A-Level Chemistry: **w25 11**

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.

A-Level Chemistry: **w25 12**

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.

A-Level Chemistry: **w25 14**

Question 17 (Answer: **B**)

- Electronegativity rises across the period: Mg < Al < Si < P.
- Melting point rises Mg < Al < 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.

A-Level Chemistry: **w25 21**

<table>
<tr><td>2(a)(i)</td><td>M1 nuclear charge increases (across period) AND similar shielding

M2 greater / stronger attraction to nucleus</td></tr>
<tr><td>2(a)(ii)</td><td>M1 Al loses (3) electrons / Al is 3+, and P gains (3) electrons / P is 3–

M2 $Al^{(3+)}$ has (one) fewer shell (than $P^{(3-)}$)</td></tr>
<tr><td>2(b)(i)</td><td><table>
<tr><td>M1</td><td>(+)1</td><td>(+)2</td><td>(+)3</td><td>(+)4</td><td>(+)5</td><td>(+)6</td></tr>
<tr><td>M2</td><td>12-14</td><td>8-10</td><td>—</td><td>—</td><td>0-4</td><td>0-4</td></tr>
</table></td></tr>
<tr><td>2(b)(ii)</td><td>they are insoluble</td></tr>
<tr><td>2(c)(i)</td><td>$Na_2O + 2HCl \rightarrow 2NaCl + H_2O$</td></tr>
<tr><td>2(c)(ii)</td><td>$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$</td></tr>
<tr><td>2(d)(i)</td><td>(thermal stability) increases (down the group)</td></tr>
<tr><td>2(d)(ii)</td><td>NO_2 AND O_2</td></tr>
</table>

A-Level Chemistry: **w25 22**

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

A-Level Chemistry: **w25 22**

<table>
<tr><td>2(c)</td><td><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></td></tr>
<tr><td>2(d)(i)</td><td>$2Al + 3Cl_2 \rightarrow 2AlCl_3$</td></tr>
<tr><td>2(d)(ii)</td><td>$PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$</td></tr>
<tr><td>2(e)(i)</td><td>rate of forward and backward (reaction) are the same / equal
OR (ratio of) concentrations of reactants and products are constant</td></tr>
<tr><td>2(e)(ii)</td><td>closed system</td></tr>
<tr><td>2(e)(iii)</td><td>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</td></tr>
<tr><td>2(f)(i)</td><td>$MgCl_2(aq) + Na_2CO_3(aq) \rightarrow MgCO_3(s) + 2NaCl(aq)$
M1 formulae in balanced equation
M2 state symbols</td></tr>
<tr><td>2(f)(ii)</td><td>MgO / magnesium oxide AND CO_2 / carbon dioxide</td></tr>
<tr><td>2(f)(iii)</td><td>(thermal stability) increases (down the group)</td></tr>
</table>