



GCE

Chemistry B (Salters)

H033/01: Foundations of chemistry

Advanced Subsidiary GCE

Mark Scheme for November 2020

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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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Annotations

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

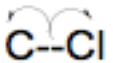
Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

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


Section A

Question	Key	AO element
1	D	1.1
2	A	2.1
3	B	1.1
4	C	1.2
5	A	1.2
6	A	1.2
7	C	2.3
8	D	2.7
9	D	1.2
10	C	2.1
11	D	1.1
12	C	2.1
13	D	1.1
14	B	1.2
15	A	1.2
16	B	2.7
17	D	1.1
18	C	2.1
19	C	2.6
20	B	2.7

Section B

Question			Answer	Mark	AO	Guidance
21	(a)		dichlorodifluoromethane ✓	1	1.2	IGNORE spaces, and other separators
21	(b)	(i)	causes skin cancer/mutations OR damages crops ✓	1	1.1	ALLOW eye damage NOT eye problems
21	(b)	(ii)	It causes photochemical smog ✓	1	1.1	ALLOW toxic/poisonous/respiratory/breathing problems OR damage to plants/rubber
21	(b)	(iii)	Bonds vibrate (more) ✓	1	1.1	ALLOW They vibrate (more) NOT Atoms vibrate (more) IGNORE reference to collisions
21	(c)	(i)	$ClO + O \rightarrow Cl + O_2$ ✓	1	1.2	
	(c)	(ii)	$Cl + Cl \rightarrow Cl_2$ OR $2Cl \rightarrow Cl_2$ OR $2ClO \rightarrow Cl_2 + O_2$ ✓	1	2.1	
21	(c)	(iii)	Both 'propagation' ✓	1	1.1	
21	(d)	(i)	 AND homolytic (fission) ✓	1	1.2	NB Half arrows
21	(d)	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3.46×10^{-5} (cm) award 4 marks Use of $v = E/h$ or implied by correct evaluation step(s) ✓ $v = 346000 / 6.63 \times 10^{-34} \times 6.02 \times 10^{23}$ (or correct evaluation 8.67×10^{14}) ✓ $\lambda = 3.00 \times 10^8 / 8.67 \times 10^{14} (= 3.48 \times 10^{-7} \text{ m})$ ✓ $= 3.46 \times 10^{-5} \text{ (cm)}$ ✓	4	2.2	ALLOW 2 or more sf. ALLOW ecf
	(e)	(i)	molecule/negatively charged ion with a (lone) pair of electrons which it donates(AW) to a (positively charged) atom (to form a covalent bond). ✓	1	1.1	

Question		Answer	Mark	AO	Guidance
(e)	(ii)	$ \begin{array}{c} \delta+ \quad \delta- \\ \text{C}-\text{Cl} \\ \curvearrowright \\ \text{OH} \\ \checkmark \end{array} \quad \text{-----} \rightarrow \quad \text{C}-\text{OH} + \text{Cl}^- $	2	2.5	<p>One arrow (double headed) must start (when projected back) at bond and end (when projected forward) on Cl AND partial charges on C and Cl</p> <p>Other arrow (double headed) must start (when projected back) at minus (or a lone pair on OH) and end (when projected forward) on C IGNORE other atoms bonded to C. If both charges omitted can award second mark for balanced equation.</p>

Question		Answer	Mark	AO	Guidance
22	(a)	6 protons; 7 neutrons ✓	1	1.2	
	(b)	(i) FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 12.01 award 2 marks (98.9 x 12) + (1.1 x 13) ✓ divide by 100 and answer to 2 dp (12.01) ✓	2	2.2	ALLOW ECF
	(b)	(ii) chance of 2 ¹³ C small (AW) ✓	1	3.2	
	(c)	 ✓ $M_r = 60$ (from M^+ peak in MS) ✓ C_3H_8O/C_3H_7OH ✓ CH ₂ OH only found in the primary isomer OR CH ₂ OH means OH at end (AW) ✓	4	3.1 3.2 3.1 3.2	ALLOW "60-31=29; which can only be CH ₃ CH ₂ "

Question			Answer	Mark	AO	Guidance
23	(a)		(Otherwise) they react ✓	1	3.3	CON reactions with other substances
23	(b)	(i)	Na ⁺ AND its oxidation number goes down/goes from +1 to zero OR it gains electrons ✓	1	2.1	ALLOW 'sodium ion' NOT 'sodium'
23	(b)	(ii)	$2Cl^{-} \rightarrow Cl_2 + 2e^{-}$ OR $2Cl^{-} - 2e^{-} \rightarrow Cl_2$ ✓	1	2.4	ALLOW equation halved ALLOW 'e' without minus
23	(b)	(iii)	breathing apparatus (AW) ✓	1	1.1	ALLOW use in a fume cupboard ALLOW well ventilated room NOT face masks
23	(b)	(iv)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 1.4×10^5 (m³) award 5 marks (moles Na =) $1 \times 10^6/23$ (= 43478) ✓ moles Cl ₂ = half Na (21739) ✓ Rearrangement $V = nRT/P$ ✓ substitute values V (= $21739 \times 8.314 \times 873/1100$) = $1.43\dots \times 10^5$ (m ³) ✓ 2sf and standard form ✓	5	2.8	ALLOW ecf Earlier points can be scored by implication in later ones, eg MP1 and MP2 from 21.74 in MP4; MP3 from correct expression in MP4 etc Award last MP for any number to two sf and standard form resulting from a shown calculation.
23	(c)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 1.1 or 1.07 award 2 marks $33/58.5$ OR $0.56(4)$ (mole Na) AND $67/111(.1)$ OR $0.60(3)$ (mole Ca) ✓ ratio (= $0.60(3)/0.56(4)$) = $1.1/1.07$ ✓	2	2.6	ALLOW ecf
23	(d)		Na – sodium ions/(1) ⁺ ions ✓	5	1.2	ALLOW labelled diagrams for all marks

Question			Answer	Mark	AO	Guidance
			delocalised electrons (AW)✓ NaCl – <u>Na</u> ⁺ and <u>Cl</u> ⁻ ions ✓ 'lattice' or one structure point (eg 'alternating') ✓ Electrostatic forces (between oppositely charged ions) ✓			ALLOW opposite charges of ions attract
23	(e)	(i)	(colourless/pale green to) brown/orange/yellow ✓ $2\text{NaI} + \text{Cl}_2 \rightarrow 2\text{NaCl} + \text{I}_2$ ✓	2	2.5	ALLOW these colours alone or in any combination but no others. ALLOW ionic equation IGNORE state symbols
23	(e)	(ii)	EITHER add organic solvent – purple colour OR heat solution – purple vapour ✓	1	3.4	

Question		Answer	Mark	AO	Guidance
24	(a)	Plotting points ✓ Smooth line of best fit ✓ 	2	2.8 3.3	ALLOW best fit line +/- half square from each point AND point 4 (2.20) off the line IGNORE labelling of line
24	(b)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = $0.046/4.6 \times 10^{-2}$ award 3 marks Expression for $K_c = [\text{CH}_4] [\text{H}_2\text{O}] / [\text{CO}] [\text{H}_2]^3$ ✓ Reading values from graph ✓ Calculation $(0.4)^2 / 0.6 (1.8)^3 = 0.0457\dots$ ✓	3	2.8	ALLOW 2 or more sf. ALLOW ecf from expression or graph reading MP1 can be inferred from later steps IGNORE units
24	(c)	 line begins at or above 1 ✓ and flattens below 0.6 (but not to zero) ✓	2	3.1	Line can go below dotted line (or not)

Question			Answer	Mark	AO	Guidance
24	(d)		Heterogeneous AND catalyst and reactants in different states✓	1	1.1	

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