Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

period 3, group 15; p-block

2.2

the nuclear charge increases across the period; the electrons are added to the same energy level, so shielding stays about the same; the outer electrons are pulled closer to the nucleus

2.3

the outer electron is in a higher energy level, further from the nucleus; there is more shielding by inner electrons; so the attraction is weaker and less energy is needed to remove it

2.4

the solution turns yellow-orange; $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$; chlorine is more reactive / a stronger oxidizing agent than bromine, so it displaces it

2.5

$Na_2O + H_2O \rightarrow 2NaOH$; $SO_3 + H_2O \rightarrow H_2SO_4$; NaOH alkaline, H_2SO_4 acidic

3.1

(a) $2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$

(b) the outer electron of K is in a higher energy level / further from the nucleus; more shielded by inner electrons; so it is lost more easily

(c) about 13–14 / strongly alkaline; hydroxide ions, OH^-, are formed

(d) electronegativity increases; nuclear charge increases with similar shielding, so bonding electrons are attracted more strongly

3.2

(a) S: +4; N: +4

(b) SO_2 reacts with water (and oxygen) in the air; forming H_2SO_3 / H_2SO_4, e.g. $SO_2 + H_2O \rightarrow H_2SO_3$; effect: damages trees / limestone buildings / acidifies lakes

(c) $CO_2 + H_2O \rightleftharpoons H_2CO_3$; $H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$

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