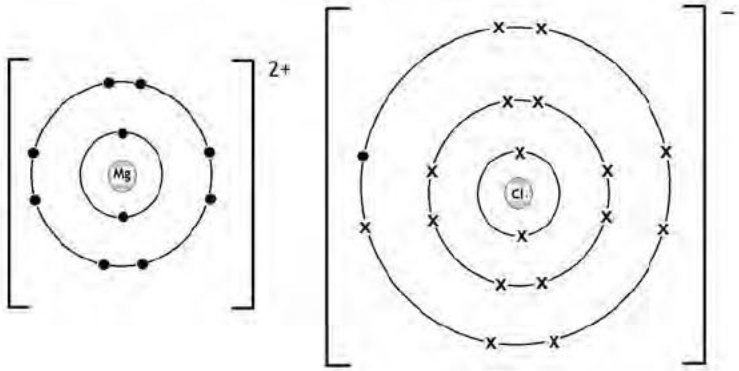
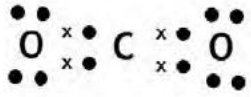
Question number	Answer	Notes	Marks
1 (a) (i)	E		6
(ii)	B		
(iii)	F		
(iv)	C		
(v)	F		
(vi)	E		
(b) (i)	**M1** (bonding/shared) electrons **M2** nuclei **OR** **M1** nuclei **M2** bonding/shared electrons	 ACCEPT protons / nucleus(es) ACCEPT nucleus(es)	2
(ii)	A_2D / DA_2	ACCEPT H_2O REJECT if charges shown	1

Question number	Answer	Notes	Marks
2 (a) (i)	 **NB** H does not need to be shown if touching / overlapping circles are shown	ACCEPT any combination of dots and crosses if overlapping / touching circles used both electrons must be within the overlapping/touching area	1
(ii)	**M1** weak forces (of attraction) between molecules / weak intermolecular forces **M2** (therefore) little (thermal/heat) energy required to overcome these forces / separate the molecules (into the gaseous state)	ACCEPT particles ACCEPT bonds for forces for both **M1** and **M2** ACCEPT correctly named IMF IGNORE more easily separated / easier to break REJECT atoms for both **M1** and **M2** **NB** any mention of breaking covalent or ionic bonds scores 0	2
(b) (i)	**M1** <u>atoms</u> of the same element **M2** with different masses	<u>atoms</u> with same atomic number / <u>atoms</u> same number of protons different mass numbers / different numbers of neutrons IGNORE references to electrons unless incorrect	2
(ii)	<table><tr><th></th><th>^{1}H</th><th>^{2}H</th><th>^{3}H</th></tr><tr><td>protons</td><td>1</td><td>1</td><td>1</td></tr><tr><td>neutrons</td><td>0</td><td>1</td><td>2</td></tr><tr><td>electrons</td><td>1</td><td>1</td><td>1</td></tr></table>	one mark for each correct row	3

Question number	Answer	Notes	Marks
(c) (i)	exothermic		1
(ii)	$2H_2 + O_2 \rightarrow 2H_2O$ **M1** all formulae correct **M2** balanced	ACCEPT multiples and halves IGNORE state symbols even if incorrect	2
(iii)	**M1** (add to) anhydrous/white copper(II) sulfate **M2** turns blue **M2** dep on **M1** or near miss	turns copper(II) sulfate from white to blue scores 2 ACCEPT equivalent description of test with anhydrous cobalt(II) chloride (blue to pink) IGNORE any references to testing with indicators	2
(iv)	**M1** measure/determine the boiling point **M2** 100 °C **OR** **M1** measure/determine the melting/freezing point **M2** 0 °C **OR** **M1** measure/determine the density **M2** 1 g/cm^3	ACCEPT boil the water / heat until it boils it boils at 100 °C ALLOW "heat it and it boils at 100 °C " for 2 ACCEPT freeze the water / cool until it freezes it freezes at 0 °C ALLOW "cool it and it freezes at 0 °C " for 2	2

Question number	Answer	Notes	Marks
3 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
3 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
3 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
4(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 4= 7 marks)

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