

ATOMS AND MOLECULES
IN TEXT QUESTIONS

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Q.1: In a reaction, 5.3 gm of sodium carbonate reacted with 6 gm of ethanoic acid. The products were 2.2 gm of carbon dioxide, 0.9 gm water and 8.2 gm sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass.

Ans: Mass of reactants = Mass of sodium carbonate + Mass of ethanoic acid
= 5.3 + 6.0 = 11.3 gm

Mass of products = Mass of carbon dioxide + Mass of water + Mass of sodium ethanoate
= 2.2 + 0.9 + 8.2 = 11.3 gm

The mass of products is equal to the mass of reactants. Thus, mass is neither created nor lost during the given chemical change which is in agreement with the law of conservation of mass.

Q.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 gm of hydrogen gas ?

Ans: Since hydrogen and oxygen combine in the ratio of 1:8 by mass, it means that x gm of hydrogen and 8x gm of oxygen will be required to form water.

So, Oxygen required to react with 3 gm of hydrogen to form water = $3 \times 8 = 24$ gm

Q.3: Which postulate of Dalton's Atomic Theory is the result of the law of conservation of mass ?

Ans: "Atoms are indivisible particles, which can not be created nor destroyed in a chemical reaction." The above postulate of Dalton's Atomic Theory is the result of the law of conservation of mass.

Q.4: Which postulate of Dalton's Atomic Theory can explain the law of definite proportions ?

Ans: "The relative number and kinds of atoms are constant in a given compound." The above postulate of Dalton's Atomic Theory can explain the law of definite proportions.

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Q.1: Define the Atomic Mass Unit.

Ans: The atomic mass of an element is the relative mass of its atom as compared with the mass of a particular atom of carbon isotope taken as 12 units. Thus the atomic mass of an element indicates the number of times one atom of the element is heavier than $1/12$ th of a ^{12}C isotope. For example the atomic mass of oxygen is 16 which indicates that an atom of oxygen is 16 times heavier than $1/12$ th of a ^{12}C isotope atom.

Thus, one Atomic Mass Unit (u) = $1/12$ th mass of ^{12}C isotope atom.

Q.2: Why is it not possible to see an atom with naked eyes ?

Ans: The size of an atom is very small and is measured in nanometers. Therefore, it is not possible to see an atom with naked eyes.

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Q.1: Write down the formulae of

- (i) sodium oxide
- (ii) aluminium chloride
- (iii) sodium sulphide
- (iv) magnesium hydroxide

Ans:

- (i) Na_2O
- (ii) AlCl_3
- (iii) Na_2S
- (iv) $\text{Mg}(\text{OH})_2$

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Q.2: Write down the names of compounds represented by the following formulae:

(i) $\text{Al}_2(\text{SO}_4)_3$, (ii) CaCl_2 , (iii) K_2SO_4 , (iv) KNO_3 , (v) CaCO_3

Ans:

- (i) aluminium sulphate
- (ii) calcium chloride
- (iii) potassium sulphate
- (iv) potassium nitrate
- (v) calcium carbonate

Q.3: What is meant by the term *chemical formula* ?

Ans: The chemical formula of a compound is the symbolic representation of its composition. a chemical formula of a compound shows its constituent elements and the number of atoms of each combining element. For example, the chemical formula of hydrogen sulphide is H_2S . It indicates that in hydrogen sulphide two hydrogen atoms and one sulphur atom are chemically united.

Q.4: How many atoms are present in a

(i) H_2S molecule and (ii) PO_4^{3-} ion ?

Ans: (i) Three atoms (ii) Five atoms

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Q.1: Calculate the molecular masses of H_2 , O_2 , Cl_2 , CO_2 , CH_4 , C_2H_6 , C_2H_4 , NH_3 , CH_3OH .

Ans:

Molecular mass of $\text{H}_2 = 1 + 1 = 2\text{u}$

Molecular mass of $\text{O}_2 = 16 + 16 = 32\text{u}$

Molecular mass of $\text{Cl}_2 = 35.5 + 35.5 = 71\text{u}$

Molecular mass of $\text{CO}_2 = 12 + 32 = 44\text{u}$

Molecular mass of $\text{CH}_4 = 12 + 4 = 16\text{u}$

Molecular mass of $\text{C}_2\text{H}_6 = 24 + 6 = 30\text{u}$

Molecular mass of $\text{C}_2\text{H}_4 = 24 + 4 = 28\text{u}$

Molecular mass of $\text{NH}_3 = 14 + 3 = 17\text{u}$

Molecular mass of $\text{CH}_3\text{OH} = 12 + 3 + 16 + 1 = 32\text{u}$

Q.2: Calculate the formula unit masses of ZnO , Na_2O , K_2CO_3 , given atomic masses of $\text{Zn} = 65\text{u}$, $\text{Na} = 23\text{u}$, $\text{K} = 39\text{u}$, $\text{C} = 12\text{u}$ and $\text{O} = 16\text{u}$

Ans:

Formula unit mass of $\text{ZnO} = 65 + 16 = 81\text{u}$

Formula unit mass of $\text{Na}_2\text{O} = 23 \times 2 + 16 = 62\text{u}$

Formula unit mass of $\text{K}_2\text{CO}_3 = 39 \times 2 + 12 \times 1 + 16 \times 3 = 138\text{u}$.

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Q.1: If one mole of carbon atoms weighs 12 gm, what is the mass (in gm) of 1 atom of carbon ?

Ans:

1 mole of carbon atoms = 6.022×10^{23} atoms.

Now 6.022×10^{23} atoms of carbon weighs = 12 gm

So, 1 atom of carbon weighs = $12 \div 6.022 \times 10^{23} = 1.99 \times 10^{-23}$ gm.