02. CHEMICAL EQUATIONS

Questions and Answers

1. Reflections on Concepts

1. What information do you get from a balanced chemical equation?

A. Interpretation of a Chemical equation:

(i) A chemical equation gives information about reactants and products and their formulae.

(ii) It gives the ratio of molecules of reactants and products.

(iii) It gives the information about relative masses of reactants and products.

(iv) It gives the molar ratios of reactants and products.

(v) We can calculate the number of molecules or atoms of different substances by using Avagadro's number.

(vi) we can calculate the masses and volumes of gases liberated in the reaction.

2. Why should we balance a chemical equation ?

A. As per law of conservation of mass no mass is created or destroyed. So the atom participated in chemical equation must be present in products but in different form. So the chemical equation should be balanced to show that it can follow the law of conservation of mass.

3. 'X' is a brown coloured shining element with atomic number one unit greater than Ni when burnt in air, turns black. What is 'X' ? What is the black coloured substance?

A. Brown coloured element 'X' is copper. The black coloured substance is copper oxide.

When brown colour copper (Cu) is heated it reacts with oxygen and forms black colour copper oxide (CuO).

$$2Cu + O_2 \rightarrow 2CuO$$

4. Balance the following chemical equations?

a) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

b) $KClO_3 \rightarrow KCl + O_2$

c) $Hg(NO_3)_2 + KI \rightarrow HgI_2 + KNO_3$

A. The balanced chemical equations are:

a) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

b) $2KClO_3 \rightarrow 2KCl + 3O_2$

c) $Hg(NO_3)_2 + 2KI \rightarrow HgI_2 + 2KNO_3$

5. Mention the physical states of the reactants and products of the following chemical reactions and balance the equations.

a) $C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$

b) $NH_3 + Cl_2 \rightarrow N_2H_4 + NH_4Cl$

c) $Na + H_2O \rightarrow NaOH + H_2$

A. The balanced chemical equations are:

a) $C_6H_{12}O_6\,(s) \rightarrow 2C_2H_5OH(\ell) + 2CO_2(g)$

b) $4NH_3(\ell) + Cl_2(g) \rightarrow N_2H_4(\ell) + 2NH_4Cl(g)$

c) $2Na(s) + 2H_2O(\ell) \rightarrow 2NaOH(aq) + H_2(g)$

2. Application on Concepts

1. Balance the chemical equation after writing the symbolic representation.

a) Calcium Hydroxide$_{(aq)}$ + Nitric acid$_{(aq)}$ → Water$_{(l)}$ + Calcium nitrate$_{(aq)}$

b) Magnesium$_{(s)}$ + Iodine$_{(g)}$ → MagnesiumIodide$_{(s)}$

A. The balanced chemical equations are:

a) Calcium Hydroxide$_{(aq)}$ + Nitric acid$_{(aq)}$ → Water$_{(l)}$ + Calcium nitrate$_{(aq)}$

$$Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$$

b) Magnesium$_{(s)}$ + Iodine$_{(g)}$ → MagnesiumIodide$_{(s)}$

$$Mg + I_2 \rightarrow MgI_2$$

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2. Write the following chemical reactions including physical states of the substances and Balance the chemical equations.

a) Sodium hydroxide reacts with Hydrochloric acid to produce Sodium chloride and water.

a) Barium chloride and Sodium sulphate aqueous solutions react to give insoluble Barium sulphate and aqueous solution of Solution of sodium chloride.

A. <u>The balanced chemical equations are:</u>

a) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(\ell)$

b) $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(\downarrow) + 2NaCl(aq)$

3. Potassium nitrate and Ammonium nitrate reacts separately with copper sulphate solution. Write balanced chemical equations for the above rections.

A. <u>The balanced chemical equations are:</u>

a) Potassium nitrate + Copper sulphate → Potassium sulphate + Copper nitrate

$2KNO_3 + CuSO_4 \rightarrow Cu(NO_3)_2 + K_2SO_4$

a) Ammonium nitrate + Copper sulphate → Ammonium sulphate + Copper nitrate

$2NH_4NO_3 + CuSO_4 \rightarrow Cu(NO_3)_2 + (NH_4)_2SO_4$

*3.Higher Order Thinking Questions

1. 2 moles of Zinc reacts with a cupric chloride solution containing 6.023×10^{22} formula units of $CuCl_2$. Calculate the moles of copper obtained.

$Zn(s) + CuCl_2(aq) \rightarrow ZnCl_2(aq) + Cu(s)$

A.

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2. 1 mole of propane(C_3H_8) on combustion at STP gives 'A' Kilo Joules of heat energy. Calculate the heat liberated when 2.4 litres of propane on combustion at STP ?

A. 1 mole of gas occupies 22.4 litres at STP.

The heat liberated when 1 mole of propane is burnt is 'A' Kilo Joules.

It means If we burnt 22.4 litres of propane, it liberates 'A' KJ of heat energy.

The amount of heat liberates when 2.4 litres of propane is burnt $= \frac{2.4}{22.4} \times A$

$= \frac{24}{224} \times A$

$= \frac{3}{28} \times A$

$= 0.107\ A\ KJ$

3. Calculate the mass and volume of oxygen required at STP to convert 2.4 Kg of graphite into carbon dioxide.

A. Balanced chemical equation for burning of graphite

C	+	O_2	→	CO_2
12u		32u		44u
1 mole		1 mole		1 mole

(i) The oxygen required to burn 12Kg of carbon is 32 Kg

The oxygen required to burn 2.4Kg of carbon is $\frac{2.4}{12} \times 32Kg$

$= 0.2 \times 32\ Kg$

$= 6.4\ Kg$

(ii) 12g of Carbon means 1 mole of carbon

2.4 Kg (2400g) of carbon means $\frac{2400}{12} = 200$ moles of carbon

The oxygen required to burn 1 mole of carbon is 1 mole

The oxygen required to burn 200 moles of carbon is 200 moles

The volume of oxygen required is 200 x 22.4 litres = 4480 litres.