Notes: ORA = or reverse argument

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| **1.** | (a) | Decreases (1)proton number increases; shielding of outer electrons remains the same; attraction between nucleus and outer electrons increases; outer electrons pulled closer to nucleus (max 2) |
|  | (b) | Increases (1)more shells; more shielding; attraction between nucleus and outer electrons decreases; outer electrons drift further away from nucleus (max 2)[max 5] |
| **2.** | (a) | Ability of an atom to attract bonding electrons towards itself (1) |
|  | (b) | Groups 1 and 2 atoms electropositive or cations have low polarising power; weak attraction to bonding electrons; allow electrons to delocalise (max 2)Group 7 atoms electronegative or cations have high polarising power; strong attraction to bonding electrons; do not allow electrons to delocalise (max 2)[5] |
| **3.** | (a) | Larger difference in electronegativity = more ionic bond (ORA) (1)F more electronegative than Cl (ORA) (1)Electronegativity difference between Al and F larger than between Al and Cl (ORA) (1) |
|  | (b) | High polarizing power = more covalent bond (ORA) (1)Be2+ more highly charged than Li+; Be2+ smaller than Li+; Be2+ higher charge density than Li+; Be2+ has higher polarizing power than Li+ (max 2)[max 5] |
| **4.** | (a) | 2Na(s) + 2H2O(l) 🡪 2NaOH(aq) + H2(g) (1)fizzing/bubbles/effervescence; sodium dissolves; solution gets hot/metal moves around; smoke; burns with yellow flame (any 3 = 2; any 2 = 1) |
|  | (b) | Reaction faster with K (1)Outer electrons in K more easily lost (1)[5] |
| **5.** | (a) | Mg + 2HCl 🡪 MgCl2 + H2 or Ba + 2HCl 🡪 BaCl2 + H2 (1)Ba more shells/more shielding (1)Outer electrons in Ba more easily lost (1) |
|  | (b) | Mg + H2SO4 🡪 MgSO4 + H2 or Ba + H2SO4 🡪 BaSO4 + H2 (1)BaSO4 insoluble (can be shown as (s) in equation) (1)Precipitate sticks to surface of metal/prevents further reaction (1)[max 5] |
| **6.** | (a) | Solubility of hydroxides increase down Group 2 and solubility of sulphates decreases down Group 2 (1)The lattice enthalpy of the hydroxides decreases faster than hydration enthalpy (1)The lattice enthalpy of the sulphates decreases more slowly than hydration enthalpy (1) |
|  | (b) | Test for sulphate ions: white ppt with BaCl2 (1)Any other suitable test for a Group 2 ion based on solubility of hydroxides or sulphates, eg (Ba2+ gives ppt with H2SO4 but not NaOH) (1)[5] |

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| **7.** | (a) | Li gives monoxide only with O2; Li reacts directly with N2; Li reacts with C to give methanides; Li forms complex ions; Li2CO3 decomposes on heating; LiNO3 gives NO2 on heating (max 1)4Li + O2 🡪 2Li2O; 6Li + N2 🡪 2Li3N; 4Li + C 🡪 Li4C; Li+ + 4H2O 🡪 [Li(H2O)4]+; Li2CO3 🡪 Li2O + CO2; 2LiNO3 🡪 Li2O + 4NO2 + O2 (max 2) |
|  | (b) | Be dissolves in NaOH or BeO dissolves in NaOH or Be(OH)2; BeCl2 hydrolysed in water; Be form 4-coordinate complex ions (max 1)Be + 2H2O + 2OH- 🡪 Be(OH)42- + H2 or BeO + 2OH- + H2O 🡪 Be(OH)42- or Be(OH)2 + 2OH- 🡪 Be(OH)42-; BeCl2 + 2H2O 🡪 Be(OH)2 + 2HCl; Be2+ + 4H2O 🡪 [Be(H2O)4]2+ (max 2)[max 5] |
| **8.** | (a) | Covalent; diatomic; molecular; Van der Waal’s forces between molecules (any 3 = 2, any 2 = 1) |
|  | (b) | Increases down group (ORA) (1)more electrons in molecule/larger molecular surface area (ORA) (1)stronger/more Van der Waal’s forces between molecules (ORA) (1)[5] |
| **9.** | Br2 + 2I- 🡪 2Br- + I2 or Br2 + 2NaI 🡪 2NaBr + I2 (1)Solution darkens/turns brown when bromine water is added to sodium iodide due to formation of iodine (1)Because bromine is more reactive than iodine or bromine is a stronger oxidising agent than iodine (ORA for reducing agents and halides) (1)No reaction when bromine water is added to sodium chloride (1)Because bromine is less reactive than chlorine or bromine is a weaker oxidising agent than chlorine (ORA for reducing agents and halides) (1)[5] |