

Question 16 (Answer: C)

- X and Z form ions much *smaller* than their atoms, so both lose electrons – they are metals.
- Y's ion is much *larger* than its atom, so it gains electrons – a non-metal.
- A metal (Z) with a non-metal (Y) gives an ionic compound.

Question 17 (Answer: D)

- Across a period the atomic radius falls, so the sodium *atom* is bigger than the sulfur atom.
- Na^+ has lost its whole outer shell, so it is much smaller than its atom.
- S^{2-} has gained electrons and swollen, so the sulfur *ion* is the bigger one.

Question 17 (Answer: B)

- Electronegativity rises across the period: $\text{Mg} < \text{Al} < \text{Si} < \text{P}$.
- Melting point rises $\text{Mg} < \text{Al} < \text{Si}$ as the metallic bonding strengthens and then the giant covalent lattice takes over.
- It then collapses at P, which is simple molecular – so the graph peaks at Si and drops sharply to P.

2(a)(i)	M1 nuclear charge increases (across period) AND similar shielding M2 greater / stronger attraction to nucleus						
2(a)(ii)	M1 Al loses (3) electrons / Al is 3+, and P gains (3) electrons / P is 3– M2 Al (³⁺) has (one) fewer shell (than P(^{3–}))						
2(b)(i)	M1	(+)1	(+)2	(+)3	(+)4	(+)5	(+)6
	M2	12-14	8-10	—	—	0-4	0-4
2(b)(ii)	they are insoluble						
2(c)(i)	$\text{Na}_2\text{O} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O}$						
2(c)(ii)	$\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$						
2(d)(i)	(thermal stability) increases (down the group)						
2(d)(ii)	NO_2 AND O_2						

2(a)(i)	delocalised electrons move (through the structure / between layers)
2(a)(ii)	P / S / Cl have no charge carriers OR (no ions and) no delocalised electrons OR no mobile / moving ions
2(b)	M1 Si has (lots of) strong covalent bonds broken M2 P / S / Cl (only) has weak Van der Waals' (forces) broken

2(c)	<table><tr><td>M1</td><td>+1</td><td>+2</td><td>+3</td><td>+4</td><td>+5</td></tr><tr><td>M2</td><td>7</td><td>6.5</td><td>0–4</td><td>0–4</td><td>0–4</td></tr><tr><td>M3</td><td>I</td><td>I</td><td>I</td><td>C</td><td>C</td></tr><tr><td>M4</td><td>G</td><td>G</td><td>G</td><td>S</td><td>S</td></tr></table>	M1	+1	+2	+3	+4	+5	M2	7	6.5	0–4	0–4	0–4	M3	I	I	I	C	C	M4	G	G	G	S	S
M1	+1	+2	+3	+4	+5																				
M2	7	6.5	0–4	0–4	0–4																				
M3	I	I	I	C	C																				
M4	G	G	G	S	S																				
2(d)(i)	$2Al + 3Cl_2 \rightarrow 2AlCl_3$																								
2(d)(ii)	$PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$																								
2(e)(i)	rate of forward and backward (reaction) are the same / equal OR (ratio of) concentrations of reactants and products are constant																								
2(e)(ii)	closed system																								
2(e)(iii)	M1 (mixture / solution becomes more) yellow M2 (forward) reaction is exothermic (equilibrium shifts left) OR equilibrium / reaction shifts (left) to absorb (additional) heat / energy M3 (mixture / solution becomes more) red M4 fewer moles of gas on right-hand side OR (gas on left and) no gas on the right																								
2(f)(i)	$MgCl_2(aq) + Na_2CO_3(aq) \rightarrow MgCO_3(s) + 2NaCl(aq)$ M1 formulae in balanced equation M2 state symbols																								
2(f)(ii)	MgO / magnesium oxide AND CO ₂ / carbon dioxide																								
2(f)(iii)	(thermal stability) increases (down the group)																								