OR 0.273**..... mol dm^{-3} ✓

Calculator: 0.2732049037

$n(CO_2)$ from 1 tablet = 5×10^{-4} (mol) ✓

n(ibuprofen) in 1 tablet = 1×10^{-3} (mol) ✓

Mass of ibuprofen = $1 \times 10^{-3} \times 206 =$ 0.206 g ✓

Common errors		
103 **AND** 597	3 marks	no ×2 for n(ibuprofen)
824 **AND** 1976	3 marks	no ÷4 for 1 tablet

824 + 1976 = 2800

***ALLOW** use of ideal gas equation with a sensible temperature (290–298K) and pressure (100/101/101325 kPa)*

e.g. At 298 K and 100 kPa,

$n(CO_2)$

$= \frac{100 \times 10^3 \times 48.0 \times 10^{-6}}{8.314 \times 298} =$

1.937....

$\times 10^{-3}$ (mol)

***ALLOW** use of 8.31 for R*

298K → = 1.938.... $\times 10^{-3}$ (mol)

ALLOW ECF throughout

3SF minimum

***ALLOW** acceptable rounding written on scripts and take care as candidate may carry their calculator answer.*

Alternatives for 1st and 2nd marks:

mass in 20 cm^3 = 100 cm^3

= 46.80 × 0.02 = 0.936 g ✓

Concentration of diluted $Ba(OH)_2$

$\frac{0.273.....}{5}$ = 0.0546..... (mol dm^{-3}) ✓

Calculator: 0.05464098074

$[OH^-]$

2 × 0.0546..... = 0.1092..... (mol dm^{-3}) ✓

Calculator 0.1092819615

pH

$[H^+] = \frac{1.00 \times 10^{-14}}{0.1092...}$ **OR 9.15**..... × 10^{-14} (mol dm^{-3}) ✓

Calculator 9.150641026 × 10^{-14}

pH = –log(9.15..... × 10^{-14}) = 13.04 to 2 DP ✓

No pH mark without use of K_w OR pOH

DO NOT ALLOW a pH value ≤ 7 for last mark

[5 marks]

$[Ba(OH)_2] = \frac{0.936}{171.3} \times 10$ =

0.0546.... ✓

$[Ba(OH)_2]$ in diluted solution

$= \frac{46.80}{5}$ = 9.36 (g dm^{-3}) ✓

$[Ba(OH)_2] = \frac{9.36}{171.3}$ = 0.0546.... ✓

For pH marks

ALLOW

pOH = –log 0.1092... = 0.96.... ✓

pH = 14 – 0.96 = 13.04 ✓

Common errors		
pH = 11.04	4 marks	÷10 instead of ×10 in alternative
pH = 12.44	4 marks	÷2 instead of ×2 for OH^-
pH = 12.74	4 marks	No ×2 for OH^-
pH = 13.74	4 marks	No ÷5
pH = 15.27	4 marks	No ÷171.3
pH = 13.44	3 marks	No ÷5 and no ×2
pH = 13.97	3 marks	No ÷171.3 and no ×2
pH = 14.27	3 marks	No ÷171.3 and ×10
pH = 14.44	2 marks	No ÷5 and no ×2 and ×10
pH = 15.67	2 marks	K_w and pH only

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