IN-TEXT QUESTIONS SOLVED

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Question 1. 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 carbonate.
Answer.

Sodium carbonate + Ethanoic acid → Sodium ethanoate + Carbon dioxide + Water

5.3 g + 6 g → 8.2 g + 2.2 g + 0.9 g

LHS RHS

∴ 11.3 g = 11.3 g

(Mass of reactant) (Mass of product)

This shows that during a chemical reaction mass of reactant = mass of product.

(*b*) Aluminium oxide

Symbol → Al O

Valency → +3 −2

Formula → Al_2O_3

- **Molecular Mass**

It is the sum of the atomic masses of all the atoms in a molecule of the substance. It is expressed in atomic mass unit (u).

e.g., $2H^+ + O_2$ H_2O [H = 1, O = 16]

$1 \times 2 + 16 = 18$ u

- **Formula Unit Mass**

It is the sum of the atomic masses of all atoms in a formula unit of a compound. The constituent particles are ions.

e.g., $Na^+ + Cl^-$ → NaCl

$1 \times 23 + 1 \times 35.5 =$ 58.5 u

- **Mole Concept**

Definition of mole: It is defined as one mole of any species (atoms, molecules, ions or particles) is that quantity in number having a mass equal to its atomic or molecular mass in grams.

1 mole = 6.022×10^{23} in number

Molar mass = mass of 1 mole → is always expressed in grams, and is also known as gram atomic mass.

1u of hydrogen has → 1 atom of hydrogen

1g of hydrogen has → 1 mole of hydrogen

= 6.022×10^{23} atoms of hydrogen

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Answer:

Sodium carbonate	+	Ethanoic acid	→	Sodium ethanoate	+	Carbon dioxide	+	Water
5.3 g	+	6 g	→	8.2 g	+	2.2 g	+	0.9 g
		LHS RHS						
∴		11.3 g = 11.3 g						

(Mass of reactant) (Mass of product)

This shows that during a chemical reaction mass of reactant = mass of product.

Question 2. 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?
Answer:
Ratio of H : O by mass in water is:
Hydrogen : Oxygen → H_2O
∴ 1 : 8 = 3 : x
x = 8 x 3
x = 24 g
∴ 24 g of oxygen gas would be required to react completely with 3 g of hydrogen gas.

Question 3. Which postulate of Dalton's atomic theory is the result of the law of conservation of mass?
Answer: The postulate of Dalton's atomic theory that is the result of the law of conservation of mass is—the relative number and kinds of atoms are constant in a given compound. Atoms cannot be created nor destroyed in a chemical reaction.

Question 4. Which postulate of Dalton's atomic theory can explain the law of definite proportions?
Answer: The relative number and kinds of atoms are constant in a given compound.

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Question 1. Define the atomic mass unit.
Answer: One atomic mass unit is equal to exactly one-twelfth (1/12th) the mass of one atom of carbon-12. The relative atomic masses of all elements have been found with respect to an atom of carbon-12.

Question 2. Why is it not possible to see an atom with naked eyes?
Answer: Atom is too small to be seen with naked eyes. It is measured in nanometres.
1 m = 109 nm

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Question 1. Write down the formulae of
(i) Sodium oxide
(ii) Aluminium chloride
(iii) Sodium sulphide
(iv) Magnesium hydroxide
Answer: The formulae are

(i) Formula of Sodium Oxide
Symbol → Na, O
Charge → +1, –2
Formula → Na_2O

(ii) Formula of aluminium chloride
Symbol → Al, Cl
Charge → +3, – 1
Formula → $AlCl_3$

(iii) Formula of Sodium Oxide
Symbol → Na, S
Charge → +1, –2
Formula → Na_2S

(iv) Formula of magnesium hydroxide
Symbol → Mg, OH
Charge → +2, 1
Formula → $Mg(OH)_2$

Question 2. What is meant by the term chemical formula?
Answer: The chemical formula of the compound is a symbolic representation of its composition, e.g., chemical formula of sodium chloride is NaCl.

Question 3. How many atoms are present in a

(i) H_2S molecule and

(ii) $P0_4^{3-}$ ion?

Answer: (i) H_2S → 3 atoms are present

(ii) $P0_4^{3-}$ → 5 atoms are present

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Question 1. Calculate the molecular masses of H_2, O_2, Cl_2, CO_2, CH_4, C_2H_2,NH_3, CH_3OH.

Answer: The molecular masses are:

$$H_2 \Rightarrow 1 \times 2 \rightarrow 2 \text{ u}$$

$$O_2 \Rightarrow 16 \times 2 \rightarrow 32 \text{ u}$$

$$Cl_2 \Rightarrow 35.5 \times 2 \rightarrow 71 \text{ u}$$

$$CO_2 \Rightarrow 1 \times 12 + 2 \times 16 = 12 + 32 = 44 \text{ u}$$

$$CH_4 \Rightarrow 1 \times 12 + 4 \times 1 = 16 \text{ u}$$

$$C_2H_6 \Rightarrow 2 \times 12 + 6 \times 1 = 30 \text{ u}$$

$$C_2H_4 \Rightarrow (2 \times 12) + (4 \times 1) = 28 \text{ u}$$

$$NH_3 \Rightarrow (1 \times 14) + (3 \times 1) = 17 \text{ u}$$

$$CH_3OH \Rightarrow 12 + (3 \times 1) + 16 + 1 = 32 \text{ u}$$

Question 2.Calculate the formula unit masses of ZnO, Na_2O, K_2CO_3, given atomic masses of Zn = 65 u, Na = 23 u, K = 39 u, C = 12 u, and O = 16 u.

Answer: The formula unit mass of

(i) ZnO = 65 u + 16 u = 81 u

(ii) Na_2O = (23 u x 2) + 16 u = 46 u + 16 u = 62 u

(iii) K_2CO_3 = (39 u x 2) + 12 u + 16 u x 3

= 78 u + 12 u + 48 u = 138 u

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Question 1. If one mole of carbon atoms weigh 12 grams, what is the mass (in grams) of 1 atom of carbon?

Answer:

$$1 \text{ mole of carbon atoms } 6.022 \times 10^{23} \text{ atoms} = 12 \text{ g}$$

$$\text{Mass of 1 atom} = ?$$

$$\therefore \quad \text{Mass of 1 atom of carbon} = \frac{12}{6.022 \times 10^{23}}$$

$$= 1.99 \times 10^{-23} \text{ g}$$

Question 2. Which has more number of atoms, 100 grams of sodium or 100 grams of iron (given atomic mass of Na = 23 u, Fe = 56 u)?

Answer:

23 g of Na = 6.022×10^{23} atoms (1 mole).

$\therefore$ 100 g of Na = ?

$$= \frac{100 \times 6.022 \times 10^{23}}{23} = \frac{602.2}{23} \times 10^{23}$$

$= 26.182 \times 10^{23} = 2.6182 \times 10^{24}$ atoms

56 g of Fe = 6.022×10^{23} atoms

100 g of Fe = ?

$$= \frac{100 \times 6.022 \times 10^{23}}{56} = \frac{602.2 \times 10^{23}}{56}$$

$= 10.753 \times 10^{23} = 1.075 \times 10^{24}$

100 g of Na contain $\rightarrow 2.618 \times 10^{24}$ atoms

100 g of Fe contain $\rightarrow 1.075 \times 10^{24}$ atoms

$\therefore$ 100 g of Na contains more atoms.

********** END **********