OCR
Oxford Cambridge and RSA

GCE

Chemistry A

H032/01: Breadth in chemistry

AS Level

Mark Scheme for June 2023

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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

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.

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 50% 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. Work crossed out:

   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 a tick to confirm that the work has been seen.

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 isn't 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.**

   If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

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.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

No Level of response questions on this paper

The only annotation on a level of response question should be the indication of the level.

A level annotation should be used where all marks for a level have been achieved.
e.g. if a candidate has 6 marks, they would have this annotation on their script:

If a candidate has achieved 5 marks then they have reached Level 3 but will not have met the communication statement.
They should have the following annotations on their scripts:

The same principle should be applied to Level 2 and Level 1.

No marks (0) should have a cross: 

Place the annotations alongside the mark for the question.

On additional pages, annotate using 

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore
	Blank page

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

Annotation	Meaning
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

13. **Subject-specific Marking Instructions**

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.

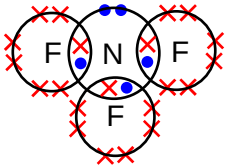
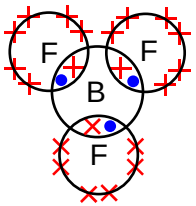
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New 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	AO element	Guidance
1	B	1	AO1.1	
2	B	1	AO1.2	
3	C	1	AO1.2	
4	C	1	AO1.1	**ALLOW 6**
5	B	1	AO1.2	
6	C	1	AO2.1	
7	C	1	AO2.6	
8	D	1	AO2.6	
9	C	1	AO2.2	
10	D	1	AO2.4	
11	D	1	AO1.1	
12	D	1	AO1.1	
13	A	1	AO1.1	
14	B	1	AO2.8	
15	D	1	AO1.2	
16	C	1	AO2.5	**ALLOW 4**
17	A	1	AO2.5	
18	D	1	AO2.7	
19	C	1	AO2.5	
20	B	1	AO2.6	
	Total	**20**		

SECTION B

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	Shared pair of electrons ✓	1	AO1.1	**IGNORE** comments about attraction between nuclei and shared pair **OR** magnetic attraction
		(ii)	  **NF_3:** 3 '*dot-and-cross*' bonds **AND** 1 lone pair around N **AND** 3 lone pairs around each of the 3 F atoms ✓ **BF_3:** 3 '*dot-and-cross*' bonds **ONLY** around B **AND** 3 lone pairs around each of the 3 F atoms ✓	2	AO2.5 ×2	**Use annotations with ticks, crosses ECF etc. for this part** Must be '*dot-and-cross*' using 2 different symbol for electron source **ONLY** **IGNORE** absence of circles **ALLOW 1 mark** for correct dot and cross diagrams for NF_3 **AND** BF_3 **BUT** with F lone pairs omitted **ALLOW** absent symbols from circles A lone pair can be shown as 2 single electrons **IGNORE** charges
	(b)	(i)	**Bond angles and shapes** | | Bond angle | Name of shape | | NF_3 | 107º | pyramidal | | BF_3 | 120º | trigonal planar | **ALL 4 points** → 2 marks ✓✓ **2 OR 3 points** → 1 mark ✓	2	AO1.2 ×2	**For NF_3** **ALLOW** 106–108º **OR** 109.5º – 2.5º **ALLOW** pyramid **ALLOW** trigonal pyramid(al) **For BF_3** **ALLOW** planar triangle **BUT** 'planar' is insufficient

Question			Answer	Marks	AO element	Guidance
		(ii)	• NF_3 has **3 bonded** pairs **AND 1 lone** pair (of electrons) **AND lone pairs** repel **more** (than bonded pairs) ✓ • BF_3 has **three** bonded pairs (of electrons) ✓	**2**	AO1.2 ×2	**ALLOW** lp for lone pair (of electrons) bp for bonding pair (of electrons) regions for electron pairs **ALLOW** 'bonds' for 'bonded pair' **IGNORE** 'electrons repel' **DO NOT ALLOW** 'atoms repel'

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>22</td><td>(a)</td><td></td><td>(Strong acid) completely/fully dissociates/ionises ✓</td><td>1</td><td>AO1.1</td><td>DO NOT ALLOW easily dissociates

ALLOW ALL H^+ ions are released</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>$CuO + 2HCl \rightarrow CuCl_2 + H_2O$ ✓</td><td>1</td><td>AO2.6</td><td>ALLOW multiples
IGNORE state symbols
IGNORE charges, even if wrong</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>$(NH_4)_2CO_3 + 2HNO_3 \rightarrow 2NH_4NO_3 + CO_2 + H_2O$

Any 4 formulae correct ✓
All 5 formulae correct and balanced ✓</td><td>2</td><td>AO2.6
×2</td><td>ALLOW multiples
IGNORE state symbols
IGNORE charges, even if wrong

ALLOW H_2CO_3 for $CO_2 + H_2O$
Counts as 2 formulae for marking criteria</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Volumetric flask ✓</td><td>1</td><td>AO1.2</td><td>ALLOW graduated flask</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><td>Final reading/cm^3</td><td>20.25</td><td>40.85</td><td>25.85</td></tr><tr><td>Initial reading/cm^3</td><td>0.00</td><td>20.25</td><td>5.50</td></tr><tr><td>Titre/cm^3</td><td>20.25</td><td>20.60</td><td>20.35</td></tr></table>All 3 titres correct to 2 DP ✓</td><td>1</td><td>AO1.2</td><td>DO NOT ALLOW 1 DP, e.g. 20.6 instead of 20.60</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>mean titre = $\frac{20.25 + 20.35}{2}$ = 20.30 (cm^3) ✓
i.e. using concordant (consistent) titres</td><td>1</td><td>AO2.8</td><td>ALLOW 20.3
Missing ‘0’ already penalised in c(ii)

DO NOT ALLOW mean of all three titres,
i.e. $\frac{20.25 + 20.60 + 20.35}{3}$ = 20.40</td></tr>
</table>

Question	Answer	Marks	AO element	Guidance
(iv)		4		**ALLOW ECF** throughout and from incorrect concordant titres from **22c(iii)**
	$n(H_2SO_4) = 0.165 \times \frac{20.30}{1000}$ $= 3.35 \times 10^{-3}$ (mol) ✓		AO3.1 ×3	Calculator value = 3.3495×10^{-3}
	n(**M**OH) in 25.0 cm^3 $= 2 \times 3.35 \times 10^{-3}$ $= 6.70 \times 10^{-3}$ (mol) ✓			Calculator value = 6.699×10^{-3}
	n(**M**OH) in 250.0 cm^3 $= 10 \times 6.70 \times 10^{-3}$ $= 6.70 \times 10^{-2}$ (mol) ✓			Calculator value = 6.699×10^{-2}
	A_r of **M** = $\frac{2.62}{6.70 \times 10^{-2}}$ = 39.1 **AND M** = potassium/K ✓		AO3.2 ×1	By **ECF, ALLOW Group 1** metal nearest to calculated value of A_r

COMMON ERRORS

Use of 20.4 from mean of all 3 titres ALL 4 MARKS

$n(H_2SO_4) = 0.165 \times \frac{20.4}{1000}$ $= 3.366 \times 10^{-3}$ (mol) ✓ from **(c)(iii)**

n(**M**OH) in 25.0 cm^3 $= 2 \times 3.366 \times 10^{-3}$ $= 6.732 \times 10^{-3}$ (mol) ✓

n(**M**OH) in 250.0 cm^3 $= 10 \times 6.732 \times 10^{-3}$ $= 6.732 \times 10^{-2}$ (mol) ✓

A_r of **M** = $\frac{2.62}{6.732 \times 10^{-2}}$ = 38.9…. **OR 39 AND M** = K ✓

IF ×10 is absent, A_r = 389 **AND M** = Cs **OR** Fr

Use of 25.0 (wrong volume) for $n(H_2SO_4)$

$n(H_2SO_4) = 0.165 \times \frac{25}{1000}$ $= 4.125 \times 10^{-3}$ (mol) ✗

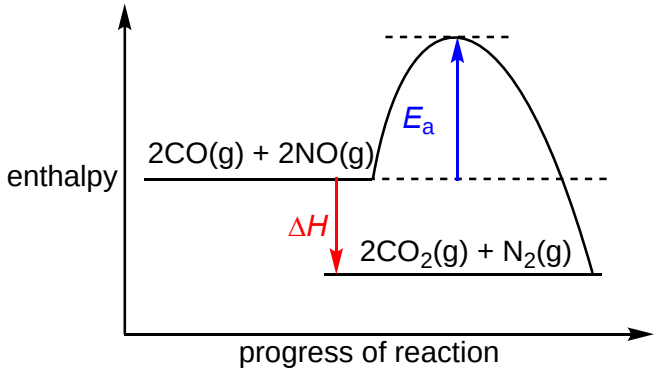
n(**M**OH) in 25.0 cm^3 $= 2 \times 4.125 \times 10^{-3}$ $= 8.25 \times 10^{-3}$ (mol) ✓

n(**M**OH) in 250.0 cm^3 $= 10 \times 8.25 \times 10^{-3}$ $= 8.25 \times 10^{-2}$ (mol) ✓

A_r of **M** = $\frac{2.62}{8.25 \times 10^{-2}}$ = 31.75….. **AND M** = K ✓

IF ×10 is absent, A_r = 317.5 **AND M** = Cs **OR** Fr

Question			Answer	Marks	AO element	Guidance
23	(a)	(i)	$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$ Correct species ✓ Balanced ✓	2	AO2.6 ×2	**ALLOW** multiples **IGNORE** state symbols For heptane formula, **ALLOW** any combination of skeletal **OR** structural **OR** displayed formula as long as unambiguous **ALLOW 1 mark** for balanced combustion equation for a different alkane (**ECF**) e.g. $C_6H_{14} + 9½O_2 \rightarrow 6CO_2 + 7H_2O$

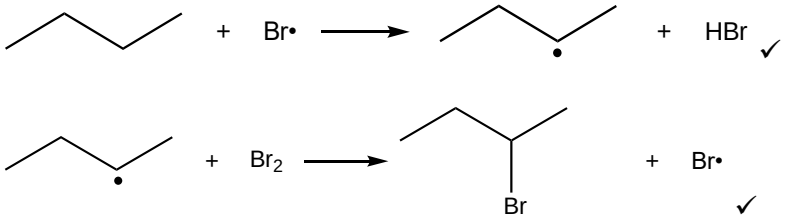
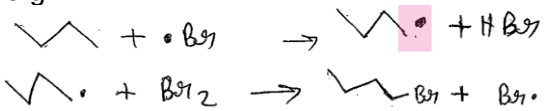
Question	Answer	Marks	AO element	Guidance
(ii)		2		**ANNOTATE ANSWER WITH TICKS AND CROSSES ETC** **IGNORE** state symbols
	Reactants, products and ΔH **2CO + 2NO** on LHS **AND** **$2CO_2$ + N_2** on RHS **AND** ΔH labelled with products **below** reactants **AND** **Arrow downwards** ✓		AO2.1	ΔH **DO NOT ALLOW –**ΔH **DO NOT ALLOW** double headed arrow on ΔH **ALLOW** ΔH arrow even with small gap at the top and bottom, i.e. line does not quite reach reactant or product line. **ALLOW** –746 for ΔH
	E_a (independent of ΔH) curve with arrow from reactants to top of curve **AND** E_a labelled ✓		AO1.2	E_a **ALLOW** AE **OR** A_E **ALLOW 2** arrowheads at **each** end of E_a line **OR** no arrowhead **BUT DO NOT ALLOW** arrowhead down E_a line must reach maximum (or near to maximum) on curve
	IF endothermic diagram shown, **ALLOW ECF** for E_a using MS criteria			

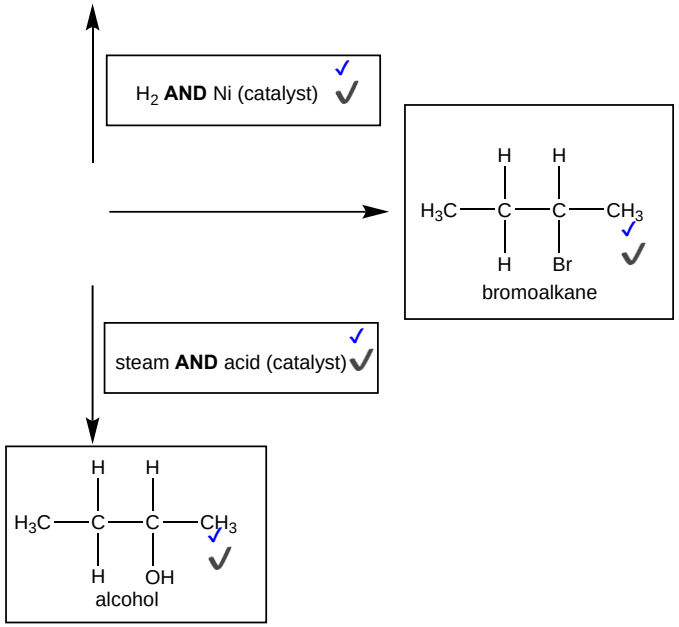
Question			Answer	Marks	AO element	Guidance
		(iii)	Catalyst lowers activation energy **OR** Catalyst increases rate without itself changing ✓ Reaction proceeds via a different route/pathway **OR** More molecules/particles exceed activation energy ✓	**2**	AO1.2 ×2	**ALLOW** 2nd labelled curve on profile diagram in **23(a)(ii)** with lower activation energy/E_c with catalyst **ALLOW** E_c needs less energy to start reaction **ALLOW** E_c curve is lower than E_a curve **IGNORE** 'shorter route' for alternative route **IGNORE** more successful collisions
	(b)	(i)	298 K/25ºC **AND** 100 kPa ✓	**1**	AO1.1	**ALLOW** 'a stated temperature' *To accept that other standard temperatures can be used and 298 should strictly be added as* $\Delta H_{298}^{\ominus}$ **IF** a temperature is seen, it **must** be 298/25ºC **ALLOW** 1×10^5 Pa, 101 kPa, 1.01×10^5 Pa, 1 atm, 1 bar

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = –394 (kJ mol^{-1}) award 3 marks** **Use of $\Delta_f H$ values and balancing numbers** ± (–824) seen anywhere **AND** ± (3 × –111) **OR** ± (333) **OR** ±1157 seen anywhere ✓ **Correct subtraction for $3\Delta_f H$(CO) using ΔH** (–25) + (–1157) *–1157 = 824 + (3 × –111)* = –1182 (kJ mol^{-1}) ✓ **Calculation of $\Delta_f H(CO_2)$ formation** $\Delta_f H(CO_2) = \frac{-1182}{3}$ = –394 (kJ mol^{-1}) ✓	**3**	AO2.6 ×3	**FULL ANNOTATIONS MUST BE USED** **ALLOW ECF** throughout **COMMON ERRORS** **–1182** omission of ÷3 for $\Delta_f H(CO_2)$ **2 marks** **(+)394** Incorrect subtraction **2 marks** **(+)1182** Incorrect subtraction **&** no ÷3 **1 mark** **–320** no ×3 for –111 **2 marks** **–960** no ×3 for –111 **AND** no ÷3 **1 mark** **–377.3 / –377** incorrect subtraction **2 mark** **–1132** incorrect subtraction **AND** no ÷3 **1 mark** **–303.3 / –303** no ×3 for –111 **AND** incorrect subtraction **1 mark** **–385.66… / –385.7** no ΔH (25) and ÷3 **2 marks** **(+)385.66… / (+)385.7** no ΔH (25) and ÷3 and wrong sign **1 mark**

24	**(a)**		All reaction species have same state/phase **OR** Reactants **AND** products has same state ✓	**1**	AO1.1	**ALLOW** SO_2 **AND** O_2 **AND** SO_3 for all species **OR** reactants and products are gases **OR** the molecules are all gases **IGNORE** reactants and catalyst have same state
	(b)		**Throughout,** **ALLOW** suitable alternatives for right-hand side, e.g. towards SO_3/products **OR** forward direction --- **Pressure** ***2 marks*** **Increased** pressure shifts equilibrium **to right** **OR** favours the **right** **OR increases** yield (of SO_3) ✓ Right-hand side has fewer (gaseous) moles **OR** 3 (gaseous) moles → 2 (gaseous) moles ✓ **Temperature** ***2 marks*** **Increased** temperature shifts equilibrium **to left** **OR** favours the **left** **OR decreases** yield (of SO_3) ✓ (Forward) reaction is exothermic/ΔH is negative **OR** (Forward) reaction gives out heat ✓ **Catalyst** ***1 mark*** No shift in equilibrium **OR** no effect on yield (of SO_3) ✓	**5**	AO1.1 AO1.2 AO1.1 AO1.2 AO1.2	***FULL ANNOTATIONS MUST BE USED*** --- **ORA for** reverse reaction e.g. decreased pressure shifts equilibrium to left For moles, **ALLOW** molecules/particles **ORA for** reverse reaction e.g. decreased temperature shifts equilibrium to right **ALLOW reverse** reaction is endothermic /ΔH is positive***/***takes in heat **ALLOW** rates of forward and reverse reaction increase **by same** amount **IGNORE** 'no increase in yield' *Yield could still decrease*

	(c)	**(i)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **IF answer = 7.9×10^4 award 2 marks** **----------** ***K_c* expression** $(K_c =) \frac{[SO_3]^2}{[SO_2]^2\,[O_2]}$ **OR** $\frac{(5.0 \times 10^{-2})^2}{(3.0 \times 10^{-3})^2 \times (3.5 \times 10^{-3})}$ **OR** 79365. ..... ✓ **Answer to 2 SF and in standard form** $K_c = 7.9 \times 10^4$ ✓	**2**	AO2.6 ×2	**IF** there is an alternative answer, check for any **ECF** credit possible using working below. **----------** Square brackets required for K_c expression **ALLOW ECF to 2 SF and standard form** **ONLY** from inverted K_c expression → 1.3×10^{-5} **DO NOT ALLOW** $\frac{[SO_3]^2}{[SO_2]^2 + [O_2]}$ = 0.71 (no marks) **IGNORE** attempts at units
		(ii)	Equilibrium **shifts** to the right/towards products/SO_3 ✓	**1**	AO3.1	**ALLOW** equilibrium favours the right

Question			Answer	Marks	AO element	Guidance
25	(a)		*Each marking point is independent* **Chain length: interaction between molecules** Chain length (in pentane) is longer **AND** more (surface) contact **OR** greater surface area/SA✓ **London forces: strength and energy** **Stronger / more** London forces **OR more energy to break** London forces ✓	**2**	AO1.1 ×2	**Comparisons** needed throughout **ORA** throughout **Assume the following for longer chain** ▪ larger/bigger molecule ▪ more C (and H) ▪ more atoms ▪ more electrons **BUT '**branching' is a **CON** **IGNORE** comments about packing **ALLOW** induced dipole(–dipole) interactions for London forces **IGNORE** van der Waals'/vdw forces
	(b)		**Skeletal formulae required**  ✓ ✓	**2**	AO3.1 ×2	**ALLOW** 1 mark (**ECF**) for 2 'correct' equations with dot omitted or incorrectly positioned **ALLOW** 1 mark for forming 1-bromobutane with dots correct for 1-bromobutane e.g.  **No credit for responses using molecular formulae for organic structures**

Question	Answer	Marks	AO element	Guidance
(c)		4	AO1.2 AO2.5 AO1.2 AO2.5	**ALLOW** any combination of skeletal **OR** structural **OR** displayed formula as long as unambiguous **ALLOW** Pt **OR** Pd for Ni **ALLOW** $H_2O(g)$ for steam *(g)* ***OR*** *temperature >100ºC required* **For acid,** **ALLOW** $H^+/H_2SO_4/H_3PO_4$ **ALLOW** small slip in acid formula e.g. phosphoric acid as H_2PO_3, etc **ALLOW** vertical bond to any part of OH, i.e. OH OH OH | | | **BUT DO NOT ALLOW** –HO **OR** OH–

Question	Answer	Marks	AO element	Guidance
26	**Correct structural isomers of C_3H_8O** *1 mark* $CH_3CH_2CH_2OH$ **AND** $CH_3CHOHCH_3$ ✓ **Reaction conditions** *1 mark* Distillation for aldehyde **AND** reflux for carboxylic acid **OR** ketone ✓ **Functional group of organic product** *2 marks* $CH_3CH_2CH_2OH$ → aldehyde **OR** → carboxylic acid ✓ $CH_3CHOHCH_3$ → ketone ✓ **One correct equation** *1 mark* $CH_3CH_2CH_2OH + [O] \rightarrow CH_3CH_2CHO + H_2O$ **OR** $CH_3CHOHCH_3 + [O] \rightarrow CH_3COCH_3 + H_2O$ **OR** $CH_3CH_2CH_2OH + 2[O] \rightarrow CH_3CH_2COOH + H_2O$ ✓			**ANNOTATE WITH TICKS AND CROSSES** **Throughout,** **ALLOW** any combination of skeletal **OR** structural **OR** displayed formula as long as unambiguous **IF functional group is NOT given,** **ALLOW** propanal / RCHO **ALLOW** propanoic acid / RCOOH **ALLOW** propanone / ….. RCOR **IGNORE** small slips in formulae (assessed in equation)

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