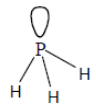
Cherry Hill Tuition AQA Chemistry AS. Paper 7 Mark Scheme

Question	Marking Guidance	Mark	Comments
1(a)	37	1	These answers only. Allow answers in words.
	48	1	Ignore any sum(s) shown to work out the answers.
1(b)(i)	Electron gun / high speed/high energy electrons	1	Not just electrons. Not highly charged electrons.
	Knock out electron(s)	1	Remove an electron.
1(b)(ii)	$Rb(g) \rightarrow Rb^{+}(g) + e^{(-)}$ ***OR*** $Rb(g) + e^{(-)} \rightarrow Rb^{+}(g) + 2e^{(-)}$ ***OR*** $Rb(g) - e^{(-)} \rightarrow Rb^{+}(g)$	1	Ignore state symbols for electron.
1(c)	Rb is a bigger (atom) / e further from nucleus / electron lost from a higher energy level/ More shielding in Rb / less attraction of nucleus in Rb for outer electron / more shells	1	Answer should refer to Rb not Rb molecule. If converse stated it must be obvious it refers to Na Answer should be comparative.
1(d)(i)	s / block s / group s	1	Only
1(d)(ii)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^1$	1	Allow $3d^{10}$ before $4s^2$ Allow in any order.

2)

estion	Marking Guidance	Mark	Comments
.(a)		1	Need to see 3 P-H bonds and one lone pair (ignore shape).
(b)	Coordinate / dative	1	If not coordinate / dative then chemical error CE=0 unless blank or covalent then M1 = 0 and mark on.
	Pair of electrons on $P(H_3)$ donated (to H+)	1	Do not allow a generic description of a coordinate bond.
(c)	109.5° / 109½ / 109° 28'	1	Allow answers in range between 109° to 109.5°
(d)	Difference in electronegativity between P and H is too small	1	Allow P not very electronegative / P not as electronegative as N, O and F / P not electronegative enough / P not one of the 3 most electronegative elements. Do not allow phosphine is not very electronegative.

3)

uestion	Marking Guidance	Mark	Comments
(a)(i)	Macromolecular / giant covalent / giant molecular / giant atomic	1	If covalent, molecular, giant, lattice, hexagonal or blank mark on. If metallic, ionic or IMF chemical error CE = 0 for 4(a)(i), 4(a)(ii) and 4(a)(iii).
(a)(ii)	Delocalised electrons / free electrons	1	
	Able to move / flow (through the crystal)	1	Allow M2 for electrons can move / flow. Ignore electrons can carry a current / charge.
(a)(iii)	Covalent bonds	1	
	Many /strong / hard to break / need a lot of energy to break	1	M2 dependent on M1. Ignore van der Waals' forces.
(b)(i)	(Giant) metallic / metal (lattice)	1	If FCC or BCC or HCP or giant or lattice, mark on. If incorrect 4(b)(i), chemical error CE for 4(b)(ii) and 4(c)(ii).
(b)(ii)	Nucleus / protons / positive ions and delocalised electrons (are attracted)	1	QWC Must be delocalised electrons – not just electrons. Chemical error = 0/2 for 4(b)(ii) if other types of bonding or IMF mentioned.
	Strong attraction	1	Allow strong metallic bonding for one mark if M1 and M2 are not awarded.
(c)(i)	Layers of atoms/ions slide (over one another)	1	Do not allow just layers.

c)(ii)	(Strong) (metallic) bonding re-formed / same (metallic) bonding / retains same (crystal) structure / same bond strength / same attraction between protons and delocalised electrons as before being hammered or words to that effect	1	If IMF, molecules, chemical error CE = 0/1 for 4(c)(ii). If metallic not mentioned in 4(b)(i) or 4(b)(ii) it must be mentioned here in 4(c)(ii) to gain this mark. Do not allow metallic bonds broken alone. Ignore same shape or same strength.
l(d)	(giant) Ionic Between + and – ions / oppositely charged ions or Mg^{2+} and O^{2-} Strong attraction	1 1 1	If not ionic, chemical error CE = 0/3 If molecules mentioned in explanation lose M2 and M3 Allow one mark for a strong attraction between incorrect charges on the ions.

stion	Marking Guidance	Mark	Comments
4(a)	P = 100 000 (Pa) and V = 5.00 x 10^{-3} (m^3) n = PV / RT = 100 000 x 5.00 x 10^{-3} / 8.31 x 298 = 0.202 moles (of gas produced) Therefore 0.202 / 5 = 0.0404 moles B_2O_3 Mass of B_2O_3 = 0.0404 x 69.6 = 2.81 (g)	1 1 1 1 1	M1 is for correctly converting P and V in any expression or list Allow 100 (kPa) and 5 (dm^3) for M1. M2 is correct rearrangement of PV = nRT This would score M1 and M2. M3 is for their answer divided by 5 M4 is for their answer to M3 x 69.6 M5 is for their answer to 3 sig figures. 2.81 (g) gets 5 marks.
b)	B + 1.5 Cl_2 → BCl_3 3 bonds Pairs repel equally/ by the same amount	1 1 1	Accept multiples. Do not allow any lone pairs if a diagram is shown.
(c)(i)	43.2/117.3 (= 0.368 moles BCl_3) 0.368 x 3 (= 1.105 moles HCl) Conc HCl = 1.105 x 1000 / 500 = 2.20 to 2.22 mol dm^{-3}	1 1 1 1	 Allow their BCl_3 moles x 3 Allow moles of HCl x 1000 / 500 Allow 2.2 Allow 2 significant figures or more
c)(ii)	H_3BO_3 + 3NaOH → Na_3BO_3 + $3H_2O$	1	Allow alternative balanced equations to form acid salts. Allow H_3BO_3 + NaOH → $NaBO_2$ + $2H_2O$
(d)	10.8 / 120.3 (x 100) 8.98(%) Sell the HCl	1 1 1	Mark is for both M_r values correctly as numerator and denominator. Allow 9(%).
e)	Cl = 86.8% B Cl 13.2 / 10.8 86.8 / 35.5 1.22 2.45 or ratio 1:2 or BCl_2 BCl_2 has M_r of 81.8 so 81.8 x 2 = 163.6 Formula = B_2Cl_4	 1 1	Alternative method Cl = 142 g B Cl 21.6 / 10.8 142 / 35.5 2:4 ratio B_2Cl_4 Allow 4 marks for correct answer with working shown. Do not allow $(BCl_2)_2$

Question	Marking Guidance	Mark	Comments
5 (a)	$3N_2H_4 \longrightarrow 4NH_3 + N_2$	1	Or multiples Ignore state symbols
(b)	**M1** enthalpy / heat (energy) change / required / needed to break / dissociate a covalent bond (or a specified covalent bond) **M2** average / mean over different molecules / compounds / substances	2	Ignore bond making Ignore standard conditions **M2** requires an attempt at **M1**
(c)	**M1** $\sum$ (bonds broken) – $\sum$ (bonds formed) = ΔH *OR* Sum of bonds broken – Sum of bonds formed = ΔH **M2** (also scores **M1**) 4(+388) + 163 + 2(146) + 4(463) – 944 – 8(463) = ΔH OR broken +3859 (2007) formed – 4648 (2796) **M3** ΔH = – 789 (kJ mol^{-1}) Award 1 mark for + 789 Students may use a cycle and gain full marks	3	**M1** could stand alone Award full marks for correct answer Ignore units Two marks can score with an arithmetic error in the working Credit **one mark only** for calculating either the sum of the bonds broken or the sum of the bonds formed provided this is the only mark that is to be awarded

Question	Marking Guidance	Mark	Comments
6 (a)	The enthalpy change / heat (energy) change (at constant pressure) in a reaction is independent of the route / path taken (and depends only on the initial and final states)	1	Ignore the use of ΔH for enthalpy
(b)	$\Delta H_{exp} + \Delta H_2 - \Delta H_1 = 0$ *OR* $\Delta H_{exp} + \Delta H_2 = \Delta H_1$ *OR* $\Delta H_1 = \Delta H_{exp} + \Delta H_2$ *OR* $\Delta H_{exp} = \Delta H_1 - \Delta H_2$ *OR* $\Delta H_{exp} = \Delta H_1 + (-\Delta H_2)$	1	Any correct mathematical statement that uses all three terms
(c)	$\Delta H_{exp} = \Delta H_1 - \Delta H_2$ $\Delta H_{exp} = -156 - 12 = -168$ (kJ mol^{-1}) Award the mark for the correct answer without any working	1	Ignore units
(d)(i)	**M1** q = m c ΔT OR calculation (25.0 x 4.18 x 14.0) **M2** = **1463** J OR **1.46** kJ (This also scores **M1**) **M3** must have both the correct value within the range specified **and** the minus sign For 0.0210 mol, therefore $\Delta H_1 = -69.67$ to -69.52 (kJ mol^{-1}) OR $\Delta H_1 = -69.7$ to -69.5 (kJ mol^{-1}) Accept answers to 3sf or 4sf in the range – 69.7 to – 69.5 Ignore -70 after correct answer	3	Award full marks for correct answer In **M1**, do not penalise incorrect cases in the formula Penalise **M3** ONLY if correct numerical value but sign is incorrect; e.g. **+69.5 to +69.7 gains 2 marks** (ignore +70 after correct answer) Penalise **M2** for arithmetic error but mark on ΔT = 287, score q = m c ΔT only If c = 4.81 (leads to 1684 J) penalise **M2** ONLY and mark on for **M3** = – 80.17 (range – 80.0 to – 80.2) Ignore incorrect units
(d)(ii)	The idea of heat loss *OR* Incomplete reaction (of the copper sulfate) *OR* Not all the copper sulfate has dissolved	1	NOT impurity NOT incompetence NOT incomplete combustion
(e)	Impossible to add / react the exact / precise amount of water *OR* Very difficult to measure the temperature rise of a solid *OR* Difficult to prevent solid dissolving *OR* (Copper sulfate) solution will form	1	Not just "the reaction is incomplete"