Chemistry Study Materials for Class 9

(Based on Chapter 3: Atoms and Molecules)

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Numericals based on the law of chemical combinations

Q1 : In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass.

Sodium carbonate + ethanoic acid → sodium ethanoate + carbon dioxide + water

Solution : In the given reaction, sodium carbonate reacts with ethanoic acid to produce sodium ethanoate, carbon dioxide, and water.

Sodium carbonate	+	Ethanoic acid	⟶	Sodium ethanoate	+	Carbon dioxide	+	Water
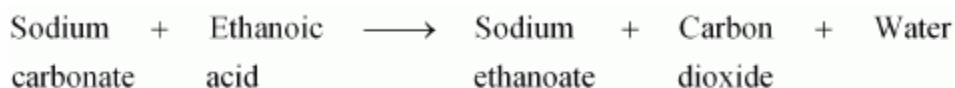
Mass of sodium carbonate = 5.3 g (Given)

Mass of ethanoic acid = 6 g (Given)

Mass of sodium ethanoate = 8.2 g (Given)

Mass of carbon dioxide = 2.2 g (Given)

Mass of water = 0.9 g (Given)

Now, total mass before the reaction = (5.3 + 6) g = 11.3 g

And, total mass after the reaction = (8.2 + 2.2 + 0.9) g = 11.3 g

∴ Total mass before the reaction = Total mass after the reaction

Hence, the given observations are in agreement with the law of conservation of mass.

Q2 : Hydrogen and oxygen combine in the ratio of 1:8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?

Solution : It is given that the ratio of hydrogen and oxygen by mass to form water is 1:8.

Then, the mass of oxygen gas required to react completely with 1 g of hydrogen gas is 8 g. Therefore, the mass of oxygen gas required to react completely with 3 g of hydrogen gas is 8 x 3 g = 24 g.

Q3: When calcium oxide is dissolved in water calcium hydroxide is formed. The reaction invole in this can be written as:

$$Calcium\ Oxide + Water \longrightarrow Calcium\ hydroxide$$
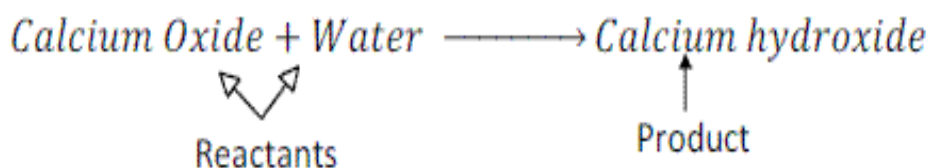
Reactants   Product

In this reaction calcium oxide and water are reactants while calcium hydroxide is product.

In this reaction 74 g of calcium hydroxide is obtained when 56 g of calcium oxide reacts with 18 g of water, which is proved by experiment.

$$Calcium\ Oxide + Water \longrightarrow Calcium\ hydroxide$$

56g + 18g = 74g   74g
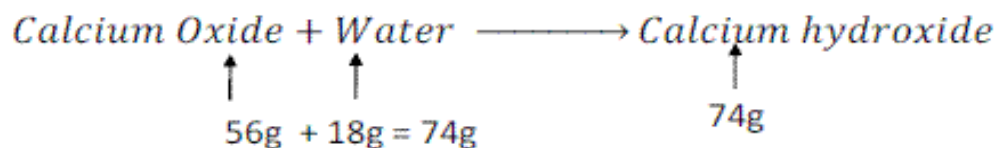
Here the total mass of reactants, i.e. calcium oxide and water is equal to 74 g. And the mass of product, i.e. calcium hydroxide is also equal to 74g. This proves that the total mass of reactants is always equal to the total mass of product, which proves the Law of Conservation of Mass.

Q4: When 3.0 g of carbon is burnt in 8.00 g oxygen, 11.00 g of carbon dioxide is produced. What mass of carbon dioxide will be formed when 3.00 g of carbon is burnt in 50.00 g of oxygen? Which law of chemical combination will govern your answer?

Solution: The reaction of burning of carbon in oxygen may be written as:

$$C + O_2 \longrightarrow CO_2$$

1 mole carbon   Oxygen 1 mole   carbon dioxide
12 g   32 g   44 g
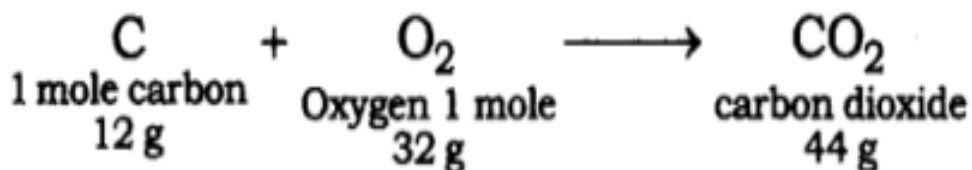
It shows that 12 g of carbon bums in 32 g oxygen to form 44 g of carbon dioxide. Therefore 3 g of carbon reacts with 8 g of oxygen to form 11 g of carbon dioxide. It is given that 3.0 g of carbon is burnt with 8 g of oxygen to produce 11.0 g of CO_2. Consequently 11.0 g of carbon dioxide will be formed when 3.0 g of C is burnt in 50 g of oxygen consuming 8 g of oxygen, leaving behind 50 – 8 = 42 g of O_2. The answer governs the law of constant proportion.

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