

Unit

# 1

## SOME BASIC CONCEPTS OF CHEMISTRY

### I. Multiple Choice Questions (Type-I)

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1. Two students performed the same experiment separately and each one of them recorded two readings of mass which are given below. Correct reading of mass is 3.0 g. On the basis of given data, mark the correct option out of the following statements.

**Student**

**Readings**

A	3.01	2.99
B	3.05	2.95

- (i) Results of both the students are neither accurate nor precise.  
(ii) Results of student A are both precise and accurate.  
(iii) Results of student B are neither precise nor accurate.  
(iv) Results of student B are both precise and accurate.
2. A measured temperature on Fahrenheit scale is 200 °F. What will this reading be on Celsius scale?
- (i) 40 °C  
(ii) 94 °C  
(iii) 93.3 °C  
(iv) 30 °C
3. What will be the molarity of a solution, which contains 5.85 g of NaCl(s) per 500 mL?
- (i) 4 mol L<sup>-1</sup>  
(ii) 20 mol L<sup>-1</sup>

- (iii)  $0.2 \text{ mol L}^{-1}$   
(iv)  $2 \text{ mol L}^{-1}$
4. If 500 mL of a 5M solution is diluted to 1500 mL, what will be the molarity of the solution obtained?  
(i) 1.5 M  
(ii) 1.66 M  
(iii) 0.017 M  
(iv) 1.59 M
5. The number of atoms present in one mole of an element is equal to Avogadro number. Which of the following element contains the greatest number of atoms?  
(i) 4g He  
(ii) 46g Na  
(iii) 0.40g Ca  
(iv) 12g He
6. If the concentration of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) in blood is  $0.9 \text{ g L}^{-1}$ , what will be the molarity of glucose in blood?  
(i) 5 M  
(ii) 50 M  
(iii) 0.005 M  
(iv) 0.5 M
7. What will be the molality of the solution containing 18.25 g of HCl gas in 500 g of water?  
(i) 0.1 m  
(ii) 1 M  
(iii) 0.5 m  
(iv) 1 m
8. One mole of any substance contains  $6.022 \times 10^{23}$  atoms/molecules. Number of molecules of  $\text{H}_2\text{SO}_4$  present in 100 mL of 0.02M  $\text{H}_2\text{SO}_4$  solution is \_\_\_\_\_.  
(i)  $12.044 \times 10^{20}$  molecules  
(ii)  $6.022 \times 10^{23}$  molecules  
(iii)  $1 \times 10^{23}$  molecules  
(iv)  $12.044 \times 10^{23}$  molecules
9. What is the mass percent of carbon in carbon dioxide?  
(i) 0.034%  
(ii) 27.27%

- (iii) 3.4%
- (iv) 28.7%

**10.** The empirical formula and molecular mass of a compound are  $\text{CH}_2\text{O}$  and 180 g respectively. What will be the molecular formula of the compound?

- (i)  $\text{C}_9\text{H}_{18}\text{O}_9$
- (ii)  $\text{CH}_2\text{O}$
- (iii)  $\text{C}_6\text{H}_{12}\text{O}_6$
- (iv)  $\text{C}_2\text{H}_4\text{O}_2$

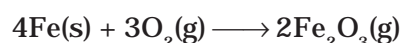
**11.** If the density of a solution is  $3.12 \text{ g mL}^{-1}$ , the mass of 1.5 mL solution in significant figures is \_\_\_\_\_.

- (i) 4.7g
- (ii)  $4680 \times 10^{-3}\text{g}$
- (iii) 4.680g
- (iv) 46.80g

**12.** Which of the following statements about a compound is incorrect?

- (i) A molecule of a compound has atoms of different elements.
- (ii) A compound cannot be separated into its constituent elements by physical methods of separation.
- (iii) A compound retains the physical properties of its constituent elements.
- (iv) The ratio of atoms of different elements in a compound is fixed.

**13.** Which of the following statements is correct about the reaction given below:



- (i) Total mass of iron and oxygen in reactants = total mass of iron and oxygen in product therefore it follows law of conservation of mass.
- (ii) Total mass of reactants = total mass of product; therefore, law of multiple proportions is followed.
- (iii) Amount of  $\text{Fe}_2\text{O}_3$  can be increased by taking any one of the reactants (iron or oxygen) in excess.
- (iv) Amount of  $\text{Fe}_2\text{O}_3$  produced will decrease if the amount of any one of the reactants (iron or oxygen) is taken in excess.

**14.** Which of the following reactions is not correct according to the law of conservation of mass.

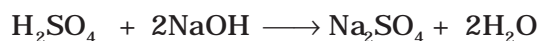
- (i)  $2\text{Mg(s)} + \text{O}_2\text{(g)} \longrightarrow 2\text{MgO(s)}$
- (ii)  $\text{C}_3\text{H}_8\text{(g)} + \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)} + \text{H}_2\text{O(g)}$
- (iii)  $\text{P}_4\text{(s)} + 5\text{O}_2\text{(g)} \longrightarrow \text{P}_4\text{O}_{10}\text{(s)}$
- (iv)  $\text{CH}_4\text{(g)} + 2\text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)} + 2\text{H}_2\text{O(g)}$

15. Which of the following statements indicates that law of multiple proportion is being followed.
- (i) Sample of carbon dioxide taken from any source will always have carbon and oxygen in the ratio 1:2.
  - (ii) Carbon forms two oxides namely  $\text{CO}_2$  and  $\text{CO}$ , where masses of oxygen which combine with fixed mass of carbon are in the simple ratio 2:1.
  - (iii) When magnesium burns in oxygen, the amount of magnesium taken for the reaction is equal to the amount of magnesium in magnesium oxide formed.
  - (iv) At constant temperature and pressure 200 mL of hydrogen will combine with 100 mL oxygen to produce 200 mL of water vapour.

## II. Multiple Choice Questions (Type-II)

In the following questions two or more options may be correct.

16. One mole of oxygen gas at STP is equal to \_\_\_\_\_.
- (i)  $6.022 \times 10^{23}$  molecules of oxygen
  - (ii)  $6.022 \times 10^{23}$  atoms of oxygen
  - (iii) 16 g of oxygen
  - (iv) 32 g of oxygen
17. Sulphuric acid reacts with sodium hydroxide as follows :



When 1L of 0.1M sulphuric acid solution is allowed to react with 1L of 0.1M sodium hydroxide solution, the amount of sodium sulphate formed and its molarity in the solution obtained is

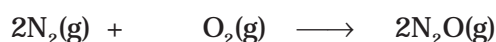
- (i)  $0.1 \text{ mol L}^{-1}$
  - (ii) 7.10 g
  - (iii)  $0.025 \text{ mol L}^{-1}$
  - (iv) 3.55 g
18. Which of the following pairs have the same number of atoms?
- (i) 16 g of  $\text{O}_2(\text{g})$  and 4 g of  $\text{H}_2(\text{g})$
  - (ii) 16 g of  $\text{O}_2$  and 44 g of  $\text{CO}_2$
  - (iii) 28 g of  $\text{N}_2$  and 32 g of  $\text{O}_2$
  - (iv) 12 g of  $\text{C}(\text{s})$  and 23 g of  $\text{Na}(\text{s})$
19. Which of the following solutions have the same concentration?
- (i) 20 g of  $\text{NaOH}$  in 200 mL of solution
  - (ii) 0.5 mol of  $\text{KCl}$  in 200 mL of solution

- (iii) 40 g of NaOH in 100 mL of solution  
(iv) 20 g of KOH in 200 mL of solution
20. 16 g of oxygen has same number of molecules as in  
(i) 16 g of CO  
(ii) 28 g of N<sub>2</sub>  
(iii) 14 g of N<sub>2</sub>  
(iv) 1.0 g of H<sub>2</sub>
21. Which of the following terms are unitless?  
(i) Molality  
(ii) Molarity  
(iii) Mole fraction  
(iv) Mass percent
22. One of the statements of Dalton's atomic theory is given below:  
"Compounds are formed when atoms of different elements combine in a fixed ratio"  
Which of the following laws is **not** related to this statement?  
(i) Law of conservation of mass  
(ii) Law of definite proportions  
(iii) Law of multiple proportions  
(iv) Avogadro law

### III. Short Answer Type

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23. What will be the mass of one atom of C-12 in grams?
24. How many significant figures should be present in the answer of the following calculations?
- $$\frac{2.5 \times 1.25 \times 3.5}{2.01}$$
25. What is the symbol for SI unit of mole? How is the mole defined?
26. What is the difference between molality and molarity?
27. Calculate the mass percent of calcium, phosphorus and oxygen in calcium phosphate Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>.
28. 45.4 L of dinitrogen reacted with 22.7 L of dioxygen and 45.4 L of nitrous oxide was formed. The reaction is given below:



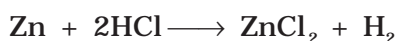
Which law is being obeyed in this experiment? Write the statement of the law?

29. If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in whole number ratio.
- Is this statement true?
  - If yes, according to which law?
  - Give one example related to this law.

30. Calculate the average atomic mass of hydrogen using the following data :

Isotope	% Natural abundance	Molar mass
${}^1\text{H}$	99.985	1
${}^2\text{H}$	0.015	2

31. Hydrogen gas is prepared in the laboratory by reacting dilute HCl with granulated zinc. Following reaction takes place.



Calculate the volume of hydrogen gas liberated at STP when 32.65 g of zinc reacts with HCl. 1 mol of a gas occupies 22.7 L volume at STP; atomic mass of Zn = 65.3 u.

32. The density of 3 molal solution of NaOH is  $1.110 \text{ g mL}^{-1}$ . Calculate the molarity of the solution.
33. Volume of a solution changes with change in temperature, then, will the molality of the solution be affected by temperature? Give reason for your answer.
34. If 4 g of NaOH dissolves in 36 g of  $\text{H}_2\text{O}$ , calculate the mole fraction of each component in the solution. Also, determine the molarity of solution (specific gravity of solution is  $1 \text{ g mL}^{-1}$ ).
35. The reactant which is entirely consumed in reaction is known as limiting reagent. In the reaction  $2\text{A} + 4\text{B} \rightarrow 3\text{C} + 4\text{D}$ , when 5 moles of A react with 6 moles of B, then
- which is the limiting reagent?
  - calculate the amount of C formed?

## IV. Matching Type

36. Match the following:

- |   |                                      |
|---|--------------------------------------|
| (i) 88 g of $\text{CO}_2$                                     | (a) 0.25 mol                         |
| (ii) $6.022 \times 10^{23}$ molecules of $\text{H}_2\text{O}$ | (b) 2 mol                            |
| (iii) 5.6 litres of $\text{O}_2$ at STP                       | (c) 1 mol                            |
| (iv) 96 g of $\text{O}_2$                                     | (d) $6.022 \times 10^{23}$ molecules |
| (v) 1 mol of any gas  | (e) 3 mol                            |

37. Match the following physical quantities with units

Physical quantity	Unit
(i) Molarity	(a) $\text{g mL}^{-1}$
(ii) Mole fraction	(b) mol
(iii) Mole	(c) Pascal
(iv) Molality	(d) Unitless
(v) Pressure	(e) $\text{mol L}^{-1}$
(vi) Luminous intensity	(f) Candela
(vii) Density	(g) $\text{mol kg}^{-1}$
(viii) Mass	(h) $\text{Nm}^{-1}$
	(i) kg

## V. Assertion and Reason Type

In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

38. **Assertion (A)** : The empirical mass of ethene is half of its molecular mass.

**Reason (R)** : The empirical formula represents the simplest whole number ratio of various atoms present in a compound.

- (i) Both A and R are true and R is the correct explanation of A.
- (ii) A is true but R is false.
- (iii) A is false but R is true.
- (iv) Both A and R are false.

39. **Assertion (A)** : One atomic mass unit is defined as one twelfth of the mass of one carbon-12 atom.

**Reason (R)** : Carbon-12 isotope is the most abundant isotope of carbon and has been chosen as standard.

- (i) Both A and R are true and R is the correct explanation of A.
- (ii) Both A and R are true but R is not the correct explanation of A.
- (iii) A is true but R is false.
- (iv) Both A and R are false.

40. **Assertion (A)** : Significant figures for 0.200 is 3 where as for 200 it is 1.

**Reason (R)** : Zero at the end or right of a number are significant provided they are not on the right side of the decimal point.

- (i) Both A and R are true and R is correct explanation of A.
- (ii) Both A and R are true but R is not a correct explanation of A.

- (iii) A is true but R is false.
- (iv) Both A and R are false.

**41. Assertion (A) :** Combustion of 16 g of methane gives 18 g of water.

**Reason (R) :** In the combustion of methane, water is one of the products.

- (i) Both A and R are true but R is not the correct explanation of A.
- (ii) A is true but R is false.
- (iii) A is false but R is true.
- (iv) Both A and R are false.

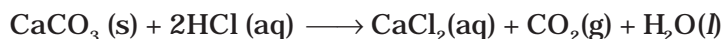
## VI. Long Answer Type

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**42.** A vessel contains 1.6 g of dioxygen at STP (273.15K, 1 atm pressure). The gas is now transferred to another vessel at constant temperature, where pressure becomes half of the original pressure. Calculate

- (i) volume of the new vessel.
- (ii) number of molecules of dioxygen.

**43.** Calcium carbonate reacts with aqueous HCl to give  $\text{CaCl}_2$  and  $\text{CO}_2$  according to the reaction given below:



What mass of  $\text{CaCl}_2$  will be formed when 250 mL of 0.76 M HCl reacts with 1000 g of  $\text{CaCO}_3$ ? Name the limiting reagent. Calculate the number of moles of  $\text{CaCl}_2$  formed in the reaction.

**44.** Define the law of multiple proportions. Explain it with two examples. How does this law point to the existence of atoms?

**45.** A box contains some identical red coloured balls, labelled as A, each weighing 2 grams. Another box contains identical blue coloured balls, labelled as B, each weighing 5 grams. Consider the combinations AB,  $\text{AB}_2$ ,  $\text{A}_2\text{B}$  and  $\text{A}_2\text{B}_3$  and show that law of multiple proportions is applicable.