Mark Scheme (Results)

January 2026

Pearson Edexcel International Advanced Subsidiary Level in Chemistry
Paper 01: Structure, Bonding and Introduction to Organic Chemistry
WCH11/01

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January 2026
Question Paper Log Number P79049A
Publication Code WCH11_01_2601_MS

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities. Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Section A

Question Number	Answer	Mark
1	**The only correct answer is D** (number of protons in the nucleus) ***A*** *is incorrect because elements are not arranged in order of the first ionisation energy* ***B*** *is incorrect because elements are not arranged in order of relative atomic mass* ***C*** *is incorrect because elements are not arranged in order of the number of electrons in the outer shell*	**(1)**

Question Number	Answer	Mark
2	**The only correct answer is B** (Cr) ***A*** *is incorrect because C has only got 2 orbitals with a single electron* ***C*** *is incorrect because Mn has only got 5 orbitals with a single electron* ***D*** *is incorrect because N has only got 3 orbitals with a single electron*	**(1)**

Question Number	Answer	Mark
3	**The only correct answer is B** (K_2X) ***A*** *is incorrect because X is sulfur so the formula would be* K_2X ***C*** *is incorrect because X is sulfur so the formula would be* K_2X ***D*** *is incorrect because X is sulfur so the formula would be* K_2X	**(1)**

Question Number	Answer	Mark
4	**The only correct answer is A** (Ti^{3+}) ***B*** *is incorrect because* Ca^{2+} *has 18 electrons* ***C*** *is incorrect because* P^{3-} *has 18 electrons* ***D*** *is incorrect because* Cl^{-} *has 18 electrons*	**(1)**

Question Number	Answer	Mark
5	**The only correct answer is C** (small radius, large charge) ***A*** *is incorrect because cations with a large charge are most polarising* ***B*** *is incorrect because cations with a small radius are most polarising* ***D*** *is incorrect because cations with a small radius and large charge are most polarising*	**(1)**

Question Number	Answer	Mark
6	**The only correct answer is C** (ZCl_2) ***A*** *is incorrect because Z is in Group 2 due to the large jump between second and third ionisation energies so loses two electrons* ***B*** *is incorrect because Z is in Group 2 due to the large jump between second and third ionisation energies so loses two electrons* ***D*** *is incorrect because Z is in Group 2 due to the large jump between second and third ionisation energies so loses two electrons*	**(1)**

Question Number	Answer	Mark
7	**The only correct answer is A** ($Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$) ***B*** *is incorrect because it is a neutralisation reaction* ***C*** *is incorrect because it is a neutralisation reaction* ***D*** *is incorrect because it is a neutralisation reaction*	**(1)**

Question Number	Answer	Mark
8	**The only correct answer is D** (C_4H_{10}) ***A*** *is incorrect because* CH_3 *cannot be a molecular formula* ***B*** *is incorrect because* C_2H_6 *is the wrong molecular formula obtained from an incorrect rounding* ***C*** *is incorrect because* C_2H_5 *is the empirical formula, not the molecular formula*	**(1)**

Question Number	Answer	Mark
9	**The only correct answer is B** (21.2%) ***A*** *is incorrect because the mass of* NH_4*, not N has been used in the calculation* ***C*** *is incorrect because mass of just one* NH_4*, not N has been used in the calculation* ***D*** *is incorrect because just one N has been used in the calculation*	**(1)**

Question Number	Answer	Mark
10	**The only correct answer is D** (7.5×10^{22}) ***A*** *is incorrect because this is the number of iron sulfate particles present* ***B*** *is incorrect because this is the number of* Fe^{3+} *ions present* ***C*** *is incorrect because this is the number of* SO_4^{2-} *ions present*	**(1)**

Question Number	Answer	Mark
11	**The only correct answer is C** (10.42 g) ***A*** *is incorrect because this is the mass to make 2000 cm^3 of solution* ***B*** *is incorrect because this is the mass to make 1000 cm^3 of solution* ***D*** *is incorrect because only one Cl has been included in the molar mass calculation*	**(1)**

Question Number	Answer	Mark
12	**The only correct answer is C** (250 cm^3) ***A*** *is incorrect because the remaining oxygen on the LHS has been omitted* ***B*** *is incorrect because the carbon dioxide volume has not been included* ***D*** *is incorrect because the loss of volume on the LHS has not been included*	**(1)**

Question Number	Answer	Mark
13	**The only correct answer is B** (217 cm^3) ***A*** *is incorrect because the temperature has not been converted to K* ***C*** *is incorrect because the temperature has not been converted to K and the volume conversion is incorrect* ***D*** *is incorrect because the volume conversion is incorrect*	**(1)**

Question Number	Answer	Mark
14	**The only correct answer is A** ($CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$) ***B*** *is incorrect because the atom economy is higher due to the absence of the molar mass of carbon dioxide* ***C*** *is incorrect because the atom economy is higher due to the molar mass of water is less than the molar mass of carbon dioxide* ***D*** *is incorrect because the atom economy is higher due to hydrogen being the only other product*	**(1)**

Question Number	Answer	Mark
15	**The only correct answer is D** (pent-2-ene and cyclopentane) ***A*** *is incorrect because the number of C and H in the products are consistent with decane* ***B*** *is incorrect because the number of C and H in the products are consistent with decane* ***C*** *is incorrect because the number of C and H in the products are consistent with decane*	**(1)**

Question Number	Answer	Mark
16	**The only correct answer is C** (12 σ-bonds 2 π-bonds) ***A*** *is incorrect because only the C−C bonds have been included for the σ-bonds and the number of π bonds has been doubled* ***B*** *is incorrect because the σ bonds in the double bonds have been omitted* ***D*** *is incorrect because the number of π bonds has been doubled*	**(1)**

Question Number	Answer	Mark
17	**The only correct answer is B** (1 and 4) ***A*** *is incorrect because the two compounds have different molecular formulae* ***C*** *is incorrect because the two compounds have different molecular formulae* ***D*** *is incorrect because the two compounds have different molecular formulae*	**(1)**

Question Number	Answer	Mark
18	**The only correct answer is B** (4) ***A*** *is incorrect because there are 4 structural isomers of* C_4H_9Br ***C*** *is incorrect because there are 4 structural isomers of* C_4H_9Br ***D*** *is incorrect because there are 4 structural isomers of* C_4H_9Br	**(1)**

Question Number	Answer	Mark
19	**The only correct answer is D** (but-2-ene) ***A*** *is incorrect because the compound has not got two different groups on each C of the double bond* ***B*** *is incorrect because the compound has not got two different groups on each C of the double bond* ***C*** *is incorrect because the compound has not got two different groups on each C of the double bond*	**(1)**

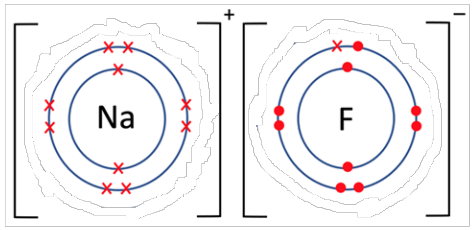
Question Number	Answer	Mark
20	**The only correct answer is D** (3-ethyl-2,3-dimethylpentane) ***A*** *is incorrect because the side chains are wrongly named* ***B*** *is incorrect because the longest chain is 5 not 3* ***C*** *is incorrect because the longest chain is 5 not 4*	**(1)**

TOTAL FOR SECTION A = 20 MARKS

Section B

Question Number	Answer	Additional Guidance	Mark
21(a)	A description that makes reference to the following points: • the (strong) **electrostatic attraction** **(1)** • (between) sodium ions / cations **and** delocalised electrons **(1)**	Allow positive ions / metal ions Ignore protons/nuclei Any reference to any other type of bonding score 0	**(2)**

Question Number	Answer	Additional Guidance	Mark
21(b)	An answer that makes reference to the following points: • (the melting temperature) would be higher because the ions are Mg^{2+} and Na^{+} (so charge is greater) **(1)** Comment for this mark we must see Mg^{2+} and Na^{+} but this comparison may be in two parts ie Na^{+} may be seen (a) and Mg^{2+} in (b). It may even be annotated in the question. • there are more **delocalised electrons** in magnesium than sodium (so the attraction between the delocalised electrons and the cations is stronger) resulting in a higher melting temperature) **(1)**	Comment Any reference to covalency score (0) Any reference to Na having the higher melting temperature score (0) Reference to the melting temperature being higher can be given in M1 or M2 but if missing (1) Allow magnesium ion is 2+ and sodium +1 Allow the Mg^{2+} has a higher charge density than Na^{+} Ignore reference to the size of the ions Ignore just Mg/Mg ion has a higher charge Ignore any reference to atomic radius Allow Mg/ Mg^{2+} donates more (OWTTE) electrons to the sea of **delocalised electrons**	**(2)**

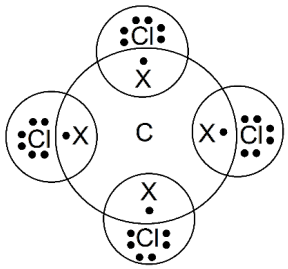
Question Number	Answer	Additional Guidance	Mark
21(c)	An answer that makes reference to the following points: • correct Na^+ ion diagram with charge **(1)** • correct F^- ion diagram with charge **(1)**	<u>Example of diagram</u>  Circles and square brackets not required Allow (1) for two correct diagram showing only outer shell electrons. Note that the Na can either have 8 or 0 electrons in this case. Allow (1) if all dots or all crosses are shown in both ions/ or are reversed Allow (1) for missing charges/reversed charges Ignore working arrows	**(2)**

Question Number	Answer	Additional Guidance	Mark
21(d)	An explanation that makes reference to the following points: • Na^+ /Na is smaller (despite having the same number of electrons) **(1)** • because Na^+ / Na has more protons **and** so the electrons are more attracted/pulled closer to the nucleus **(1)**	Comment Allow reference just to Na/F as the question is about the ions. Note M2 has 2 points. Do not award any marks if they say Na is larger. Score (0) Do not award smaller **atomic** radius Do not award if they say the ions have different numbers of electrons Allow greater nuclear charge/ Allow greater proton: electron ratio Ignore greater atomic number Allow so pulls the outer shell closer to the nucleus OWTTE Ignore shielding Allow reverse argument for both points	**(2)**

Question Number	Answer	Additional Guidance	Mark
21(e)	An explanation that makes reference to the following points: • Na conducts when solid and liquid **(1)** • because it has (delocalised) electrons that move **(1)** • NaF **only** conducts when liquid/molten **(1)** • because ions free to move/flow **(1)**	Allow in both states/ regardless of state Ignore just free electrons Ignore electrons carry charge Do not award any reference to ions moving M1 and M2 are standalone marks Allow NaF doesn't conduct when solid Allow ions are fixed (in place) in the solid Ignore ions carry charge Ignore any reference to aqueous solutions Ignore no free electrons Do not award if there is any reference to (delocalised) electrons moving Note M4 dependent on M3	**(4)**

Question Number	Answer		Additional Guidance	Mark
21(f)	• calculation of mass of F in 1 g of toothpaste	**(1)**	Example of calculation $n = 19.0 \times 5.68 \times 10^{-5} = 1.0792 \times 10^{-3}$ (g)	**(3)**
	• calculation of ppm	**(1)**	$n = 1.0792 \times 10^{-3} \times 1.0 \times 10^{6} = (1079.2$ (ppm))	
	• answer to 2 or 3 SF	**(1)**	1100 / 1080 (ppm)	
			Correct answer to 2 or 3 SF with no working scores 3	
	Some are using 42 the Mr of NaF			
	(n = 42 × $5.68 \times 10^{-5} = 2.3856 \times 10^{-3}$ (g))		Allow TE from an attempt at M1 Ignore early rounding and incorrect truncating	
	n = 2.3856×10^{-3} (g) × 1.0×10^{6} = 2385.6 (ppm)	**(1)**		
	2400/ 2390	**(1)**	Comment M3 the SF mark is only awarded if they have multiplied a mass by 5.68×10^{-5} in M1 and multiplied this number by 10^{6} in M2.	
	Some are using 38 the Mr of F_2			
	(n = 38 × $5.68 \times 10^{-5} = 2.1584 \times 10^{-3}$ (g))		If no other mark is awarded score 1 for multiplication of $5.68 \times 10^{-5} \times 1.0 \times 10^{6} = 56.8$	
	n = 2.1584×10^{-3} (g) × 1.0×10^{6} = 2158.4 (ppm)	**(1)**		
	2200/ 2160	**(1)**		

(Total for Question 21 = 15 marks)

Question Number	Answer	Additional Guidance	Mark
22(a)(i)	An answer that makes reference to the following points: • correct electrons round 4 Cls **(1)** • correct electrons round C **(1)**	<u>Example of diagram</u>  Allow (1) if all dots or crosses used Allow (1) if dots and crosses reversed Ignore inner shell electrons Circles not required	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(a)(ii)	An answer that makes reference to the following points: • 109.5(°) **(1)** • (four) electron pairs / bonding pairs repel each other to get minimum repulsion **(1)** Comment Allow if they say there are bonding pairs and the bonds repel to get minimum repulsion	Ignore shape even if wrong Allow maximum separation of electron pairs / bonding pairs Ignore bonds/electron region for electron pairs	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(a)(iii)	An explanation that makes reference to the following points: • chlorine is more electronegative than carbon (so the bonds are polar) **(1)** • but the molecule is not polar because the dipoles cancel out / the dipole moments cancel **(1)**	Accept differences in electronegativity between carbon and chlorine (make the bond polar) Allow the molecule is symmetrical Allow polarities cancel out Ignore the polar bonds cancel out	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(b)	An explanation that makes reference to the following points: • (lone pairs of electrons) repel more than bonding pairs **(1)** • so the bond angle (of the HOCl) bond is reduced/ smaller **(1)**	Allow shared pairs for bonding pairs Ignore LP repel more than BP Allow any indication that the angle is reduced Allow the bond angle is any value between 104.5^{o} and 103 ^{o} Any reference to 180^{o} will not score M2 Comment It is actually 103^{o}	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(c)(i)	• calculation of moles of hydrochloric acid	Example of calculation $n = 22.5 \times 1.6 \div 1000 = 0.036$ (mol) Correct answer with no working scores (1)	**(1)**

Question Number	Answer	Additional Guidance	Mark
22(c)(ii)	• calculation of moles of hydrogen	Example of calculation $n = 430 \div 24000 = 0.017917$ (mol) Ignore SF except 1SF Correct answer with no working scores (1) Only penalise incorrect rounding to 2SF so 0.017 (mol) will not score.	**(1)**

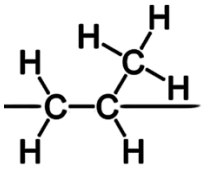
Question Number	Answer	Additional Guidance	Mark
22(c)(iii)	An answer that makes reference to the following points: • correct formula of MCl_2 **(1)** • rest of equation **(1)** Comment If no answers/ nonsense answers are given for ci and cii (ie with a ratio greater than 1:4) then (1) for the correct equation	Example of equation $M + 2HCl \rightarrow MCl_2 + H_2$ TE from parts (i) and (ii) But very unlikely to be seen	**(2)**

Question Number	Answer	Additional Guidance	Mark
22(d)	• molar mass of AgBr **(1)** • moles of AgBr in 400 cm^3 water **(1)** • concentration of bromide ions in sea water **(1)** Comment Look at the final answer and if it is correct score 3. If not look for salvage marks. Most are not showing the calculation for the molar mass so if you see 6.9223×10^{-4} (mol) they must have calculated it correctly so this will score 2. No TE for M2 and M3 if they have not used a molar mass (correct or otherwise) in M1.	Example of calculation $M_r = 79.9 + 107.9 = 187.8$ (g mol^{-1}) $n = 0.13 \div 187.8 = 0.00069223 / 6.9223 \times 10^{-4}$ (mol) $c = \frac{1000}{400} \times 6.9223 \times 10^{-4} = 0.00173 / 1.731 \times 10^{-3}$ (mol dm^{-3}) Ignore SF except 1 SF Ignore units even if incorrect Correct answer with or without working scores 3	**(3)**

(Total for Question 22 = 15 marks)

Question Number	Answer	Additional Guidance	Mark
23(a)(i)	An answer that makes reference to the following points: • steam **(1)** • phosphoric((V)) acid / H_3PO_4/sulfuric acid/H_2SO_4 (catalyst) **(1)** Comment If they put an incorrect reagent e.g. $KMnO_4$ max (1) as list principle applies	Allow $H_2O(g)$ Allow water/ H_2O and a stated temperature above 100°C Do not award a temperature below 100°C Allow acid/acidic Allow H^+ Allow answers in any order or both on the same line Ignore state symbols of the acids Ignore any reference pressure If name and formula are given both must be correct	**(2)**

Question Number	Answer	Additional Guidance	Mark
23(a)(ii)	An answer that makes reference to the following points: • electrophilic addition **(1)** • 2-bromopropane **(1)**	Ignore missing or extra hyphens, commas, two words and gaps	**(2)**

Question Number	Answer	Additional Guidance	Mark
23(a)(iii)	An answer that makes reference to the following point: • diagram showing extension bonds	<u>Example of diagram</u>  Allow CH_3 Allow more than one repeat unit Ignore brackets or n Do not award missing Hs Do not award skeletal formula	**(1)**

Question Number	Answer		Additional Guidance	Mark
23(b)	• g of iodine added to one mole of **X**	**(1)**	Example of calculation m = 126.9 × 2 × 3 = 761.4 (g)	**(2)**
	• calculation of the iodine number	**(1)**	N = 100 ÷ 278 × 761.4 = 273.88 (g per 100 g)	
	Alternative method			
	• calculation of moles of iodine	**(1)**	n = 100 ÷ 278 = 0.35971 (mol) Ignore incorrect rounding	
	• calculation of the iodine number	**(1)**	N = 0.35971 × 126.9 × 2 × 3 = 273.88 (g)	
	Comment Firstly, look at the final answer and if correct score 2. If not look for salvage marks. If they only use one Iodine and a mass of 126.9 so do not multiply by 3 and 2 only treat this as one mistake and an answer of 45.647 will score 1. If they do not multiply by 3 an answer of 91.294 will score 1. If they do not multiply by 2 an answer of 136.942 will score 1. In the unlikely event of any other masses being used you will have to do the calculation.		TE from M1 Ignore units even if incorrect Ignore SF except 1SF	

(Total for Question 23 = 7 marks)

Question Number	Answer	Additional Guidance	Mark
24(a)(i)	An answer that makes reference to the following point: • ultraviolet light / ultraviolet radiation	 Allow UV light / sunlight/ Ignore heat	**(1)**

Question Number	Answer	Additional Guidance	Mark
24(a)(ii)	An answer that makes reference to the following point: • a single electron/ unpaired electron	 Allow an electron/one electron Allow free electron Allow a free radical electron Ignore free radical	**(1)**

Question Number	Answer	Additional Guidance	Mark
24(b)	An answer that makes reference to the following points: Propagation • $Cl\bullet + CH_3CH_3 \rightarrow CH_3CH_2\bullet + HCl$ **(1)** • $CH_3CH_2\bullet + Cl_2 \rightarrow CH_3CH_2Cl + Cl\bullet$ **(1)** Termination any 2 from • $CH_3CH_2\bullet + Cl\bullet \rightarrow CH_3CH_2Cl$ $CH_3CH_2\bullet + CH_3CH_2\bullet \rightarrow CH_3CH_2\,CH_2\,CH_3 / C_4H_{10}$ $Cl\bullet + Cl\bullet \rightarrow Cl_2$ **(1)**	Penalise the omission of dots once only Allow $C_2H_5\bullet$ etc throughout Ignore the position of the • Ignore any other propagation steps for M1 and M2 TE from any other correct free radicals produced by subsequent propagation steps If any other alkane is used, they can only score M3	**(3)**

Question Number	Answer	Additional Guidance	Mark
24(c)	An answer that makes reference to the following point: • there can be further substitution reactions / more than one substitution product	Allow there are other organic products Allow other hydrocarbons Allow other named products such as dichloroethanes and butane Ignore chlorine is formed Ignore waste products Ignore low yield Ignore just further reactions Ignore reference to atom economy/yield Ignore side reactions	**(1)**

(Total for Question 24 = 6 marks)

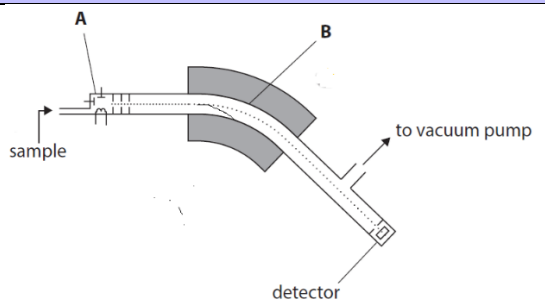
Question Number	Answer	Additional Guidance	Mark
25(a)(i)	An answer that makes reference to the following point: Protons: 12 | Neutrons: 13 | Electrons: 12	All required	**(1)**

Question Number	Answer	Additional Guidance	Mark
25(a)(ii)	An answer that makes reference to the following points: • (similarity =) same number of protons / same atomic number **and** (difference =) different mass number / number of neutrons	Ignore the number of electrons	**(1)**

Question Number	Answer	Additional Guidance	Mark
25(b)	An answer that makes reference to the following points: • weighted mean mass of an **atom/** the average mass of an **atom** **(1)** • compared to 1/12 (of the mass) of a ^{12}C (atom) **(1)** Comment Atom must be seen in M1 but can be omitted in M2	Ignore element/ isotopes	**(2)**

Question Number	Answer	Additional Guidance	Mark
25(c)(i)	An answer that makes reference to the following points: • **A** ionisation **(1)** • **B** deflection **(1)**	Ignore any reference to the processes i.e. being bombarded by electrons	**(2)**

Question Number	Answer	Additional Guidance	Mark
25(c)(ii)	An explanation that makes reference to the following points: • if there was not a vacuum air / water vapour (would be present) **(1)** • the ions and air/molecules could collide **(1)** Comment Both marks could be scored in one sentence e.g. air molecules could collide with the ions (2)	Allow to remove air/ particles/ or any correctly named gas/atoms/molecules Allow nothing present Ignore to remove impurities The air/ molecules/particles/ any named gas could: deflect/ stop/ interfere with/react with the ions Allow air/molecules/particles any named gas could be detected Allow reverse argument	**(2)**

Question Number	Answer	Additional Guidance	Mark
25(c)(iii)	An answer that makes reference to the following point: • diagram showing the ion hitting the lower surface of the magnet Allow any movement downwards provided it does not hit the detector.		**(1)**

Question Number	Answer	Additional Guidance	Mark
25(c)(iv)	• relative atomic mass equation **(1)** • simplification of equation **(1)** • calculation of abundance of ^{26}Mg **(1)** • calculation of abundance of ^{25}Mg **(1)** Note the x and y may be reversed in the calculation and some are using % instead of mole fractions.	Example of calculation $24.3 = (24 \times 0.79) + ((0.21 - y) \times 25) + 26y$ $24.3 = 18.96 + 5.25 - 25\ y + 26y$ $y = 0.09$ / 9% $0.21 - 0.09 = 0.12$ / 12% Correct answer with no working scores 4 If the isotopes are reversed in the final answer score 3 If no other marks are scored $24.3 = (24 \times 0.79) + 25\ x + 26y$ Or $24.3 = \frac{(24 \times 79) + 25\ x\ + 26y}{100}$ Score (1)	**(4)**

Question Number	Answer	Additional Guidance	Mark
25(d)	• An answer that makes reference to the following points: • *m/z* 79 due to ^{79}Br (isotope) **and** *m/z* 81 due to ^{81}Br (isotope) **(1)** • *m/z* 158 due to $Br_2^{(+)}$ comprising of 2 × ^{79}Br atoms **and** *m/z* = 162 due to $Br_2^{(+)}$ comprising of 2 × ^{81}Br atoms **(1)** • *m/z* 160 due to $Br_2^{(+)}$ comprising of 1 × ^{79}Br atom and 1 × ^{81}Br atom **(1)** • the isotopes have similar abundances / **slightly** more $^{79}Br^{(+)}$ **and** so the peak at *m/z* 160 results from ^{79}Br – ^{81}Br and ^{81}Br – ^{79}Br (and there is only one for 158 and 162 so the 160 peak is double the height) **(1)**	Look on the mass spectrum for annotation Ignore missing charges Penalise wrong charge once only Allow any reference to ^{79}Br and ^{81}Br and this may seen in M2. Ignore Br_{79} etc Do not award if they refer to ^{80}Br Allow $^{79}Br_2$ etc Allow both isotopes about 50% Allow similar number Allow ratio of the isotopes about 1:1 Allow two arrangements of ^{79}Br atom and ^{81}Br atom Allow ^{79}Br atom and ^{81}Br atom × 2 Allow answers in terms of probabilities/ fractions	**(4)**

(Total for Question 25 = 17 marks)

TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 80 MARKS