IIT PRAGATI CENTRE

Chapter : Some basic concepts of chemistry

SOLUTIONS

CLASS : XI CBSE

MCQ

1. (c) $Fe_2 (So_4)_3$
2. (a) 26.89
3. (b)
   21
4. (a) 10
5. (a) 81.398 g
6. (d) I_2
7. (c) 4 g atom of Hydrogen
8. (d) 10^{-21}
9. (a) 24 g of C (12)
10. (c) Constant Composition
11. (c) 4
12. (a) Anion
13. (b) 8.0 g Methane
14. (a) 39.9 g
15. (d) 0.1

Very Short Answer:

1. Chemistry is the branch of science that studies the composition, properties and interaction of matter.

2. chemical principles are important in diverse areas such as weather patterns, functioning of brain, operation of a computer, chemical industries, manufacturing , fertilizers, alkalis, acids, salts, dyes, polymers, drugs, soaps, detergents, metals, alloys, contribute in a big way to national economy.

3.

roperty	**Solids**	**Liquids**	**Gases**
1. Volume	Definite	Definite	**Not definite**
2. Shape	**Fixed**	**Not fixed, take the shape of container,**	**Not fixed, takes the shape of the container**

4. The components of a mixture can be separated by physical methods like handpicking, filtrations, crystallization, distillation etc.

5.

Pure Substances	Mixtures
Glucose	Air
Gold	Milk
Sodium	

6. Molecules consist of different atoms or same atoms. e.g. molecule of hydrogen contains two atoms of hydrogen whereas molecule of water contain two atoms of hydrogen and one of oxygen.

Compound is formed when two or more than two different atoms combine in fire propo e.g. water –ration carbon dioxide, sugar etc.

7. The constituents of a compound cannot be separated by physical methods. They can only be separate by chemical methods.

8. Physical properties are those properties which can be measured or observed without changing the identity or the composition of the substance whereas the measurement of

chemical properties require a chemical change to occur e.g. color, odour etc. are physical properties and combustion, basicity etc. are chemical properties.

9. The different system of measurement are English system and the metric system.

10. The SI Unit of density is Kg m^{-3} or kg/m^3

Short Answer:

Ans: 1. A mole is the amount of a substance that contains as many entities (atoms, molecules, or other particles) as there are atoms in exactly 0.012 kg or 12 g of the carbon-12 isotope.

Ans: 2. The molarity of a solution is defined as the number of moles of the solute present per liter of the solution. It is represented by the symbol M. Its value changes with the change in temperature.

Ans: 3. Precision and accuracy: The term precision refers to the closeness of the set of values obtained from identical measurements of a quantity.
Accuracy refers to the closeness of a single measurement to its true value.

Ans: 4. Fundamental units: Fundamental units are those units by which other physical units can be derived. These are mass (M), Length (L), time (T), temperature (°).

Derived units: The units which are obtained by the combination of the fundamental units are called derived units.

Ans: 5. Molality (m) = $\frac{Mole\ of\ solute}{Mass\ of\ the\ solvent\ in\ kg}$

The molality of the solution does not depend upon the temperature.

Ans: 6. Atom: An atom is the smallest particle of an element that takes part in a chemical reaction. It may or may not be capable of independent existence.

Molecule: It is the smallest particle of a substance (element or compound) that is capable of independent existence

Ans: 7. Joule is the SI unit of work or energy

$$\text{As work} = \text{force} \times \text{distance}$$
$$= (\text{mass} \times \text{acceleration}) \times \text{distance}$$
$$= \text{Mass} \times \frac{\text{distance}}{\text{time}^2} \times \text{distance}$$
$$= \frac{\text{mass} \times (\text{distance})^2}{\text{time}^2}$$

Hence $$J = \frac{kg \times m^2}{s^2} = kg\, m^2 s^{-2}.$$

Long Answer:

Ans: 1. The Law of Multiple Proportions states:

"When two elements combine to form two or more than two chemical compounds than the weights of one of elements which combine with a fixed weight of the other, bear a simple ratio to one another.

Examples:

1. Compound of Carbon and Oxygen: C and O combine to form two compounds CO and CO_2.

In CO_2 12 parts of wt. of C combined with 16 parts by wt. O.

In CO_2 12 parts of wt. of C combined with 32 parts by wt. of O.

If the weight of C is fixed at 12 parts by wt., then the ratio in the weights of oxygen which combine with the fixed wt. of C (= 12) is 16: 32 or 1: 2.

Thus, the weight of oxygen bears a simple ratio of 1: 2 to each other.

2. Compounds of Sulphate (S) and Oxygen (O):

S forms two oxides with O, viz., SO_2 and SO_3

In SO_2, 32 parts of wt. of S combine with 32 parts by wt. of O.

In SO_3, 32 parts of wt. of S combine with 48 parts by wt. of O.

If the wt. of S is fixed at 32 parts, then' the ratio in the weights of oxygen which combine with the fixed wt. of S is 32: 48 or 2: 3.

Thus, the weights of oxygen bear a simple ratio of 2: 3 to each other.

Ans: 2. Law of Constant Composition of Definite Proportions states: "A chemical compound is always found, to be made up of the same elements combined together in the same fixed proportion by weight".

Examples:

1. CO_2 may be prepared in the laboratory as follows:

$$(i)\ CaCO_3 \xrightarrow{\text{Heat}} CaO + CO_2\uparrow$$

$$(ii)\ C + O_2 \xrightarrow{\text{Heat}} CO_2\uparrow$$

$$(iii)\ CaCO_3 + 2\,HCl \longrightarrow CaCl_2 + CO_2\uparrow + H_2O$$

$$(iv)\ 2NaHCO_3 \xrightarrow{\text{Heat}} Na_2CO_3 + CO_2\uparrow + H_2O$$

In all the above examples, CO2 is made up of the same elements i. e., Carbon (C) and Oxygen (O) combined together in the same fixed proportion by weight of 12: 32 or 3: 8 by weight.

Ans: 3. The empirical formula of a compound expresses the simplest whole-number ratio of the atoms of the various elements present in one molecule of the compound.

For example, the empirical formula of benzene is CH and that of glucose is CH2O. This suggests that in the molecule of benzene one atom of Carbon (C) is present for every atom of Hydrogen (H). Similarly in the molecule of glucose (CH2O), for every one atom of C, there are two atoms of H and one atom of O present in its molecule. Thus, the empirical formula of a compound represents only the atomic ratio of various elements present in its molecule.

The molecular formula of a compound represents the true formula of its molecule. It expresses the actual number of atoms of various elements present in one molecule of a compound. For example, the molecular formula of benzene is C_6H_6 and that of glucose is $C_6H_{12}O_6$. This suggests that in one molecule of benzene, six atoms of C and 6 atoms of H are present. Similarly, one molecule of glucose ($C_6H_{12}O_6$) actually contains 6 atoms of C, 12 atoms of H, and 6 atoms of O.

Relation between the empirical and molecular formula

Molecular formula = n × Empirical formula where n is an integer such as 1, 2, 3…

When n = 1; Molecular formula = Empirical formula

When n = 2; Molecular formula = 2 × Empirical formula.

The value of n can be obtained from the relation.

n = $\frac{Molecular\ mass}{Empirical\ formula\ mass}$

The molecular mass of a volatile substance can be determined by Victor Meyer's method or by employing the relation.

Molecular mass = 2 × vapour density.

Empirical formula mass can however be obtained from its empirical formula simply by adding the atomic masses of the various atoms present in it.

Thus, the empirical formula mass of glucose CH_2O

= 1 × 12 + 2 × 1 + 1 × 16 = 30.0 u.

Ans: 4. 2 mols of HNO_3 are produced by 3 mols of NO_2

7.33 mol HNO_3 are produced by $\frac{3 \times 7.33}{2}$ mol of NO_2

= 10.995 mols.

Ans: 5. Molar mass of $NaNO_3$ = 23 + 14 + 3 × 16 = 85 g mol^{-1}

Molarity = Number of moles of solute Volume of solution in L

= $\frac{0.83 \times 1000}{85 \times 50}$

= 0.196 M.

Assertion Reason Answer:

1. (i) Both A and R are true and R is the correct explanation of A.
2. (ii) Both A and R are true but R is not the correct explanation of A.

Case Study Answer:

1. Answer:

(1) (b)
Liquid

(2) (c) Solid

(3) (c) Element

(4) (d) Two , one.

(5) (d) Composition

2. Answer:

(1) (c) Precision

(2) (b) Antoine Lavoisier

(3) (d) 0.0052

(4) (a) Accuracy

(5) (d) John Dalton