Moles and chemical equations: Stoichiometry

SCH3U_06-07

An equation's coefficient allows us to determine the relative masses of products and reactants by using mol calculations.
When we write a balanced chemical equation we are indicating the numbers of moles of reactants and products involved in the chemical reaction.
Consider the reaction between copper and oxygen:

$$2Cu_{(s)} + O_{2\,(g)} \longrightarrow 2\,CuO_{(s)}$$
$$2\text{ mol} \qquad 1\text{ mol} \qquad 2\text{ mol}$$

This equations shows that 2 mol of copper atoms react with 1 mol of oxygen molecules to give 2 mol of copper (II) oxide.

Hence:	2 x 63.5	1 x (16 x 2)	2 x (63.5 + 16)
=	127 g	32 g	159 g

Total mass of reactants is equal to the total mass of the products, as predicted by the **Law of Conservation of mass**, (FYI: this law was formulated by Antoine Lavoisier in 1774), for any chemical reaction.
We can thus use this idea to calculate the masses of products formed and reactants used in a chemical reaction.

Example:

$$Al_2(SO_4)_3 + 3\,NH_3 + 6\,H_2O \longrightarrow 2\,Al(OH)_3 + 3\,(NH_4)_2SO_4$$

a. Name the reactants and the products.

b. How many moles of H_2O are required to react with 2.50 moles of aluminium sulphate?

c. How many moles of aluminium hydroxide would be produced by the reaction of 5.00 moles of NH_3 ?

d. How many grams of aluminium hydroxide would be produced by the reaction of 5.00 moles of NH_3?

e. How many moles are there in 200.0 g of ammonium sulphate?

f. How many moles of aluminium sulphate are required to produce 200.0 g of ammonium sulphate?

g. How many grams of aluminium hydroxide will be produced if 36.0 g of water react?

h. How many molecules of ammonia are required to react with 50.0 g of aluminium sulphate?

i. If 4.50×10^{46} molecules of water react, how many grams of aluminium hydroxide will be formed?

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