1 Some Basic Concepts of Chemistry

Conceptual MCQs

1. The molecular weight of O_2 and SO_2 are 32 g and 64 g respectively. At 15°C and 150 mm Hg pressure, one litre of O_2 contains 'N' molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be :

(a) N/2 (b) 1 N (c) 2 N (d) 4 N

2. Among the following pairs of compounds, the one that illustrates the law of multiple proportions is

(a) NH_3 and NCl_3 (b) H_2S and SO_2

(c) CS_2 and $FeSO_4$ (d) CuO and Cu_2O

3. A sample was weighted using two different balances. The result's were (i) 3.929 g (ii) 4.0 g. How would the weight of the sample be reported. (If it has to be reported in 3 significant numbers)

(a) 3.929 g (b) 3 g (c) 3.9 g (d) 3.93 g

4. A metallic chloride contain 47.22% metal. Calculate the equivalent weight (in g) of metal.

(a) 39.68 (b) 31.76 (c) 36.35 (d) 33.46

5. The percentage weight of Zn in white vitriol [$ZnSO_4.7H_2O$] is approximately equal to

(Zn = 65, S = 32, O = 16 and H = 1)

(a) 33.65 % (b) 32.56 %

(c) 23.65 % (d) 22.65 %

6. 480mL of 1.5 M of a solution is mixed with 520 mL of 1.2 M of another solution. What is the molarity of the final mixture?

(a) 2.70 M (b) 1.344 M (c) 1.50 M (d) 1.20 M

7. Volume of water needed to mix with 10 mL of 10 N HNO_3 to get 0.1 N HNO_3 is :

(a) 1000 mL (b) 990 mL

(c) 1010 mL (d) 10 mL

8. What volume of water is to be added to 100 cm^3 of 0.5 M NaOH solution to make it 0.1 M solution?

(a) 200 cm^3 (b) 400 cm^3

(c) 500 cm^3 (d) 100 cm^3

9. Molarity equation of a mixture of solutions of same substance is given by

(a) $M_1 + V_1 \times M_2 + V_2 \times M_3 + V_3 + ... = M_1 + M_2 + M_3$

(b) $M_1V_1 + M_2V_2 + M_3V_3 + ... = M(V_1 + V_2 + V_3)$

(c) $\frac{M_1}{V_1} + \frac{M_2}{V_2} + \frac{M_3}{V_3} + ... = M\left(\frac{1}{V_1} + \frac{1}{V_2} + \frac{1}{V_3}\right)$

(d) $\frac{M_1}{V_1} \times \frac{M_2}{V_2} \times \frac{M_3}{V_3} + ... = M_1\left(\frac{1}{V_1} \times \frac{1}{V_2} \times \frac{1}{V_3}\right)$

10. 1.24 g of phosphorus is present in 2.2 g of

(a) P_4S_3 (b) P_2S_2 (c) PS_2 (d) P_2S_4

11. Number of atoms in 558.5 g Fe (at. wt. of Fe = 55.85 g mol^{-1}) is

(a) twice that in 60 g carbon

(b) 6.023×10^{22}

(c) half that in 8 g He

(d) $558.5 \times 6.023 \times 10^{23}$

12. The number of molecules in 8.96 litre of a gas at 0 °C and 1 atm pressure is approximately

(a) 6.023×10^{23} (b) 12.04×10^{23}

(c) 18.06×10^{23} (d) 24.1×10^{22}

13. How many number of molecules and atoms respectively are present in 2.8 litres of a diatomic gas at STP?

(a) $6.023 \times 10^{23}, 7.5 \times 10^{23}$ (b) $6.023 \times 10^{23}, 15 \times 10^{22}$

(c) $7.5 \times 10^{22}, 15 \times 10^{22}$ (d) $15 \times 10^{22}, 7.5 \times 10^{23}$

14. The total number of protons in 10 g of calcium carbonate is ($N_0 = 6.023 \times 10^{23}$)

(a) 1.5057×10^{24} (b) 2.0478×10^{24}

(c) 3.0115×10^{24} (d) 4.0956×10^{24}

15. The simplest formula of a compound containing 50% of element X (atomic mass 10) and 50% of element Y (atomic mass 20) is

(a) XY (b) XY_3 (c) X_2Y (d) X_2Y_3

16. If $1\frac{1}{2}$ moles of oxygen combine with Al to form Al_2O_3 the weight of Al used in the reaction is (Al = 27)

(a) 27 g (b) 54 g (c) 49.5 g (d) 31 g

17. A compound contains atoms of three elements A, B and C. If the oxidation number of A is +2, B is +5 and that of C is –2, the possible formula of the compound is

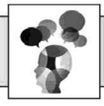
(a) $A_3(BC_4)_2$ (b) $A_3(B_4C)_2$

(c) ABC_2 (d) $A_2(BC_3)_2$

18. If N_A is Avogadro's number then number of valence electrons in 4.2 g of nitride ions (N^{3-}) is
(a) $3N_A$ (b) $4.2N_A$ (c) $1.6N_A$ (d) $3.2N_A$

19. At NTP, 1 L of O_2 reacts with 3 L of carbon monoxide. What will be the volume of CO and CO_2 after the reaction?
(a) 1 L of CO_2, 1 L of CO (b) 2 L of CO_2, 2 L of CO
(c) 1 L of CO_2, 2 L of CO (d) 2 L of CO_2, 1 L of CO

20. In acidic medium, equivalent weight of $K_2Cr_2O_7$ (mol. wt. = M) is
(a) M / 3 (b) M / 4 (c) M / 6 (d) M / 2



Application Based MCQs

21. Arrange the following in the order of increasing mass (atomic mass : O = 16 g, Cu = 63 g, N = 14 g)
(I) One atom of oxygen
(II) One atom of nitrogen
(III) 1×10^{-10} mole of oxygen
(IV) 1×10^{-10} mole of copper
(a) II < I < III < IV (b) I < II < III < IV
(c) III < II < IV < I (d) IV < II < III < I

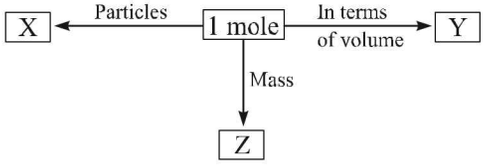
22. 0.32 g of metal on treatment with an acid gave 112 mL of hydrogen at NTP. Calculate the equivalent weight of the metal (in g)
(a) 58 (b) 32 (c) 11.2 (d) 24

23. The atomic weights of two elements A and B are 40 g and 80 g respectively. If x g of A contains y atoms, how many atoms are present in $2x$ g of B
(a) $\frac{y}{2}$ (b) $\frac{y}{4}$ (c) y (d) 2 y

24. The maximum number of molecules are present in
(a) 15 L of H_2 gas at STP (b) 5 L of N_2 gas at STP
(c) 0.5 g of H_2 gas (d) 10 g of O_2 gas

25. How many atoms in total are present in 1 kg of sugar?
(a) 7.92×10^{25} atoms (b) 6×10^{23} atoms
(c) 6.022×10^{25} atoms (d) 1000 atoms

26. Fill in the blanks by choosing the correct options.



	X	Y	Z
(a)	6.023×10^{23} molecules	22.4 L at any pressure	Gram molecular mass
(b)	6.023×10^{23} atoms/molecules	22.4 L at NTP	Gram atomic mass
(c)	6.023×10^{23} atoms	22.4 L at any temperature	1 gram mole
(d)	6.023×10^{23} particles	11.2 L at NTP	Molar volume

27. If 1 mL of water contains 20 drops. Then no. of molecules in a drop of water is
(a) 6.023×10^{23} molecules (b) 1.376×10^{26} molecules
(c) 1.344×10^{18} molecules (d) 4.346×10^{20} molecules

28. Which one of the following is the lightest?
(a) 0.2 mole of hydrogen gas
(b) 6.023×10^{22} molecules of nitrogen
(c) 0.1 g of silver
(d) 0.1 mole of oxygen gas

29. Common salt obtained from sea-water contains 95% NaCl by mass. The approximate number of molecules present in 10.0 g of the salt is
(a) 10^{21} (b) 10^{22} (c) 10^{23} (d) 10^{24}

30. Liquid benzene (C_6H_6) burns in oxygen according to the equation

$$2\,C_6H_6\,(l) + 15\,O_2\,(g) \longrightarrow 12\,CO_2 + 6H_2O\,(g)$$

How many litres of O_2 at STP are needed to complete the combustion of 39 g of liquid benzene? (Mol. wt. of O_2 = 32 g, C_6H_6 = 78 g)
(a) 74 L (b) 11.2 L (c) 22.4 L (d) 84 L

31. In the reaction

$$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(l)$$

When 1 mole of ammonia and 1 mole of O_2 are made to react to completion, then
(a) 1.0 mole of H_2O is produced
(b) 1.0 mole of NO will be produced
(c) all oxygen will be consumed
(d) all ammonia will be consumed

32. An organic compound contains 49.3% carbon, 6.84% hydrogen and its vapour density is 73. Molecular formula of the compound is :
(a) $C_3H_5O_2$ (b) $C_4H_{10}O_2$
(c) $C_6H_{10}O_4$ (d) $C_3H_{10}O_2$

33. For the reaction $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$, the volume of carbon monoxide required to reduce one mole of ferric oxide is
(a) 67.2 dm^3 (b) 11.2 dm^3
(c) 22.4 dm^3 (d) 44.8 dm^3

34. In a reaction container, 100 g of hydrogen and 100 g of Cl_2 are mixed for the formation of HCl gas. What is the limiting reagent and how much HCl is formed in the reaction?
(a) H_2 is limiting reagent and 36.5 g of HCl is formed.
(b) Cl_2 is limiting reagent and 102.8 g of HCl is formed.
(c) H_2 is limiting reagent and 142 g of HCl is formed.
(d) Cl_2 is limiting reagent and 73 g of HCl is formed.

35. Under similar conditions of pressure and temperature, 40 mL of slightly moist hydrogen chloride gas is mixed with 20 mL of ammonia gas, the final volume of gas at the same temperature and pressure will be
(a) 100 mL (b) 20 mL (c) 40 mL (d) 60 mL

36. 1 g of a mixture of $NaHCO_3$ and Na_2CO_3 is heated to 150°C. The volume of the CO_2 produced at STP is 112.0 mL. Calculate the percentage of Na_2CO_3 in the mixture (Na = 23, C = 12, O = 16)
(a) 20 (b) 46 (c) 84 (d) 16

37. 5 litres of a solution contains 25 mg of $CaCO_3$. What is its concentration in ppm (mol wt. of $CaCO_3$ is 100)?
(a) 25 (b) 1 (c) 5 (d) 2500

38. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4. The ratio of number of their molecule is:
(a) 1 : 4 (b) 7 : 32 (c) 1 : 8 (d) 3 : 16

39. In Haber process 10 litres of dihydrogen and 30 litres of dinitrogen were taken for reaction which yielded only 50% of the expected product. What will be the composition of gaseous mixture under the aforesaid condition in the end?
(a) 20 litres ammonia, 25 litres nitrogen, 15 litres hydrogen
(b) 20 litres ammonia, 20 litres nitrogen, 20 litres hydrogen
(c) 10 litres ammonia, 25 litres nitrogen, 15 litres hydrogen
(d) 20 litres ammonia, 10 litres nitrogen, 30 litres hydrogen

40. The percentage of P_2O_5 in diammonium hydrogen phosphate $(NH_4)_2HPO_4$ is
(a) 23.48 (b) 46.96 (c) 53.78 (d) 71.00

41. Volume occupied by one molecule of water (density = 1 g cm^{-3}) is :
(a) 9.0×10^{-23} cm^3 (b) 6.023×10^{-23} cm^3
(c) 3.0×10^{-23} cm^3 (d) 5.5×10^{-23} cm^3

42. In the reaction,

$$2Al(s) + 6HCl(aq) \rightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$$

(a) 11.2 L $H_2(g)$ at STP is produced for every mole HCl(aq) consumed
(b) 6 L HCl(aq) is consumed for every 3 L $H_2(g)$ produced
(c) 33.6 L $H_2(g)$ is produced regardless of temperature and pressure for every mole Al that reacts
(d) 67.2 L $H_2(g)$ at STP is produced for every mole Al that reacts.

43. A 400 mg iron capsule contains 100 mg of ferrous fumarate, $(CHCOO)_2$ Fe. The percentage of iron present in it is approximately
(a) 33% (b) 25% (c) 14% (d) 8%

44. 2.76 g of silver carbonate on being strongly heated yield a residue weighing
(a) 2.16 g (b) 2.48 g (c) 2.64 g (d) 2.32 g

45. One litre hard water contains 12.00 mg Mg^{2+} Milli-equivalents of washing soda required to remove its hardness is :
(a) 1 (b) 12. 16
(c) 1×10^{-3} (d) 12.16×10^{-3}

Skill Based MCQs

46. Experimentally it was found that a metal oxide has formula $M_{0.98}O$. Metal M, present as M^{2+} and M^{3+} in its oxide. Fraction of the metal which exists as M^{3+} would be :
(a) 7.01% (b) 4.08% (c) 6.05% (d) 5.08%

47. The most abundant elements by mass in the body of a healthy human adult are :
Oxygen (61.4%) ; Carbon (22.9%), Hydrogen (10.0%) ; and Nitrogen (2.6%). The weight which a 75 kg person would gain if all ^1H atoms are replaced by ^2H atoms is
(a) 15 kg (b) 37.5 kg (c) 7.5 kg (d) 10 kg

48. A metal oxide has the formula Z_2O_3. It can be reduced by hydrogen to give free metal and water. 0.1596 g of the metal oxide requires 6 mg of hydrogen for complete reduction. The atomic weight of the metal is
(a) 27.9 g (b) 159.6 g (c) 79.8 g (d) 55.8 g

49. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (at. wt. of Fe is 56) present in one molecule of haemoglobin are
(a) 1 (b) 6 (c) 4 (d) 2

50. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/g. whose radius and length 7 Å & 10 Å respectively.
If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus
(a) 3.08×10^3 kg/mol (b) 3.08×10^4 kg/mol
(c) 1.54×10^4 kg/mol (d) 15.4 kg/mol

51. The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (molar mass = 98 g mol^{-1}) by mass will be
(a) 1.45 (b) 1.64 (c) 1.88 (d) 1.22

52. Choose the molecular formula of an oxide of iron in which the mass per cent of iron and oxygen are 69.9 and 30.1 respectively and its molecular mass is 160 g.
(a) FeO (b) Fe_3O_4 (c) Fe_2O_3 (d) FeO_2

53. 1 g of Mg is burnt in a closed vessel containing 0.5 g of O_2. Which reactant is limiting reagent and how much of the excess reactant will be left?
(a) O_2 is a limiting reagent and Mg is in excess by 0.25 g
(b) Mg is a limiting reagent and is in excess by 0.5 g
(c) O_2 is a limiting reagent and is in excess by 0.25 g
(d) O_2 is a limiting reagent and Mg is in excess by 0.75 g

54. In an experiment, 4 g of M_2O_x oxide was reduced to 2.8 g of the metal. If the atomic mass of the metal is 56 g mol^{-1}, the number of O atoms in the oxide is
(a) 1 (b) 2 (c) 3 (d) 4

55. The equivalent weight of a metal is 9 and vapour density of its chloride is 59.25. The atomic weight of metal is
(a) 23.9 g (b) 27.3 g (c) 36.3 g (d) 48.3 g

ANSWER KEY

Conceptual MCQs																			
1	(c)	**3**	(d)	**5**	(d)	**7**	(b)	**9**	(b)	**11**	(a)	**13**	(c)	**15**	(c)	**17**	(a)	**19**	(d)
2	(d)	**4**	(b)	**6**	(b)	**8**	(b)	**10**	(a)	**12**	(d)	**14**	(c)	**16**	(b)	**18**	(a)	**20**	(c)
Application Based MCQs																			
21	(a)	**24**	(a)	**27**	(c)	**30**	(d)	**33**	(a)	**36**	(d)	**39**	(c)	**42**	(a)	**45**	(a)		
22	(b)	**25**	(a)	**28**	(c)	**31**	(c)	**34**	(b)	**37**	(c)	**40**	(c)	**43**	(d)				
23	(c)	**26**	(b)	**29**	(c)	**32**	(c)	**35**	(b)	**38**	(b)	**41**	(c)	**44**	(a)				
Skill Based MCQs																			
46	(b)	**47**	(c)	**48**	(d)	**49**	(c)	**50**	(d)	**51**	(d)	**52**	(c)	**53**	(a)	**54**	(c)	**55**	(a)