Chapter

1

Some Basic Concepts of Chemistry

1. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weighs 10 g and 0.05 mole of X_3Y_2 weighs 9 g, the atomic weights of X and Y are

(a) 40, 30 (b) 60, 40
(c) 20, 30 (d) 30, 20

(NEET-II 2016)

2. What is the mass of the precipitate formed when 50 mL of 16.9% solution of $AgNO_3$ is mixed with 50 mL of 5.8% NaCl solution? (Ag = 107.8, N = 14, O = 16, Na = 23, Cl = 35.5)

(a) 3.5 g (b) 7 g (c) 14 g (d) 28 g

(2015)

3. If Avogadro number N_A, is changed from 6.022×10^{23} mol^{-1} to 6.022×10^{20} mol^{-1} this would change

(a) the mass of one mole of carbon
(b) the ratio of chemical species to each other in a balanced equation
(c) the ratio of elements to each other in a compound
(d) the definition of mass in units of grams.

(2015)

4. The number of water molecules is maximum in

(a) 1.8 gram of water
(b) 18 gram of water
(c) 18 moles of water
(d) 18 molecules of water. *(2015)*

5. A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). What is the molar ratio of the two gases in the mixture?

(a) 16 : 1 (b) 2 : 1 (c) 1 : 4 (d) 4 : 1

(2015, Cancelled)

6. Equal masses of H_2, O_2 and methane have been taken in a container of volume V at temperature 27 °C in identical conditions. The ratio of the volumes of gases $H_2 : O_2$: methane would be

(a) 8 : 16 : 1 (b) 16 : 8 : 1
(c) 16 : 1 : 2 (d) 8 : 1 : 2 *(2014)*

7. When 22.4 litres of $H_{2(g)}$ is mixed with 11.2 litres of $Cl_{2(g)}$, each at S.T.P, the moles of $HCl_{(g)}$ formed is equal to

(a) 1 mol of $HCl_{(g)}$ (b) 2 mol of $HCl_{(g)}$
(c) 0.5 mol of $HCl_{(g)}$ (d) 1.5 mol of $HCl_{(g)}$.

(2014)

8. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much? (At. wt. Mg = 24, O = 16)

(a) Mg, 0.16 g (b) O_2, 0.16 g
(c) Mg, 0.44 g (d) O_2, 0.28 g

(2014)

9. 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is

(a) 0.001 M (b) 0.1 M
(c) 0.02 M (d) 0.01 M

(NEET 2013)

10. In an experiment it showed that 10 mL of 0.05 M solution of chloride required 10 mL of 0.1 M solution of $AgNO_3$, which of the following will be the formula of the chloride (X stands for the symbol of the element other than chlorine)

(a) X_2Cl_2 (b) XCl_2 (c) XCl_4 (d) X_2Cl

(Karnataka NEET 2013)

11. Which has the maximum number of molecules among the following?

(a) 44 g CO_2 (b) 48 g O_3
(c) 8 g H_2 (d) 64 g SO_2

(Mains 2011)

12. The number of atoms in 0.1 mol of a triatomic gas is ($N_A = 6.02 \times 10^{23}$ mol^{-1})

(a) 6.026×10^{22} (b) 1.806×10^{23}
(c) 3.600×10^{23} (d) 1.800×10^{22}

(2010)

13. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, Na^+ and carbonate ions, CO_3^{2-} are respectively (Molar mass of Na_2CO_3 = 106 g mol^{-1})
(a) 0.955 M and 1.910 M
(b) 1.910 M and 0.955 M
(c) 1.90 M and 1.910 M
(d) 0.477 M and 0.477 M *(2010)*

14. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be
(a) 3 mol (b) 4 mol
(c) 1 mol (d) 2 mol *(2009)*

15. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?
(a) 5 L (b) 10 L (c) 7 L (d) 6 L *(2008)*

16. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g HCl?
(a) 0.011 (b) 0.029 (c) 0.044 (d) 0.333 *(2008)*

17. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be
(a) CHO (b) CH_4O
(c) CH_3O (d) CH_2O *(2008)*

18. An element, X has the following isotopic composition:
^{200}X : 90% ^{199}X : 8.0% ^{202}X : 2.0%
The weighted average atomic mass of the naturally occurring element X is closest to
(a) 201 amu (b) 202 amu
(c) 199 amu (d) 200 amu *(2007)*

19. The maximum number of molecules is 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. *(2004)*

20. Which has maximum molecules?
(a) 7 g N_2 (b) 2 g H_2
(c) 16 g NO_2 (d) 16 g O_2 *(2002)*

21. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (at. wt. = 78.4) then minimum molecular weight of peroxidase anhydrous enzyme is
(a) 1.568×10^4 (b) 1.568×10^3
(c) 15.68 (d) 2.136×10^4 *(2001)*

22. Molarity of liquid HCl, if density of solution is 1.17 g/cc is
(a) 36.5 (b) 18.25
(c) 32.05 (d) 42.10 *(2001)*

23. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/g whose radius and length are 7 Å and 10 Å respectively. If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus.
(a) 15.4 kg/mol (b) 1.54×10^4 kg/mol
(c) 3.08×10^4 kg/mol (d) 3.08×10^3 kg/mol *(2001)*

24. In quantitative analysis of second group in laboratory, H_2S gas is passed in acidic medium for precipitation. When Cu^{2+} and Cd^{2+} react with KCN, then for product, true statement is
(a) $K_2[Cu(CN)_4]$ more soluble
(b) $K_2[Cd(CN)_4]$ less stable
(c) $K_3[Cu(CN)_2]$ less stable
(d) $K_2[Cd(CN)_3]$ more stable. *(2000)*

25. Volume of CO_2 obtained by the complete decomposition of 9.85 g of $BaCO_3$ is
(a) 2.24 L (b) 1.12 L
(c) 0.84 L (d) 0.56 L *(2000)*

26. Oxidation numbers of A, B, C are +2, +5 and –2 respectively. Possible formula of compound is
(a) $A_2(BC_2)_2$ (b) $A_3(BC_4)_2$
(c) $A_2(BC_3)_2$ (d) $A_3(B_2C)_2$ *(2000)*

27. The number of atoms in 4.25 g of NH_3 is approximately
(a) 4×10^{23} (b) 2×20^{23}
(c) 1×10^{23} (d) 6×10^{23} *(1999)*

28. Given the numbers: 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers is
(a) 3, 3 and 4 respectively
(b) 3, 4 and 4 respectively
(c) 3, 4 and 5 respectively
(d) 3, 3 and 3 respectively. *(1998)*

29. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule of haemoglobin is
(a) 4 (b) 6 (c) 3 (d) 2
(1998)

30. 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 :
(a) All the oxygen will be consumed.
(b) 1.0 mole of NO will be produced.
(c) 1.0 mole of H_2O is produced.
(d) All the ammonia will be consumed.
(1998)

31. Among the following which one is not paramagnetic? [Atomic numbers; Be = 4, Ne = 10, As = 33, Cl = 17]
(a) Ne^{2+} (b) Be^{+} (c) Cl^{-} (d) As^{+}
(1998)

32. 0.24 g of a volatile gas, upon vaporisation, gives 45 mL vapour at NTP. What will be the vapour density of the substance? (Density of H_2 = 0.089)
(a) 95.93 (b) 59.93 (c) 95.39 (d) 5.993
(1996)

33. The amount of zinc required to produce 224 mL of H_2 at STP on treatment with dilute H_2SO_4 will be
(a) 65 g (b) 0.065 g (c) 0.65 g (d) 6.5 g
(1996)

34. The dimensions of pressure are the same as that of
(a) force per unit volume
(b) energy per unit volume
(c) force
(d) energy. *(1995)*

35. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions, is
(a) 0.0093 mol (b) 2.10 mol
(c) 0.186 mol (d) 0.21 mol.
(1995)

36. The total number of valence electrons in 4.2 g of N_3^- ion is (N_A is the Avogadro's number)
(a) 2.1 N_A (b) 4.2 N_A
(c) 1.6 N_A (d) 3.2 N_A *(1994)*

37. A 5 molar solution of H_2SO_4 is diluted from 1 litre to a volume of 10 litres, the normality of the solution will be
(a) 1 N (b) 0.1 N
(c) 5 N (d) 0.5 N *(1991)*

38. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is
(a) 10 g molecules (b) 5 g molecules
(c) 1 g molecules (d) 0.5 g molecules.
(1990)

39. Boron has two stable isotopes, ^{10}B(19%) and ^{11}B(81%). Calculate average at. wt. of boron in the periodic table
(a) 10.8 (b) 10.2
(c) 11.2 (d) 10.0 *(1990)*

40. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. At 15°C and 150 mmHg 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) N
(c) 2 N (d) 4 N *(1990)*

41. 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 (b) 159.6
(c) 79.8 (d) 55.8 *(1989)*

42. Ratio of C_p and C_V of a gas 'X' is 1.4. The number of atoms of the gas 'X' present in 11.2 litres of it at NTP will be
(a) 6.02×10^{23} (b) 1.2×10^{23}
(c) 3.01×10^{23} (d) 2.01×10^{23}
(1989)

43. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene?
(a) 2.8 kg (b) 6.4 kg (c) 9.6 kg (d) 96 kg
(1989)

44. The number of oxygen atoms in 4.4 g of CO_2 is
(a) 1.2×10^{23} (b) 6×10^{22}
(c) 6×10^{23} (d) 12×10^{23}
(1989)

45. At S.T.P. the density of CCl_4 vapour in g/L will be nearest to
(a) 6.87 (b) 3.42 (c) 10.26 (d) 4.57
(1988)

46. 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}
(1988)

47. 1 cc N_2O at NTP contains
(a) $\frac{1.8}{224} \times 10^{22}$ atoms
(b) $\frac{6.02}{22400} \times 10^{23}$ molecules
(c) $\frac{1.32}{224} \times 10^{23}$ electrons
(d) All the above. *(1988)*

Answer Key

1.	(a)	**2.**	(b)	**3.**	(a)	**4.**	(c)	**5.**	(d)	**6.**	(c)	**7.**	(a)	**8.**	(a)	**9.**	(d)	**10.**	(b)
11.	(c)	**12.**	(b)	**13.**	(b)	**14.**	(b)	**15.**	(a)	**16.**	(b)	**17.**	(c)	**18.**	(d)	**19.**	(a)	**20.**	(b)
21.	(a)	**22.**	(c)	**23.**	(a)	**24.**	(c)	**25.**	(b)	**26.**	(b)	**27.**	(d)	**28.**	(d)	**29.**	(a)	**30.**	(a)
31.	(c)	**32.**	(b)	**33.**	(c)	**34.**	(b)	**35.**	(a)	**36.**	(c)	**37.**	(a)	**38.**	(b)	**39.**	(a)	**40.**	(c)
41.	(d)	**42.**	(a)	**43.**	(c)	**44.**	(a)	**45.**	(a)	**46.**	(a)	**47.**	(d)						

EXPLANATIONS

1. (a) : Let atomic weight of element X is x and that of element Y is y.

For XY_2, $n = \dfrac{w}{\text{Mol. wt.}}$

$$0.1 = \frac{10}{x+2y} \Rightarrow x + 2y = \frac{10}{0.1} = 100 \quad ...(i)$$

For X_3Y_2, $n = \dfrac{w}{\text{Mol. wt.}}$

$$0.05 = \frac{9}{3x+2y} \Rightarrow 3x + 2y = \frac{9}{0.05} = 180 \quad ...(ii)$$

On solving equations (i) and (ii), we get $y = 30$

$x + 2(30) = 100 \Rightarrow x = 100 - 60 = 40$

2. (b) : 16.9% solution of $AgNO_3$ means 16.9 g of $AgNO_3$ in 100 mL of solution.
16.9 g of $AgNO_3$ in 100 mL solution ≡ 8.45 g of $AgNO_3$ in 50 mL solution.
Similarly, 5.8% of NaCl in 100 mL solution ≡ 2.9 g of NaCl in 50 mL solution.
The reaction can be represented as :

	$AgNO_3$ +	NaCl	⟶ AgCl +	$NaNO_3$
Initial mole	8.45/170 = 0.049	2.9/58.5 = 0.049	0	0
Final moles	0	0	0.049	0.049

∴ Mass of AgCl precipitated = 0.049 × 143.3
= 7.02 ≈ 7 g

3. (a) : Mass of 1 mol (6.022×10^{23} atoms) of carbon = 12 g
If Avogadro number is changed to 6.022×10^{20} atoms then mass of 1 mol of carbon

$$= \frac{12 \times 6.022 \times 10^{20}}{6.022 \times 10^{23}} = 12 \times 10^{-3}\ \text{g}$$

4. (c) : 1.8 gram of water = $\dfrac{6.023 \times 10^{23}}{18} \times 1.8$
$= 6.023 \times 10^{22}$ molecules

18 gram of water = 6.023×10^{23} molecules
18 moles of water = $18 \times 6.023 \times 10^{23}$ molecules

5. (d) : Number of moles of $H_2 = \dfrac{1}{2}$

Number of moles of $O_2 = \dfrac{4}{32}$

Hence, molar ratio = $\dfrac{1}{2} : \dfrac{4}{32} = 4 : 1$

6. (c) : According to Avogadro's hypothesis, ratio of the volumes of gases will be equal to the ratio of their no. of moles.

So, no. of moles = $\dfrac{\text{Mass}}{\text{Mol. mass}}$

$n_{H_2} = \dfrac{w}{2}$; $n_{O_2} = \dfrac{w}{32}$; $n_{CH_4} = \dfrac{w}{16}$

So, the ratio is $\dfrac{w}{2} : \dfrac{w}{32} : \dfrac{w}{16}$ or 16 : 1 : 2.

7. (a) : 1 mole ≡ 22.4 litres at S.T.P.

$n_{H_2} = \dfrac{22.4}{22.4} = 1$ mol ; $n_{Cl_2} = \dfrac{11.2}{22.4} = 0.5$ mol

Reaction is as,

	$H_{2(g)}$ +	$Cl_{2(g)}$	⟶ $2HCl_{(g)}$
Initial	1 mol	0.5 mol	0
Final	(1 − 0.5) = 0.5 mol	(0.5 − 0.5) = 0 mol	2 × 0.5 = 1 mol

Here, Cl_2 is limiting reagent. So, 1 mole of $HCl_{(g)}$ is formed.

8. (a) : $n_{Mg} = \dfrac{1}{24} = 0.0416$ moles

$n_{O_2} = \dfrac{0.56}{32} = 0.0175$ moles

The balanced equation is

	Mg +	$\frac{1}{2}O_2$	⟶ MgO
Initial	0.0416 moles	0.0175 moles	0
Final	(0.0416 − 2 × 0.0175) = 0.0066 moles (O_2 is limiting reagent.)	0	2 × 0.0175

∴ Mass of Mg left in excess = 0.0066 × 24 = 0.16 g

9. (d) : Moles of urea = $\dfrac{6.02 \times 10^{20}}{6.02 \times 10^{23}} = 0.001$

Concentration of solution = $\dfrac{0.001}{100} \times 1000 = 0.01$ M

10. (b) : Millimoles of solution of chloride
$= 0.05 \times 10 = 0.5$
Millimoles of $AgNO_3$ solution = $10 \times 0.1 = 1$
So, the millimoles of $AgNO_3$ are double than the chloride solution.
∴ $XCl_2 + 2AgNO_3 \rightarrow 2AgCl + X(NO_3)_2$

11. (c) : 8 g H_2 has 4 moles while the others has 1 mole each.

12. (b) : No. of atoms = N_A × No. of moles × 3
$= 6.023 \times 10^{23} \times 0.1 \times 3 = 1.806 \times 10^{23}$

13. (b) : Given that molar mass of Na_2CO_3 = 106 g

∴ Molarity of solution = $\dfrac{25.3 \times 1000}{106 \times 250}$
$= 0.9547\ \text{M} = 0.955\ \text{M}$

$Na_2CO_3 \rightarrow 2Na^+ + CO_3^{2-}$