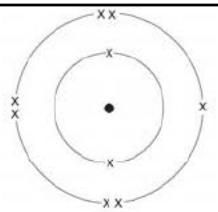
Question number	Answer	Notes	Marks
1 a	atomic number	Accept proton number Accept number of protons	1
b	(relative) atomic mass	Reject mass number	1
c i	electrons		1
ii	electrons		1
iii	protons AND neutrons	Names can be in either order	1
iv	protons AND electrons	Names can be in either order	1
v	neutrons		1

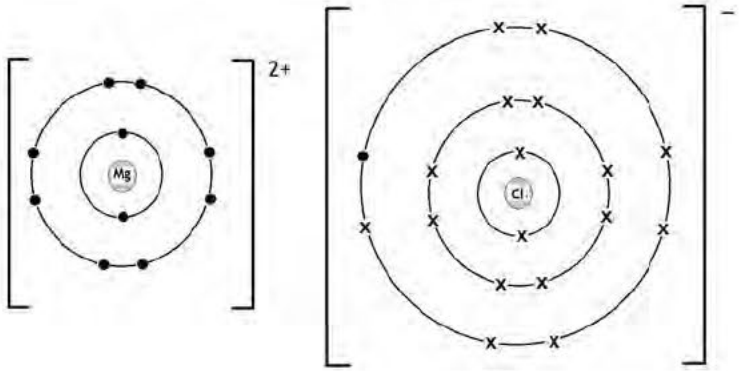
Question number	Expected Answer	Accept	Reject	Marks
2 (a)	(increasing) atomic number(s) IGNORE references to electrons / electronic configurations	proton number / number of protons	mass number / RAM	1
(b) (i)	sodium / potassium	Na / K		1
(ii)	fluorine / chlorine / bromine	F / Cl / Br / F_2 / Cl_2 / Br_2	fluoride / chloride / bromide	1
(c) (i)	sodium OR potassium <u>AND</u> fluorine OR chlorine OR bromine OR hydrogen Answers can be in either order IGNORE incorrect symbols/formulae if names are correct	Na / K F / Cl / Br / H / F_2 / Cl_2 / Br_2 / H_2	fluoride / chloride / bromide / hydride	1
(ii)	Marks do not have to be CQ on (c)(i), and all marks can be scored here for correct diagrams of the ions in a hydrogen halide M1 Na or K with 8 electrons	0 electrons	Incorrect electron transfer for M1 and M2	1
		H with 2 electrons		1
	M2 F, Cl or Br with 8 electrons IGNORE diagrams showing initial electron configurations M3 (1)+ <u>AND</u> (1)– charges correct IGNORE inner shells even if incorrect			1

	Allow any combination of dots and crosses If shown covalently bonded, then max. 1 for correct charges if given If the position of 2 electrons shown between the two species makes it hard to be sure that the bonding is definitely ionic (and not covalent), do not award M1 or M2			

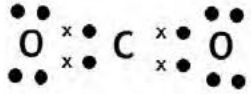
Question number	Expected Answer	Accept	Reject	Marks
2(d)	(fluorine reacts) vigorously / instantly / explosively / violently / very quickly / very rapidly IGNORE references to electron transfer, even if incorrect	the quickest / more quickly than chlorine	fluorine reaction slower than chlorine reaction	1
	(to form) iron(III) fluoride	ferric fluoride / FeF_3		1

(e)	M1 colourless (IGNORE clear) M2 orange / yellow /brown IGNORE qualifiers such as light / dark	no colour any combination of colours on left	decolourised any other colour	1 1

Question number	Answer	Notes	Marks
3 (a) (i)	A (Ag)		1
(ii)	D (Zr)		1
(b) (i)	3		1
(ii)	(The atom has) three <u>electrons</u> in its outer / valence shell	'energy level' for 'shell' ignore references to inner shells ignore 'it has a valency of 3'	1
(iii)	3		1
(iv)	(The atom has) electrons in three shells / three shells are occupied (with electrons)	'energy levels' for 'shells' accept 'it has three shells'	1
(v)	aluminium / Al		1
(c)		accept any symbol for electrons, eg dots, the letter 'e'	1

Question number	Answer	Notes	Marks
4 a	A simple molecular B giant covalent C giant metallic D giant ionic		4
b i	M1 electron transfer AND correct direction M2 magnesium (atoms) lose 2 electrons M3 (each) chlorine (atom) gains an electron	If any reference to sharing electrons, 0/3 If any reference to covalent bonds, MAX 2 Penalise atoms in place of electrons each time Accept two chlorine (atoms) gain two electrons Reject chloride in place of chlorine M2 and M3 both correct also scores M1	3
ii		M1 for electronic configuration of Mg^{2+} ion M2 for electronic configuration of Cl^- ion M3 for both charges correct Accept any combination of dots and crosses Charges can be shown anywhere so long as there is no ambiguity Brackets not essential Ignore 2 before or after chloride ion 0/3 for any diagram showing shared electrons Ignore diagrams showing electron transfer – mark only the ions formed Penalise missing inner shell(s) once only If two Cl^- ions shown, both must be correct	3

		Do not penalise empty third shell in Mg^{2+} If only 2.8 etc notations without diagram, only M3 can be awarded	

Question number	Answer	Notes	Marks
4 c		M1 for 4 electrons in both C=O bonds These can be shown in a vertical or horizontal line M2 all other electrons correct M2 DEP on M1 Accept any combination of dots and crosses Ignore inner electrons even if wrong Ignore circles around atoms Non-bonding electrons do not need to be paired	2
d i	M1 positive ions / cations M2 delocalised electrons / sea of electrons M3 crystal / lattice / regular arrangement / array / giant structure / OWTTE	Not just ions Reject reference to protons/nuclei/atoms in place of cations for M1, but M2 and M3 can still be awarded Ignore free electrons Ignore layers / planes / rows or similar Accept (electrostatic) attraction between positive ions and electrons 0/3 if reference to ionic bonding / covalent bonding / molecules / intermolecular forces (eg van der Waals')	3

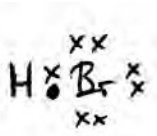
Question number	Answer	Notes	Marks
4 d ii	M1 layers / sheets / planes / rows AND (positive) ions / atoms / particles		2
	M2 slide (over each other)	Allow OWTTE, eg slip / flow / shift / roll / move M2 DEP on mention of EITHER layers or equivalent OR mention of ions or equivalent Do not award M2 if protons / electrons / nuclei / molecules in place of ions, etc If reference to ionic bonding / covalent bonding / molecules / intermolecular forces, no marks	
			Total 17 marks

Question number	Expected Answer	Accept	Reject	Marks
5(a) (i)	12			1
(ii)	**M1** – 2	roman numeral		1
	M2 – two electrons in <u>outer/valence</u> shell Award M2 if M1 missing but not if incorrect Ignore references to magnesium and 2.8.2			1
(iii)	X^{2+}	Mg^{2+}		1
(b)	**M1** – (79 x 24) + (10 x 25) + (11 x 26)	(0.79 x 24) + (0.10 x 25) + (0.11 x 26) for 2 marks		1
	M2 – divide by <u>100</u>			1
	M3 – 24.3	24.32 with no working scores 2		1
	Mark **M2** and **M3** csq on **M1** if one minor slip in numbers in M1 (eg 97 instead of 79 or 25 instead of 24)			
	M3 dep on **M2**			
	Correct answer with no working scores 3			
	IGNORE units			

(Total marks for Question 5 = 7 marks)

Question number	Answer	Notes	Marks
6 (a) i	5		1
ii	11		1
iii	5		1
iv	6		1
v	5		1
6 (b) i	more		1
ii	more		1
iii	the same number of		1
6 (c)	cross in box D (2.8.3)		1
		Total	**9**

Question number				Answer	Notes	Marks
7	a	i	M1	35 on lines 1 and 3		1
			M2	44 on line 2		1
		ii		isotopes		1
		iii		same number of electrons (in outer shell) OR same electron arrangement or configuration	Ignore references to protons and neutrons unless incorrect, eg different numbers of protons, same number of neutrons	1
		iv	M1	^{79}Br	Accept just 79	1
			M2	79 is closer to 79.9/more accurate value	Accept 79 is closer to relative atomic mass M2 dependent on M1	1

Question number				Answer	Notes	Marks
7	b	i	M1		shared pair of electrons	1
			M2		other electrons correct (not necessary to be paired)	1
					M2 dependent on M1 Accept any combinations of dots and crosses Circles not needed but if drawn must overlap or touch – if not, then 0/2 Ignore inner electron shells even if incomplete or incorrect	
					Do not penalise incorrect symbols, eg br/BR If Na used in place of H, max 1 No marks if ions shown	
		ii	M1	shared (two/pair of) electrons	Not share an electron	1
			M2	attracted to <u>both</u> nuclei	M2 dependent on M1 or near miss eg the electrons are attracted to the nucleus scores 0 the electrons are attracted to both nuclei scores M2 but not M1	1
					0/2 if references to ions / ionic bond / intermolecular forces	

Question number				Answer	Notes	Marks
7	b	iii	M1	(sodium bromide) ionic bonding / + and – ions	Reject covalent bonding / shared electrons	1
			M2	(hydrogen bromide) attraction between molecules / intermolecular forces (of attraction)	Accept dipole-dipole attractions / van der Waals' forces / IMF / vdW Ignore hydrogen bonds Reject ions/ionic	1
			M3	ionic bonding stronger OR IMF / attractions between HBr molecules weaker	Accept ionic bonds stronger M3 dependent on comparison of intermolecular forces and ionic bonding Accept correct references to energy needed to overcome bonding / attractions	1
					Ignore references to reactivity and mass	

Question number		Answer			Notes	Marks
7 c	M1	Na 13.8 23	Br 47.9 80	O 38.3 16	0/3 if division by atomic number(s) /division wrong way round If only two elements shown correctly, only M1 can be awarded	1
	M2	0.6	0.6	2.4	Accept 1 : 1: 4	1
	M3	$NaBrO_4$			Accept elements in any order Penalise M3 for incorrect symbol, eg $SBrO_4$ or $NaBO_4$	1
					Dividing by 160 instead of 80 gives Na2BrO8 Dividing by 32 instead of 16 gives NaBrO2 Award 2 in these cases Both these errors give Na2BrO4 Award 1 in this case	
					Correct final answer scores 3 marks	
					Total	**16**