AS level Chemistry A

H032/02 Depth in chemistry

Question Set 1

1. Barium combines with oxygen, chlorine and nitrogen to form ionic compounds.

(a) Barium oxide, BaO, has a giant ionic lattice structure.

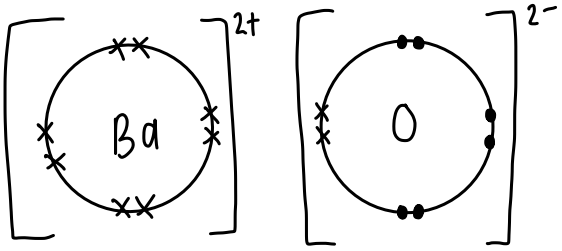
(i) State what is meant by the term *ionic bond*. **[1]**

electrostatic attraction between positive and negative ions

(ii) Draw a '*dot-and-cross*' diagram to show the bonding in barium oxide.

Show outer electrons only. **[2]**

Ba^{2+} O^{2-}



(iii) Calculate the number of barium ions in 1.50 g of barium oxide.

Give your answer in standard form and to **three** significant figures. **[2]**

ions = moles x 6.02×10^{23}

$= \frac{1.50}{153.3} \times 6.02 \times 10^{23} = 5.89 \times 10^{21}$ ions

(b) Barium chloride, $BaCl_2$, is soluble in water.

(i) Compare the electrical conductivities of solid and aqueous barium chloride.

Explain your answer in terms of the particles involved. **[2]**

i) solid barium chloride cannot conduct electricity because the ions are stuck in a solid ionic lattice so cannot move, whereas in a liquid the particles are free to move so can conduct electricity this is because the ionic lattice is broken down allowing the ions to move freely.

(ii) Describe the use of aqueous barium chloride in qualitative analysis. **[2]**

$BaCl_2$ can be used to identify SO_4^{2-} ions in solution; a white precipitate forms ($BaSO_4$) if sulfate ions are present, because $BaSO_4$ is insoluble in water.

(iii) Hydrated barium chloride can be crystallised from solution.

Hydrated barium chloride has the formula $BaCl_2 \cdot xH_2O$ and a molar mass of 244.3 g mol^{-1}.

Determine the value of x in the formula of $BaCl_2 \cdot xH_2O$.

Show your working.

[2]

$BaCl_2 \cdot xH_2O = 244.3\ g\,mol^{-1}$

$BaCl_2$ Mr = 208.3 Mr H_2O = 18

$244.3 - 208.3 = 36$

$36 \div 18 = 2$

$\Rightarrow x = 2$

[2]

(c) Barium nitride is formed when barium is heated with nitrogen. → Ba_3N_2

(i) Complete the electron configuration of a nitride ion. → N^{3-}

$1s^2$ ..2s²2p⁶.....

[1]

(ii) Solid barium nitride is reacted with water, forming an alkaline solution **A** and an alkaline gas **B**.

Identify **A** and **B**. A = $Ba(OH)_2$ B = NH_3

Write an equation, including state symbols, for the reaction.

[4]

$$Ba_3N_{2(s)} + H_2O_{(l)} \longrightarrow 3Ba(OH)_{2(aq)} + NH_{3(g)}$$

Total Marks for Question Set 1: 16