Mark Scheme (Results)

October 2020

Pearson Edexcel GCE
In Chemistry (8CH0)
Paper 1: Core Inorganic and Physical Chemistry

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October 2020
Publications Code 8CH0_01_2010_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.

Question Number	Answer	Mark
1(a)	**The only correct answer is C** ($1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6$) **A** *is not correct because this is the electron configuration of* $^{33}As^{3+}$ **B** *is not correct because this is the electron configuration of* ^{33}As **D** *is not correct because this has added electrons in the 4d orbital*	**(1)**

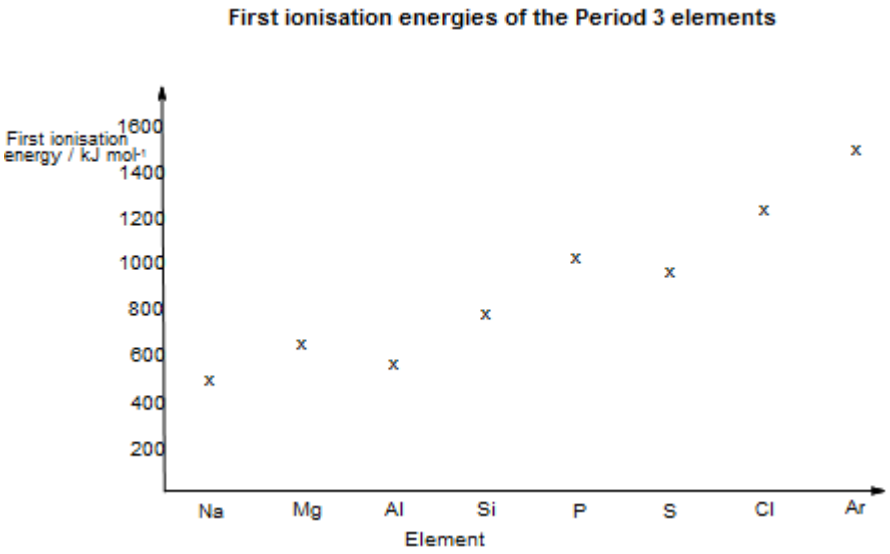
Question Number	Acceptable Answer	Additional Guidance	Mark
1(b)(i)	An answer that makes reference to the following point: • (up and down arrows represent) electrons with opposite spin or two electrons in the same orbital with opposite spins	Answer must refer to spin Ignore just number of electrons Ignore 'moving / opposite direction' in place of 'spin' Ignore comments re repulsion, same orbital etc	**(1)**

	Acceptable Answer	Additional Guidance	Mark
1(b)(ii)	An answer that makes reference to the following point: • (three) electrons with parallel / same spin / direction of rotation (because the electrons are in different orbitals)	 Allow 'spinning in the same direction' Allow electrons are added into separate orbitals first because of Hund's rule Do not award for just 'direction' of spin, with no reference to 'same'	**(1)**

(Total for Question 1 = 3 marks)

Question Number	Answer	Mark
2(a)(i)	**The only correct answer is D** ($Br^{+}(g) - e^{-} \rightarrow Br^{2+}(g)$) **A** *is not correct because* $Br(g) + e^{-} \rightarrow Br^{-}(g)$ *is an equation for first electron affinity* **B** *is not correct because* $Br^{-}(g) + e^{-} \rightarrow Br^{2-}(g)$ *is an equation for second electron affinity* **C** *is not correct because* $Br(g) - 2e^{-} \rightarrow Br^{2+}(g)$ *is an equation that combines first and second ionisations*	**(1)**

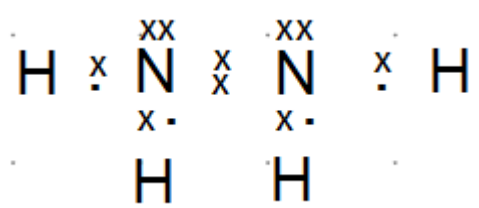
Question Number	Answer	Mark
2(a)(ii)	**The only correct answer is B** (801, 2 427, 3 660, 25 026, 32 828) **A** *is not correct because* 738, 1 451, 7 733, 10 541, 13 629 *is typical of Group 2 elements* **C** *is not correct because* 1 086, 2 353, 4 621, 6 223, 37 832 *is typical of Group 4 elements* **D** *is not correct because* 1 402, 2 856, 4 578, 7 475, 9 445 *could be for Group 5, 6, 7, 8 or transition elements*	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(b)(i)	An answer that makes reference to the following points: • Al below Mg but above /equal to Na **(1)** • rise from Al to Si and then to P **and** rise from S to Cl to Ar **(1)** • S below P but above / equal to Si **(1)**	<u>Example of chart</u>  Allow use of dots (·) or other alternatives to X Ignore any lines connecting the crosses (X)	**(3)**

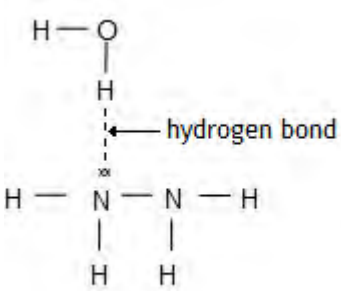
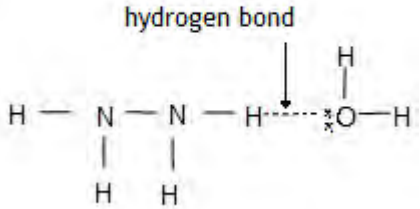
Question Number	Acceptable Answer	Additional Guidance	Mark
2(b)(ii)	An answer that makes reference to the following points: • big increase/jump between 1st and 2nd electrons removed and between 9th and 10th electrons removed **(1)** • one / first electron in the outer most / third shell **and** eight electrons / electron 2 - 9 in the next / second shell **and** two electrons / electrons 10 & 11 in the inner most/ first shell **(1)**	Allow answers in terms of energy levels Allow Na is a group 1 element Allow electronic configuration of Na is 2, 8, 1 Allow an answer that relates jump in energy to existence of (new) shells Allow there are three shells of electrons	**(2)**

(Total for Question 2 = 7 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)(i)	A description that makes reference to the following points: • (electrostatic / electric(al)) attraction of (two) **nuclei** **(1)** • with a shared pair /2 electrons **(1)**	Allow a pair of electrons between the nuclei	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)(ii)	• correct dot and cross diagram	 Allow diagram with all dots, all crosses, dots and crosses in reversed order, or a mix of dots and crosses Allow non-bonding pairs on N to be shown separated Allow H at any position around N Ignore circles used to show shells Ignore inner electrons if shown Ignore lines representing bonds	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)(iii)	• bond angle = 107^{o}	Allow angles in the range 105 to 108^{o}	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)	A diagram and description showing the following points: • any mention of hydrogen bonding /H –bonds in water, hydrazine or the mixture, in text or diagram **(1)** • diagram showing hydrogen bond between the correct atoms **(1)** • lone pair on either nitrogen or oxygen and bond angle shown on diagram as approximately 180 ^{o} **(1)**	Examples of suitable diagrams: Do not award if H bonding clearly within the molecule, e.g. the O-H / N-H bond is a hydrogen bond   Allow more than one H bond Allow description of atoms connected by H-bond Ignore any dipoles Allow bonds involving lone pair on the hydrazine or the water, and hydrogen atoms in hydrazine or water.	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(c)	An answer that makes reference to the following points: • (large quantities of) gases produced (from liquids) **(1)** • (formation of strong triple bond in nitrogen) releases a large quantity of energy **or** hot gases expand **or** reaction ignites itself **or** reaction is (very) fast **(1)**	Allow hydrazine is a liquid Allow nitrogen gas is produced / water vapour/ gas is produced Ignore just very exothermic Allow non-polluting / non-toxic products / N_2 and H_2O	**(2)**

(Total for Question 3 = 9 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(i)	An answer that makes reference to the following points: • (relative isotopic mass refers to) the mass of an atom of that isotope **(1)** • (relative atomic mass refers to) the weighted average / mean mass of an atom **(1)** • (both are) relative to 1/12th the mass of a C-12 atom **(1)**	Penalise omission of 'atom' once only in the answer Do not award any reference to ' average' for relative isotopic mass	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(ii)	A description that makes reference to the following points: • (atoms with the) same number of protons but different numbers of neutrons **(1)** • comparison between any 2 or all 3 of the 3 quoted isotopes of potassium, referring to the correct numbers of protons and neutrons **(1)**	Allow 'atoms with the same atomic number but different mass number' isotope / number of protons / number of neutrons ^{39}K / 19 / 20 ^{40}K / 19 / 21 ^{41}K / 19 / 22 Example: allow ^{40}K has one more neutron than ^{39}K	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(iii)	• correct calculation **(1)** • evaluation to 4 SF only **(1)**	Example of calculation: Using relative isotopic mass $\frac{(38.9637 \times 93.218) + (39.9340 \times 0.012) + (40.9618 \times 6.770)}{100}$ = 39.09908781 = 39.10 Use of $\frac{(39 \times 93.218) + (40 \times 0.012) + (41 \times 6.770)}{100}$ = 39.13552 = 39.14 scores M2 only An answer of 39.10/39.1 4 with no working scores (1) Ignore all units	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(i)	• (deflection by) (electro)magnetic field	Allow just magnet / electromagnet Allow magnetic / electromagnetic plates Do not award electric field	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(ii)	An answer that makes reference to the following points: • (pathway B), ions are deflected (by the magnetic field (and detected) **(1)** • pathway A, ions with greater / higher / larger mass / *m/z* are deflected less **(1)** • pathway C, ions with lower / smaller mass / lower *m/z* are deflected more **or** ions with greater / higher / multiple charge are deflected more **(1)**	Penalise 'size' once only Allow answers in terms of 'lighter and heavier' in place of mass Answers may make reference to the three dotted lines shown in the diagram	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(iii)	An answer that makes reference to the following point: • to prevent collisions with gas / air molecules / particles (that would deflect the ions)	Allow to prevent collisions/ reaction/interaction with other particles Allow gas/air/other particles could be detected	**(1)**

(Total for Question 4 = 12 marks)

Question Number	Answer	Mark
5(a)(i)	**The only correct answer is C** (redox) **A** *is not correct because chlorine is reduced and iodide is oxidised* **B** *is not correct because chlorine is reduced and iodide is oxidised* **D** *is not correct because different species are oxidised and reduced*	**(1)**

Question Number	Answer	Mark
5(a)(ii)	**The only correct answer is A** (pale yellow) **B** *is not correct because the question refers to the aqueous layer* **C** *is not correct because the question refers to the aqueous layer* **D** *is not correct because this would be the colour of Cl_2 (aq) in the absence of I_2 (aq)*	**(1)**

Question Number	Answer	Mark
5(b)(i)	**The only correct answer is D** (hydrogen iodide, hydrogen sulfide and iodine) **A** *is not correct because iodide is oxidised to iodine and sulfur is reduced to hydrogen sulfide* **B** *is not correct because iodide is oxidised to iodine and sulfur is reduced to hydrogen sulfide* **C** *is not correct because iodide is oxidised to iodine*	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(ii)	An answer that makes reference to the following points: • white **(1)** • smoke **(1)** • balanced equation **(1)**	 $HI(g) + NH_3(g) \rightarrow NH_4^+I^-(s)$ Allow $NH_4I(s)$	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(c)(i)	An answer that makes reference to the following points. • cool (the reaction mixture) **(1)** • filter off (the less soluble potassium iodate) **(1)** • any suitable method of drying (the resulting solid) **(1)**	Mark independently Ignore addition of extra water Allow give time for potassium iodate to crystallise Ignore the method used to cool the solution, (ice, fridge etc.) Ignore any details of the filtration methods Examples of methods used to dry: 'leave to dry', warm oven, press between filter papers	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(c)(ii)	An explanation that makes reference to the following points: • add silver nitrate (solution) / $AgNO_3$ (and HNO_3 / nitric acid) **(1)** • yellow **and** precipitate /ppt/solid/crystals **(1)**	Mark independently Do not award hydrochloric acid Allow a correct description of the yellow ppt, e.g. primrose coloured Do not award 'electrolysis'	**(2)**

Question Number	Answer	Mark
5(d)	**The only correct answer is B** (85 K) **A** *is not correct because the Tb trend would suggest approx. 160 K. Therefore 4 K is much too low for fluorine* **C** *is not correct because this figure is derived from the trend in Tm (not Tb), with F placed at the bottom of Group 7 (575 K is the melting temperature of astatine)* **D** *is not correct because although this figure is derived from the trend in Tb, F is placed at the bottom of Group 7 (610 K is the boiling temperature of astatine)*	**(1)**

(Total for Question 5 = 12 marks)

Question Number	Answer	Mark
6(a)	**The only correct answer is C** (57.5%) **A** *is not correct because* 40.3 % *would be the % for* $CuCO_3(OH)_2$ **B** *is not correct because* 51.4 % *would be the % for* $CuCO_3$ **D** *is not correct because* 67.9 % *would be the % for* Cu_2CO_3	**(1)**

Question Number	Acceptable Answer		Additional Guidance	Mark
6(b)	An answer that makes reference to the following points:			**(3)**
	• solid/ malachite/$Cu_2CO_3(OH)_2$ disappears	**(1)**	Allow dissolves Allow volume of solid reduces	
	• effervescence	**(1)**	Allow fizzes / bubbles Ignore incorrect gas evolved, e.g. hydrogen Ignore just gas / CO_2 given off	
	• green / blue solution (produced)	**(1)**	Allow just blue, just green or blue-green	

Question Number	Acceptable Answer	Additional Guidance	Mark
6(c)(i)	An answer that makes reference to the following points: • any mention of platinum / nichrome wire / loop **(1)** • dip the wire into (clean / fresh concentrated) hydrochloric acid **(1)** • dip the (wet) wire into the solid / sample **and** place in a (non-luminous / roaring Bunsen) flame **(1)**	Allow NiCr for nichrome Ignore inoculating / flame-test (wire) / spatula Do not award just nickel / chromium / Ni / Cr wire Allow any mention of HCl(aq) e.g. cleaning or mixing solid and acid or making a paste / solution Allow HCl for HCl(aq) Ignore dilute Allow on / over / under / near / show / above for 'in' flame	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(c)(ii)	An answer that makes reference to the following points: • electrons move up energy levels /are excited /promoted **(1)** • electrons return to a lower energy level/ground state **(1)** • energy emitted/lost / released from the atom as visible light / flame colour **(1)** • different energy gaps / energy lost / emitted / released (in different elements) so different colours emitted. **(1)**	Penalise use of 'atom' in place of 'electron' once only Allow orbitals/subshells but not just shells Allow radiation for light Allow different amounts of energy are needed to excite the electrons, scores M1 and M4	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)(i)	• moles of malachite / carbon dioxide **(1)** • convert temperature to kelvin **(1)** • convert pressure to Pa **(1)** • rearrange the expression for V and substitute the candidate's values **(1)** • calculation of V with units and answer to 2 or 3 SF **(1)**	Example of calculation: 0.810/ 221 = 3.66(5158371) x 10^{-3} (mol) temperature = 298 (K) allow for correct temperature in K shown in the calculation Pressure = 101000 (Pa) Allow use of 101 (kPa) if answer given in dm^3 *V = nRT/p* = 3.66(5158371) x 10^{-3} x 8.31 x 298 ÷ 101000 Correct use of rearranged equation scores M4 =8.98(6460284) x 10^{-5} m^3 =8.99 x 10^{-5} m^3 /9.0 x 10^{-5} m^3/ 0.0899 dm^3 /0.090 dm^3/89.9 cm^3 / 90 cm^3 Use of 300ºC / 573 K gives 1.73 x 10^{-4} m^3 Use of 25º gives 7.54 x 10^{-6} m^3 Allow equivalent answers in standard or nonstandard form . Allow TE throughout Correct answer with no working scores 5 marks	**(5)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)(ii)	• 0.556 (%) / 0.56 (%) / 0.6 (%)	Example of calculation: 0.5/89.9 x 100 = 0.556 (%) Allow TE from answer to 6(d)(i) Ignore SF	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)(iii)	• moles of copper(II) oxide expected (from 0.810 g pure malachite) **(1)** • mass of copper(II) oxide expected (from 0.810 g pure malachite) **(1)** • evaluation of answer **(1)** **OR** • moles of copper(II) oxide in 0.571 g **(1)** • moles of copper(II) oxide expected from 0.810 g pure malachite **(1)** • evaluation of answer **(1)** **OR** • calculate mass of CO_2 from decomposition of 0.810 g malachite **and** calculate mass of H_2O from decomposition of 0.810 g malachite **(1)**	Example of calculation: 2 x 3.66(5158371) x 10^{-3}= 7.33(0316742) x 10^{-3} (mol) 7.33(0316742) x 10^{-3} x 79.5 = 0.582(760181) (g) (0.583 (g) scores M1 and M2) % purity = actual mass x 100 / expected mass = 0.571 x 100 / 0.582(760181) = 97.981(98618) = 98.0(%)/ 98(%) 0.571 / 79.5 = 7.18(2389937) x 10^{-3} (mol) 2 x 3.66(5158371) x 10^{-3}= 7.33(0316742) x 10^{-3} (mol) 7.18(2389937) x 10^{-3} x 100 / 7.33(0316742) x 10^{-3} = 97.9(8198618) = 98.0(%) / 98(%) 3.66(5158371) x 10^{-3} x 44 = 0.161(2669683) (g) 3.66(5158371) x 10^{-3} x 18 = 0.0659(7285068) (g)	**(3)**

	• calculate total mass of products **(1)**	0.161 + 0.066 + 0.571 = 0.798(239819) (g)	
	• evaluation of answer **(1)**	$\frac{0.798(239819) \times 100}{0.810}$ = 98.5 (481258) / 99(%)	
	OR		
	• calculate moles of CuO in 0.571 g **(1)**	0.571/ 79.5 = 7.18×10^{-3} (mol)	
	• calculate mass of malachite to produce 0.571 g CuO **(1)**	Moles of malachite = $7.18 \times 10^{-3} \div 2$ = 3.59119×10^{-3} (mol) Mass of malachite = $3.59119 \times 10^{-3} \times 221$ = 0.79365 (g)	
	• calculate % **(1)**	Purity = 0.79365 x 100/0.810 = 97.98198618 (%) =98 / 98.0(%) Allow TE throughout Correct answer with no working scores 3 marks	

(Total for Question 6 = 20 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)	An answer that makes reference to the following points: • a trend/pattern of repeating (physical and chemical) properties (with increasing atomic number) **(1)** • atomic radii decrease from left to right/ across the period **(1)** • the pattern /atomic radius trend is repeated in period 3 **(1)**	Do not award for trend in group Allow a sketch of the trend Allow even if the trend is incorrect	**(3)**

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>*7(b)</td>
<td>This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.
Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.
The following table shows how the marks should be awarded for indicative content.
<table>
<tr><th>Number of indicative marking points seen in answer</th><th>Number of marks awarded for indicative marking points</th></tr>
<tr><td>6</td><td>4</td></tr>
<tr><td>5-4</td><td>3</td></tr>
<tr><td>3-2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>
The following table shows how the marks should be awarded for structure and lines of reasoning.
<table>
<tr><th></th><th>Number of marks awarded for structure and sustained lines of reasoning</th></tr>
<tr><td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout.</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning.</td><td>1</td></tr>
<tr><td>Answer has no linkages between points and is unstructured.</td><td>0</td></tr>
</table>
</td>
<td>Guidance on how the mark scheme should be applied:

The mark for indicative content should be added to the mark for lines of reasoning. For example, an answer with five indicative marking points that is partially structured with some linkages and lines of reasoning, scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning).

If there are no linkages between points, the same five indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages).

In general it would be expected that 5 or 6 indicative points would get 2 reasoning marks, and 3 or 4 indicative points would get 1 mark for reasoning, and 0, 1 or 2 indicative points would score zero marks for reasoning.

If there is any incorrect chemistry, deduct mark(s) from the reasoning. If no reasoning mark(s) awarded do not deduct mark(s).
Comment: Look for the indicative marking points first, then consider the mark for the structure of the answer and sustained line of reasoning.</td>
<td>(6)</td>
</tr>
</table>

	Indicative points: • **IP1**: at the start of the period / on the LHS / Li to Be the bonding is metallic • **IP2**: metallic bonding gets stronger as the number of delocalised electrons in a metal (atom) increases **or** metallic bonding gets stronger as radius of cation decreases **or** metallic bonding gets stronger as the charge on the cation increases • **IP3** in the middle of the period / (B and) C has / have a giant structure of atoms • **IP4** A lot of energy is needed to break (strong) covalent bonds, (in graphite and diamond) • **IP5**: at the end of the period / on the RHS / N to Ne are simple molecules **or** N_2, O_2 and F_2 are simple molecules, • **IP6**: weak London forces (between molecules)	Ignore statements about boron Allow a description of a giant structure, e.g. each C atom is bonded to 4 other (in diamond) Do not award London forces Ignore reference / lack of reference to Ne unless incorrect	

(Total for Question 7 = 9 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
8(a)	• equation for sodium nitrate **(1)** • equation for calcium nitrate1 **(1)**	Examples of equations $NaNO_3 \rightarrow NaNO_2 + ½O_2$ $Ca(NO_3)_2 \rightarrow CaO + 2NO_2 + ½O_2$ Allow multiples of both equations Ignore states even if incorrect	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)	An answer that makes reference to the following points: • thermal stability (of nitrates) depends on the polarising power / charge density of the cation OR Na+ causes more distortion/Cs+ causes less distortion **(1)** • Na^+ is a smaller cation / has greater charge density **(1)** • Na^+ weakens / distorts electron clouds / (N-O) bonds in the nitrate ion to a greater extent / more than Cs^+ **(1)**	Allow reverse arguments for M2 and M3 Penalise lack of reference to positive ion once only Penalise incorrect charge on ions once only	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)(i)	• correct formulae and state symbols of each species	$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)(ii)	• ionic **and** covalent (bonding)	Ignore reference to single/double/dative	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
8(c)(iii)	• strong bonds within the carbonate ion / CO_3^{2-} /C-O bond / C=O bond	Ignore bonds between the ions / (Ca^{2+} and CO_3^{2-}) are strong	(1)

(Total for Question 8 = 8 marks)

Total for paper = 80 marks

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