Question Number	Answer	Acceptable answers	Mark
1(a)	2.8.1	any separation allowed	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	An explanation linking **two** of the following points • both have two electrons (1) • in outer shell (1) • (therefore) in group 2 (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(e)	An explanation linking the following points • {equal numbers of / three} protons and electrons (in atoms) (1) • proton (charge) +1 and electron (charge) -1 (1)		**(2)**

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Question Number	Answer	Acceptable answers	Mark
1(a)	An explanation including the following points • metal (1) • because {on left of / below} the line dividing metals and non-metals/because boron only non-metal in group 3 (1)	correct statement relating to neighbouring metallic elements surrounded by metals	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	2.8.3	283	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	A five protons		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation including the following points • atoms of same element / same {number of protons / atomic number} (1) • different {numbers of neutrons / mass numbers} (1)	ignore electrons	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(iii)	more atoms have mass 11 (than 10) / ORA	boron 11 isotope more abundant OWTE	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	<table><tr><th>particle</th><th>number</th></tr><tr><td>proton</td><td>29</td></tr><tr><td>neutron</td><td>34</td></tr><tr><td>electron</td><td>29</td></tr></table> all 3 correct **(2)** any 1 or 2 correct **(1)**		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	(copper atom has) 4 (shells of electrons)	Do not allow 4 electrons on the outer shell Do not allow 4 outer shells	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	An explanation linking • atoms of the (same) element/ atoms with the same {number of protons/atomic number} **(1)** • (but) different {numbers of neutrons/mass numbers} **(1)**	Maximum **(1)** if no mention of atom(s)/atomic Allow the marks if a specific example is given e.g. all chlorine atoms have 17 protons **(1)** but some have 18 neutrons and others have 20 neutrons **(1)** Ignore any reference to numbers of electrons Ignore different forms of an element Allow {more/less} neutrons than the {usual/original} atom **(1)** Do not allow more neutrons than protons Do not allow different (relative) atomic masses	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iv)	• (in 100 atoms) mass of copper-63 atoms = 63 x 70 / 63 x 0.7 / 63 x 7 **(1)** (= 4410 / 44.1 / 441) • mass of copper-65 atoms = 65 x 30 / 65 x 0.3 / 65 x 3 **(1)** (= 1950 / 19.5 / 195) • relative atomic mass = $\frac{(63 \times 70 + (65 \times 30)}{100}$ / $\frac{4410 + 1950}{100}$ 44.1 + 19.5/ $\frac{441+ 195}{10}$ **(1)** (= 63.6)	63.6 with no working **(3)** 63.5/64 with no working **(0)** Allow correct working shown to calculate 63.6 then final answer is rounded to 64 **(3)** Note: correct working shown to calculate 63.6 then final answer is incorrectly rounded to 63.5/63 **(2)** Ignore any unit e.g. g Allow TE for third mark e.g if percentages used the wrong way round 64.4 scores **(1)**	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	• two electrons/ $2e^{(-)}$ **(1)** • {loses/gives away} electrons **(1)**	Reject any reference to a covalent bond or sharing electrons (0) $Cu \rightarrow Cu^{2+} + 2e^{(-)}$ **or** $Cu - 2e^{(-)} \rightarrow Cu^{2+}$ **(2)** Allow +2 for charge Allow transfers electrons to another atom **(1)** Allow electrons taken away **(1)** Ignore electrons are missing Ignore references to the nitrate ion/other non-metals Ignore references to full outer shell	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	$Cu(NO_3)_2$	Formula must be totally correct including subscripts, letter case and brackets Allow $Cu^{2+}(NO_3^-)_2$ Ignore any balancing numbers in front of formula Ignore any working/attempted equation to find the formula	**(1)**

Total for Question 4 = 11 marks

Question Number	Answers	Acceptable Answers	Mark
5 (a)	**D** is inert		**(1)**

Question Number	Answers	Acceptable Answers	Mark
5 (b)	An explanation linking • {atoms/cations/ions} are in {layers /sheets} **(1)** • { layers/sheets} can {slide/slip/ move/roll} (over each other) (1)	Any mention of intermolecular forces/covalent bonds/ionic bonds (0) Accept a diagram showing layers with labelled {atoms/cations/ions} Ignore rows /lines/ lattice Do not allow electrons can slide/slip/move over each other Ignore references to delocalised electrons	**(2)**

Question Number	Answers	Acceptable Answers	Mark
5 (c)	P Br mass 3.1/31(= 0.1) 24/80 (=0.3) **(1)** A_r ratio 1 3 **(1)** formula PBr_3 **(1)**	Allow PBr_3 with no working or incorrect working **(1)** PBr_3 with some correct working **(3)** Accept Br_3P Allow TE for second and third marks e.g. P Br 31/3.1(= 10) 80/24 (= 3.33) **(0)** 3 1 **(1)** P_3Br **(1)** P_3Br with no working **(0)**	**(3)**

Question Number		Indicative content	Mark
QWC	**5(d)**	A description / explanation including some of the following points **Description** • effervescence / fizzing / bubbles • float /on surface • move • produce hydrogen (may be shown in word or balanced equation) • {an alkaline/metal hydroxide} solution (may be shown in word or balanced equation) • gets smaller / disappears / dissolves • reactivity increases with {increasing atomic number/ down the group} / potassium effervesces more than sodium and lithium / potassium moves faster than sodium or lithium • sodium and potassium melt/form a (silver-coloured) ball • hydrogen burns when potassium/ sodium react • potassium gives a lilac flame/sodium gives a yellow flame • Universal Indicator added to water turns blue/purple **Explanation** • (group 1 metals) react by losing one electron • electron is more easily lost with {increasing atomic number/ down the group} • {electron/ outer shell} is further away from nucleus/ atomic radius increases/ there are more electron shells with {increasing atomic number/ down the group} • {more shielding (of outer electron)/ less attraction between nucleus and outer electron/ more shells between outer electron and nucleus} with {increasing atomic number/down the group}	**(6)**
Level	0	No rewardable material	
1	**1-2**	• a limited description of one or two points describing the reactions or explaining them e.g. reactivity increases down the group. • the answer communicates ideas using simple language and uses limited scientific terminology. • spelling, punctuation and grammar are used with limited accuracy.	
2	**3-4**	• a simple description of at least three points describing the reactions OR a combination of three points from the description and explanation e.g. they all float on water, fizz and potassium gives a lilac flame. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • spelling, punctuation and grammar are used with some accuracy.	
3	**5-6**	• a detailed description and explanation of at least five points describing the reactions **and** explaining the pattern of reactivity e.g. the metals all fizz, float and produce hydrogen, the reactivity increases down the group because the outer electron is more easily lost. • the answer communicates ideas clearly and coherently and uses scientific terminology accurately. • spelling, punctuation and grammar are used with few errors.	

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	soft / low melting point / low boiling point	**easily** cut with a knife = soft low density malleable solid at room temp. ignore float on water reject chemical properties	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking (all have) one electron in outer shell (2)	one outer electron = 2 marks group number shows number of electrons in outer shell = 2 marks same number of electrons in outer shell = 1 mark incorrect number of electrons in the outer shell = 1 mark accept outer orbit / highest energy level in place of outer shell	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	A description including any two of effervescence / fizzing / bubbles (1) potassium floats (1) moves (on surface) (1) potassium forms ball / melts (1) potassium decreases in size / disappears / dissolves (1) (lilac) flame / catches fire (1) spits / explodes / sparks (1)	 ignore ignites ignore smoke	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	D : $2K + 2\ H_2O \rightarrow 2KOH + H_2$		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking any two of increasing {size /radius (of atom) / number of shells} (1) increased shielding (of outer electron) (1) less attraction for (outer) electron (1)	 easier to remove (outer) electron	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	A, B and C	Mg Ca Au (any order) magnesium calcium gold (any order)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	A and B	Mg Ca (any order) magnesium calcium (any order)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	8 (protons)		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A : 10		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	(in 100 atoms) mass of mass number 20 atoms = 20 x 90 (1) mass of mass number 22 atoms = 22 x 10 (1) relative atomic mass = {(22 x 10) + (20 x 90)}/100 (=20.2) (1) OR 20 contributes = 90/100 x20(1) 22 contributes = 10/100 x22(1) relative atomic mass 90/100 x 20 + 10/100 x 22 (= 20.2) (1)	20.2 = 3 marks 21.8 = 2 marks (only 1 error made)	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation linking any two of (the element is) group 0 / noble gas /unreactive / inert / does not react (1) {(has) 8 electrons / full} outer shell (1) prevents filament from reacting (1)	 ignore 'not very reactive' does not {gain / lose / share} electrons	**(2)**

Question Number	Answers	Acceptable Answers	Mark
1 (a)	<table><tr><th></th><th>relative mass</th><th>relative charge</th><th>position in atom</th></tr><tr><td>proton</td><td>**1**</td><td>(+1)</td><td>**in nucleus**</td></tr><tr><td>neutron</td><td>(1)</td><td>**0**</td><td>(in nucleus)</td></tr><tr><td>electron</td><td>**1/1837**</td><td>**-1**</td><td>**in shells**</td></tr></table> all 6 correct (3) 4 or 5 correct (2) 2 or 3 correct (1)	ignore units reject relative mass of proton: +1/1+ for relative mass of electron: anything smaller than 1/1500/0.00067 (almost) 0/negligible/very small for relative charge on neutron: none/no charge/neutral for position of electron in an atom: in orbits / orbitals / energy levels / around the nucleus /outside the nucleus ignore rings ignore inner/outer	**(3)**

Question Number	Answers	Acceptable Answers	Mark
1 (b)	D equal numbers of protons and electrons		**(1)**

Question Number	Answers	Acceptable Answers	Mark
1 (c)(i)	Ca	Reject CA / ca /cA ignore calcium	**(1)**

Question Number	Answers	Acceptable Answers	Mark
1 (c)(ii)	O	ignore any negative charge on the O ignore oxygen reject: oxide/O_2	**(1)**

Question Number	Answers	Acceptable Answers	Mark
1 (d)(i)	13	Allow correct working even if wrong answer	**(1)**

Question Number	Answers	Acceptable Answers	Mark
1 (d)(ii)	**D** AlN		**(1)**

(total for Question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)	B potassium and caesium, copper and iron		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	A description linking (regular arrangement of) positive ions /cations (1) (surrounded by) {delocalised/sea of} electrons (1)	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks overall metal ions reject "negative and positive particles" / positive atoms / protons ignore descriptions of atoms in rows/ layers of particles etc cloud of electrons ignore free	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	An explanation linking M1 electrons (1) M2 move/flow (1) M2 dep on M1	 pass through / travel For M2: ignore free/delocalised (electrons) ignore electricity flows ignore (electrons) vibrate ignore carry/pass the current/charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	A description including any two from floats (1) moves (around) (1) effervescence / fizzing / bubbles (1) melts/changes to a ball shape (1) becomes smaller /disappears (1)	moves (around) on the surface (2) white smoke formed ignore gas/hydrogen given off dissolves / explodes Ignore: burns/catches fire/ignites/flame/sparks ignore addition of indicators	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$ LHS (1) RHS (1) balancing of correct formulae(1)	NaHO ignore brackets around OH Use of lower case h, upper case A, lower case o, or use of superscripts or large numbers inside the formulae loses 1 mark only ignore state symbols	**(3)**

(total for Question 3 = 10 marks)