GCE

Chemistry A

H032/01: Breadth in chemistry

AS Level

Mark Scheme for June 2025

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training: OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. **Crossed-Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses
When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions **(requiring only a list by way of a response, usually worth only one mark per response)**
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions **(requiring a more developed response, worth two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions **(requiring a developed response)**
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. There is a NR (**No Response**) option. Award NR (No Response):

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
   - OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

Annotations

Place the annotations alongside the mark for the question.

On additional pages, annotate using SEEN

Annotation	Meaning
✓	Correct response
✗	Incorrect response
^	Omission mark

Annotation	Meaning
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore
BP	Blank page

Subject Specific Marking Instructions

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	**Meaning**
/; OR	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

SECTION A

Question	Answer	Marks	Guidance
1	D	1	
2	C	1	ALLOW 11
3	C	1	
4	D	1	
5	A	1	
6	C	1	ALLOW +2
7	B	1	
8	B	1	
9	C	1	
10	A	1	
11	D	1	
12	B	1	
13	B	1	
14	C	1	
15	C	1	
16	D	1	
17	C	1	ALLOW 3
18	B	1	
19	D	1	
20	B	1	
	Section A Total	20	

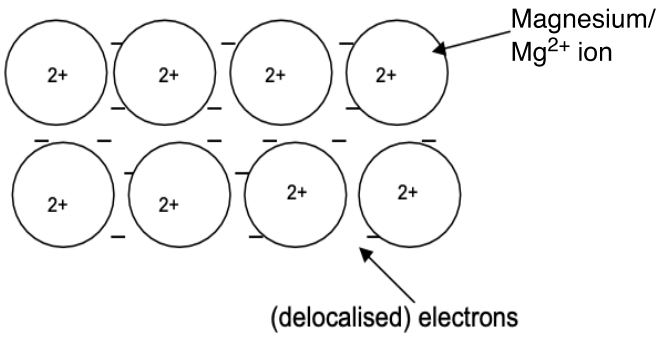
SECTION B

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>21</td><td>(a)</td><td></td><td>
<table>
<tr><th>Species</th><th>Protons</th><th>Neutrons</th><th>Electrons</th><th></th></tr>
<tr><td>^{34}S</td><td>16</td><td>18</td><td>16</td><td></td></tr>
<tr><td>$^{32}S^{2-}$</td><td>16</td><td>16</td><td>18</td><td></td></tr>
</table>

4 correct ✓✓
3 correct ✓
</td><td>2</td><td>NOTE: Look out for the 2– on $^{32}S^{2-}$
ALLOW $^{32}S^{-2}$</td></tr>
<tr><td>21</td><td>(b)</td><td></td><td>
FIRST CHECK ANSWER ON THE ANSWER LINE IF answer = 24.34 (to 2 DP) award 2 marks

$\frac{(75.45 \times 24 + 15.21 \times 25 + 9.34 \times 26)}{100}$
OR 24.3389 OR 24.339 ✓

= 24.34 (to 2 DP) ✓
</td><td>2</td><td>For 1 mark: ALLOW ECF → to 2 DP if:
• %s used with wrong isotopes ONCE
OR
• transposed decimal places for ONE %</td></tr>
</table>

Question			Answer	Mark	Guidance
21	(c)		 Diagram showing a regular arrangement of **labelled** '**Mg^{2+} ions**' or '**2+ ions**' ✓ Scattering of **labelled** electrons **between** other species **AND** statement anywhere of **delocalised** electrons (can be in text or in diagram) ✓ Delocalised electrons move/flow (in an electric field/across a p.d.) ✓ ***Idea of movement required***	3	Regular arrangement must have at least 2 rows of **correctly charged** ions and a minimum of 2 ions per row **ALLOW** as label: positive ions, cations if correct charge is seen within circle **ALLOW** for labelled Mg^{2+} ions: circles with **Mg^{2+}** inside **DO NOT ALLOW** incorrect charge for ions e.g.+ , 3+ etc **DO NOT ALLOW** for label of ions: nuclei **OR** positive atom **OR** protons **ALLOW** e– or 'e' as a label for electron **IGNORE** "–" for electron label (i.e. needs an additional label) **ALLOW** 'electrons are mobile (charge carriers)' **OR** 'sea of electrons moves' **IGNORE** electrons are free **DO NOT ALLOW** ions can move

Question	Answer		Answer	Mark	Guidance
21	(d)	(i)	**FIRST CHECK ANSWER ON THE ANSWER LINE IF answer = 2.0×10^{-1} award 3 marks** ---------- $n(H_2) = \frac{60}{24000} = 2.50 \times 10^{-3}$ **OR** 0.0025(0) (mol) ✓ $n(HCl) = 5.00 \times 10^{-3}$ **OR** 0.005(00) (mole ratio = 2:1) ✓ $c(HCl) = \frac{5.00 \times 10^{-3}}{0.0245} = 0.204 = 2.0 \times 10^{-1}$ **2 SF and standard form required** ✓	3	**ALLOW ECF** throughout **ALLOW** use of ideal gas equation for all 3 marks provided 'sensible' *p* and *T* used: e.g. from 101 kPa and 298 K → nH_2 = 0.0024459 → $nHCl$ = 0.0048919 → $cHCl$ 0.1996688 → **2.0×10^{-1} (2SF and standard form)** from 100 kPa and 273 K → nH_2 = 0.0026435→ $nHCl$ = 0.005287 → 0.21579656 → **2.2×10^{-1} (2SF and standard form)** Examples of 'sensible' *p* = 100 kPa, 101 kPa, 101,325 Pa *T* = 273 – 298 K **<u>Common errors</u> (final answer)** **Use of 24.5cm³ for H_2 volume** 8.3×10^{-2} → 2 marks **Incorrect units for H_2 volume (i.e. 60/24)** 2.0×10^{2} → 2 marks **Not 2SF or standard form** 0.204 → 2 marks calculator 0.2040816327

Question	Answer		Answer	Mark	Guidance
21	(d)	(ii)	**Concentration** (Acid) concentration decreases ✓	3	For Concentration and Collisions, **ALLOW ORA** for initial conditions (when t = 0), but answer must be comparative (e.g. initially the concentration is highest/higher) **ALLOW** 'fewer particles in a given volume/space' for concentration decreases **IGNORE** amount of acid decreases **IGNORE** magnesium concentration decreases *(Mg is solid)* **DO NOT ALLOW** (line increases so) rate increases **IGNORE** references to energy even if incorrect
			Collisions Fewer collisions per second **OR** less frequent collisions ✓		**IGNORE** responses not linked to time, e.g. • fewer successful collisions • fewer collisions, less chance of collisions *No link to rate.*
			Reaction stops/graph plateaus (Acid/reactant/limiting reagent) has reacted/been used up ✓		**ALLOW** idea that reaction stops e.g. no more collisions **DO NOT ALLOW** Magnesium/reactant**S** used up *(Magnesium is in excess)*

Question			Answer	Mark	Guidance
22	(a)		**Disproportionation** Oxidation and reduction of the same **element/bromine** **OR** Bromine has been **oxidised** and bromine has been **reduced** ✓ **Oxidation numbers and redox** Br is oxidised from 0 (in Br_2) to +1 in NaBrO ✓ Br is reduced from 0 (in Br_2) to –1 in NaBr ✓ **IGNORE** oxidation numbers shown in equation *(treat as rough working)* **BUT** If no oxidation numbers in explanation, or if oxidation numbers are not linked to substances, look at equation for annotations which may be worthy of credit	3	'Atom' is insufficient for element **ALLOW** 1 out of 2 redox marks if NaBrO AND NaBr omitted, i.e. Br is oxidised from 0 to +1 **AND** Br is reduced from 0 to –1 **ALLOW** 1 out of 2 redox marks if oxidation number changes are **BOTH** correct ...**BUT** reduction/oxidation is incorrectly assigned, i.e. Br is reduced from 0 (in Br_2) to +1 in NaBrO Br is oxidised from 0 (in Br_2) to –1 in NaBr **ALLOW** 1 out of 2 redox marks for 3 oxidation numbers correct but no mention of words **oxidation/reduction**: e.g. 0 in Br_2 **AND** –1 in NaBr **AND** +1 in NaBrO **----------** **General:** **ALLOW number before sign in ox no,** **i.e.** 1+ for +1 1– for –1 **IGNORE** ionic charges, e.g. Br^{1+} **IGNORE** '1' (signs required) **IGNORE** '+' and '-' (numbers required) **IGNORE** references to electron loss/gain (even if wrong)

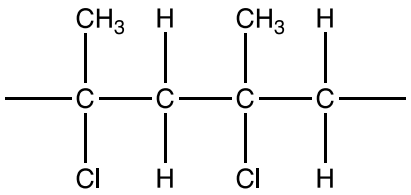
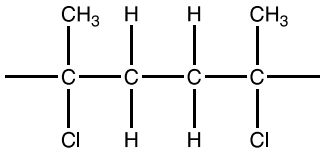
Question			Answer	Mark	Guidance
22	(b)	(i)	**Atomic radius** Cl has a smaller atomic radius (than Br) **OR** Cl has fewer shells **OR** Cl has less shielding ✓ **Attraction** **Nuclear** attraction is more in Cl **OR** (outer) electrons in Cl are more attracted (to **nucleus**) **OR** Decreased distance / shielding in Cl outweighs decreased **nuclear** charge ✓ **Ease of gaining electron** Easier to gain an electron in Cl ✓	3	Comparison required throughout **ORA** throughout **ALLOW** 'down the group' if the group is clearly identified as group 7/halogens For **fewer** shells**, ALLOW** lower energy level **IGNORE** fewer orbitals **OR** fewer sub-shells **IGNORE** 'different shell' **ALLOW** Cl has more **nuclear** pull **IGNORE** more effective nuclear charge **IGNORE** 'nuclear charge' for nuclear attraction **ALLOW** easier to reduce chlorine **IGNORE** comments about energy/electronegativity
22	(b)	(ii)	toxic/poisonous **OR** (forms) chlorinated/halogenated hydrocarbons **OR** (forms) carcinogenic compounds / toxic compounds ✓	1	**IGNORE** 'harmful'/'dangerous' **IGNORE** chlorine is carcinogenic/causes cancer dangerous for health/causes breathing problems **IGNORE** forms HCl

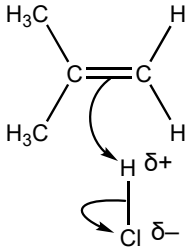
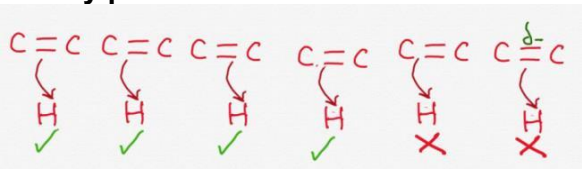
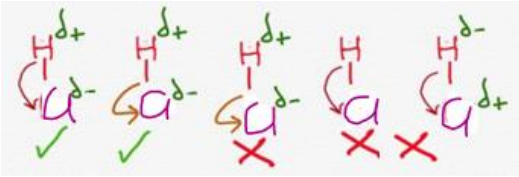
Question			Answer	Mark	Guidance
22	(c)		**Identification of halide** Add (aqueous) silver nitrate **OR** $AgNO_3$ **OR** Ag^+/silver ions ✓ **Observations – mark independently** **Any 2 precipitate colours from** Chloride/Cl^- gives white precipitate Bromide/Br^- gives cream precipitate Iodide/I^- gives yellow precipitate ✓ **Precipitate/solid seen at least once** **Correct equation for at least one halide** e.g. $Ag^+ + Cl^- \rightarrow AgCl$ **ALLOW** $Ag^+ + X^- \rightarrow AgX$ ✓ ***IGNORE** state symbols (ppt already assessed)* **Solubility** AgCl/precipitate dissolves in dilute $NH_3(aq)$ **AND** AgBr/precipitate dissolves in concentrated $NH_3(aq)$, **AND** AgI/precipitate does not dissolve (in concentrated $NH_3(aq)$) ✓	4	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **IGNORE** addition of HNO_3 but HCl/H_2SO_4 is a **CON** for $AgNO_3$ **IGNORE** addition of $Ba(NO_3)_2$ but $BaCl_2$ is a **CON** for $AgNO_3$ **ALLOW** Cl/chlorine for chloride, etc. (credit is for the colours and precipitate) **ALLOW** ppt/ptte for precipitate **ALLOW** equation with Br^- **OR** I^- e.g. $Ag^+ + Br^- \rightarrow AgBr$ **ALLOW** 'ammonia' or NH_3 for $NH_3(aq)$ *Answer needs to be clear it is the solid/AgX which is dissolving*

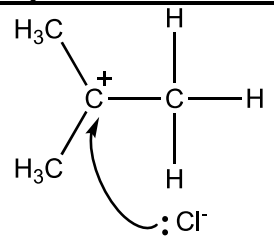
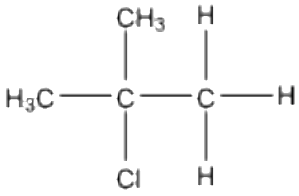
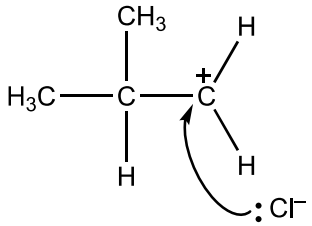
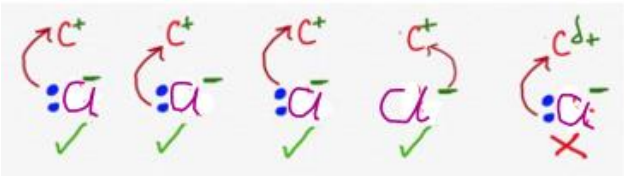
Question			Answer	Mark	Guidance
23	(a)		Two (✓ ✓) from: • **rate** of forward reaction = **rate** of reverse reaction • Concentrations (of reactants and products) do not change/are constant • In a closed system/environment	2	**IGNORE** reactions take place together/reversible reaction **ALLOW** backward for reverse **DO NOT ALLOW** concentration of reactants = concentration of products **ALLOW** 'nothing can leave/enter'

Question	Answer		Answer	Mark	Guidance
23	(b)		**FIRST, CHECK THE ANSWER LINE, IF bond enthalpy = (+)463 (kJ mol^{-1}) award 3 marks** ---------- *Energy for bonds broken (4 × S=O in SO_2) + 1 × O=O)* (4 × 522) + (1 × 494) **OR** 2088 + 494 **OR** 2582 (kJ) ✓ *S=O bond enthalpy in 6 x SO_3 correctly calculated* 6 × S=O bond enthalpy in SO_3 = 2582 + 196 = 2778 (kJ mol^{-1}) ✓ *S=O bond enthalpy in SO_3 correctly calculated* S=O bond enthalpy in SO_3 = $\frac{2778}{6}$ = (+)463 kJ mol^{-1} ✓ *Mark is for answer*	3	**FULL ANNOTATIONS MUST BE USED** ---------- **IGNORE** sign *(rearranging assessed below)* **ECF for MP2:** Ans to part 1 + 196 **ECF for MP3:** Ans to part 2/6; **IGNORE** significant figures and rounding errors. **COMMON ERRORS** Use of 2 S=O (reactants) and 3 S=O (product) +578 → 1 mark Wrong sign for 196 +398 → 2 marks (ans: 397.6...) Use of 2 S=O (reactants) and dividing by 2 +867 → 1 mark Addition of S=O (product) bonds, not subtraction -463 → 2 marks

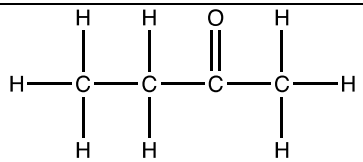
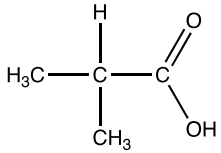
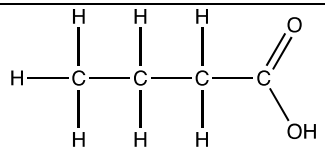
Question	Answer		Answer	Mark	Guidance
23	(c)		**K_c expression** (K_c =) $\frac{[SO_3(g)]^2}{[SO_2(g)]^2\,[O_2(g)]}$ ✓	3	Square brackets required for K_c expression **IGNORE** state symbols, even if wrong **DO NOT ALLOW** $Kc = \frac{[SO_{3(g)}]^2}{[SO_{2(g)}]^2 + [O_{2(g)}]}$ for first two marks **BUT ALLOW ECF to 3SF and standard form** i.e. 2.41 x 10^0
			Calculation (K_c =) $\frac{42.0^2}{25.0^2 \times 108}$ **OR** 0.02613……. ✓		**ALLOW** 42^2 and 25^2 in substituted equation **ALLOW ECF for Calculation** from inverted K_c expression **ONLY** i.e. 3.83 × 10^1 for two marks (to 3 SF and standard form)
			= 2.61 × 10^{-2} **to 3 SF and standard form** ✓		**DO NOT ALLOW** 0.0261 x 10^0 **ALLOW ECF** from any incorrect Kc value for 3 SF and standard form **IGNORE** attempts at units

Question			Answer	Mark	Guidance
24	(a)	(i)	 **Two** correct repeat units for **2-chloropropene** (*n* and brackets **not** required) ✓	1	**ALLOW** structural **OR** displayed **OR** skeletal formula **OR** mixture of the above (as long as unambiguous) **ALLOW**:  ……but CH_3 and Cl must be on same C atom CH_3 and Cl can be shown either side of the structure **NOTE**: 'side bonds' **ARE** required on either side of repeat unit from C atoms **IGNORE** connectivity of methyl group **IGNORE** brackets **IGNORE** *n* or subscript numbers
24	(a)	(ii)	Formation of HCl/hydrochloric acid/ **OR** chlorine	1	**ALLOW** Cl or Cl_2 for chlorine **ALLOW** produces CO (from incomplete combustion) **IGNORE** toxic waste products *Response must reflect chlorine or carbon monoxide in some way*
24	(b)		$C_5H_{10} + 7½\ O_2 \rightarrow 5CO_2 + 5H_2O$ ✓	1	**ALLOW** $2C_5H_{10} + 15O_2 \rightarrow 10CO_2 + 10H_2O$ **IGNORE** state symbols (even if incorrect)

Question			Answer	Mark	Guidance
24	(c)	(i)	Curly arrows can be straight, snake-like, etc. but **NOT** double headed or half headed arrows **1. <u>Curly arrow from C=C to HCl and H–Cl</u>** ***2 marks***  **DO NOT ALLOW** partial charge on C=C Curly arrow from C=C bond to H of **H–Cl** ✓ Correct dipole shown on H–Cl **AND** curly arrow that breaks H–Cl bond ✓	5	**1st curly arrow must** • go to the H atom of H–Cl **AND** • start from, **OR** be traced back to **any point across width** of C=C  **2nd curly arrow must** • start from, **OR** be traced back to **any part of** $^{\delta+}$H–Cl$^{\delta-}$ bond **AND** • go to Cl$^{\delta-}$  **Use of Cl-Cl or H-Br** loses first marking point but gains **ECF** for second marking point

Question			Answer	Mark	Guidance
			2. Curly arrow from Cl^- to carbocation ***1 mark***  **DO NOT ALLOW** δ+ on C of carbocation Curly arrow from Cl^- to C^+ of carbocation (carbocation must follow structure from step 1 i.e. 2 methyl groups) ✓ **3. Product** ***1 mark***  ✓		**ALLOW formation of minor carbocation, i.e.**  *(formation of major product assessed below)* **ALLOW ECF from use of Cl_2 OR HBr** **3rd curly arrow must** • go to the C+ of carbocation **AND** • start from, **OR** be traced back to any point across width of lone pair on $:Cl^-$ • **OR** start from – charge of Cl^- ion  *(Lone pair **NOT** needed if curly arrow shown from – charge of Cl^- ion)* **ALLOW ECF** for correct tertiary product following use of **HBr ONLY (i.e. Cl in structure shown replaced with Br)**

Question			Answer	Mark	Guidance
			4. Name of mechanism ***1 mark*** Electrophilic addition ✓		
24	**(c)**	**(ii)**	**More stable** (tertiary) **carbocation** is formed as intermediate **OR** The minor product forms a **less stable** (primary) **carbocation** ✓	**1**	**NOTE** must refer to **stability** of carbocation **IGNORE** references to Markownikoff's rule **IGNORE** secondary

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>25</td><td>(a)</td><td></td><td>
<table>
<tr><th>Alcohol</th><th>Organic product</th></tr>
<tr><td>D</td><td>  </td></tr>
<tr><td>E</td><td>  </td></tr>
<tr><td>F</td><td>No reaction</td></tr>
<tr><td>G</td><td>  </td></tr>
</table>

ALL 4 responses correct → 3 marks ✓✓✓
3 responses correct → 2 marks ✓✓
2 responses correct → 1 marks ✓
</td><td>3</td><td>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’</td></tr>
<tr><td>25</td><td>(b)</td><td></td><td>D ✓</td><td>1</td><td></td></tr>
</table>

Question			Answer	Mark	Guidance
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* $n(\text{Alcohol } \mathbf{F}) = \frac{g}{M} = \frac{25.9}{74.0} = 0.35(0)$ (g mol^{-1}) ✓ $n(CO_2) = \mathbf{4} \times 0.35(0) = 1.4(0)$ 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	**ANNOTATE ANSWER WITH TICKS AND CROSSES** **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. **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

Question			Answer	Mark	Guidance
					<u>Common errors:</u> **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

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