

UNIT : 1 SOME BASIC CONCEPTS IN CHEMISTRY

Important Points

[A] Important formulae :

$$1. \quad \text{No. of moles} = \frac{\text{mass}}{\text{Molar mass}}$$

$$2. \quad \text{No. of moles of gas} = \frac{\text{Volume at STP}}{22.4}$$

$$3. \quad \text{No. of moles of Particles} = \frac{\text{No. of Particles}}{6.022 \times 10^{23}}$$

$$4. \quad \text{No. of moles of solute} = \text{Molarity} \times \text{Vol(L)}$$

$$5. \quad \text{Eq. wt. of a salt} = \frac{\text{M.W. of salt}}{\text{Total +ve charge of metal ion}}$$

$$6. \quad \text{Eq. wt. of element} = \frac{\text{Atomic Weight}}{\text{Valency}}$$

$$7. \quad \text{Avg. at. mass} = \frac{m \times a + n \times b}{m + n}$$

where, a + b are atomic masses
and m + n are percentage.

$$8. \quad \% \text{ of element in compound} = \frac{n (\text{at mass of element})}{\text{M.W. of compound}} \times 100$$

where, n = No. of atoms of that element

$$9. \quad \text{Molarity} = \frac{w \times 1000}{\text{M.W.} \times V(\text{ml})}$$

$$10. \quad \text{Normality} = \frac{w \times 1000}{\text{E.W.} \times V(\text{ml})}$$

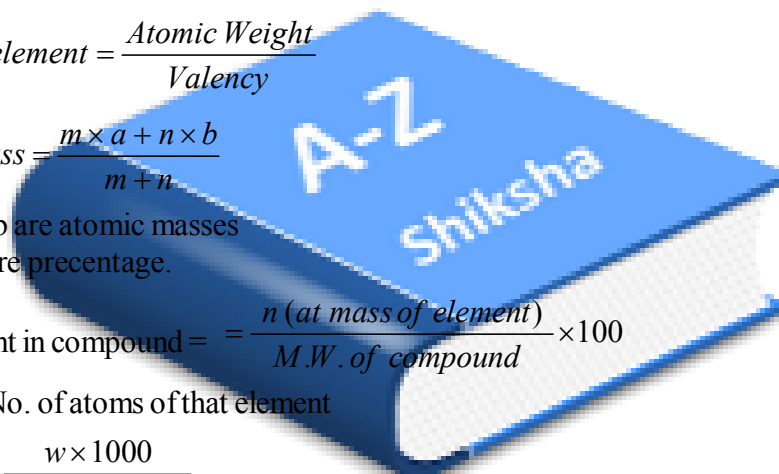
$$11. \quad \text{Molality} = \frac{w \times 1000}{\text{MW} \times W_o(\text{g})}$$

W_o = Weight of solvent

$$12. \quad \text{Mole fraction (X)} = \frac{n}{n + N}$$

$$13. \quad \%W/W = \frac{W \times 100}{W + W_o}$$

$$14. \quad \text{ppm} = \frac{\text{weight(vol) of solute} \times 10^6}{\text{weight(vol) of solution}}$$



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15. Molecular weight = $2 \times \text{V.D.}$
16. $\text{Eq.wt of metal} = \frac{\text{Wt. of metal}}{\text{wt of } H_2 \text{ displaced}} \times 1.008$
17. $\text{Eq.wt of metal} = \frac{\text{Wt. of metal} \times 11200}{\text{Vol of } H_2 \text{ displaced at STP (mL)}}$
18. $\text{Eq.wt of metal} = \frac{\text{Wt. of metal} \times 35.5}{\text{Wt of Chlorine combined}}$
19. $\text{Eq.wt of metal} = \frac{\text{Wt. of metal} \times 11200}{\text{Vol of } Cl_2 \text{ combined at STP (mL)}}$
20. $\text{Eq.wt of metal} = \frac{\text{Wt. of metal} \times 8}{\text{Wt of oxygen combined}}$
21. $\text{Eq.wt of metal} = \frac{\text{Wt. of metal} \times 5600}{\text{Vol of } O_2 \text{ displaced at STP (mL)}}$
22. $\text{Molarity} = \frac{\%W/W \times \text{density} \times 10}{\text{Molecular weight}}$
23. $M_1 V_1 = M_2 V_2$ (Molarity equation)
24. $N_1 V_1 = N_2 V_2$ (Normality equation)
25. $n = \frac{\text{Molecular weight}}{\text{Empirical formula Weight}}$
26. ${}^{\circ}F = \frac{9}{5}({}^{\circ}C) + 32$
27. $K = {}^{\circ}C + 273.15$
28. $1 L = 1 dm^3, 1 mL = 1 cm^3$

[B] Important Facts :

1. Antoine Lavoisier - Law of conservation of mass
2. Joseph proust - Law of definite proportions
3. John Dalton - Law of Multiple proportions
4. Richter - Law of combining weights.
5. Gay Lussac - Law of combining Volumes.
6. $1 \text{ amu} = 1.6605 \times 10^{-24} \text{ gram}$
7. $\text{Mass of } {}^{12}C \text{ atom} = 1.9926 \times 10^{-23} \text{ gram}$
8. $\text{Avogadro number}(N_A) = 6.022 \times 10^{23}$
9. AZT = Azido thymidine, drug used for aids victims.
10. The limiting reagent is the reagent that is entirely consumed when a reaction goes to completion. Its amount limits the amount of the product formed.

[c] Precision and Accuracy.

The term precision refers for 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.

Let us take an example to illustrate. this. Three students were asked to determine the mass of a piece of metal where mass is known to be 0.520g. Data obtained by each Student are recorded in table below

	measurements in g.			
	1	2	3	Average
Student A	0.521	0.515	.0509	0.515
Student B	0.516	0.515	.0514	0.515
Student C	0.521	0.500	.0520	0.520

The data for student A are neither, precise nor accurate. The data for student B are precise but not accurate. The data for student C are both precise and accurate.

M.C.Q.

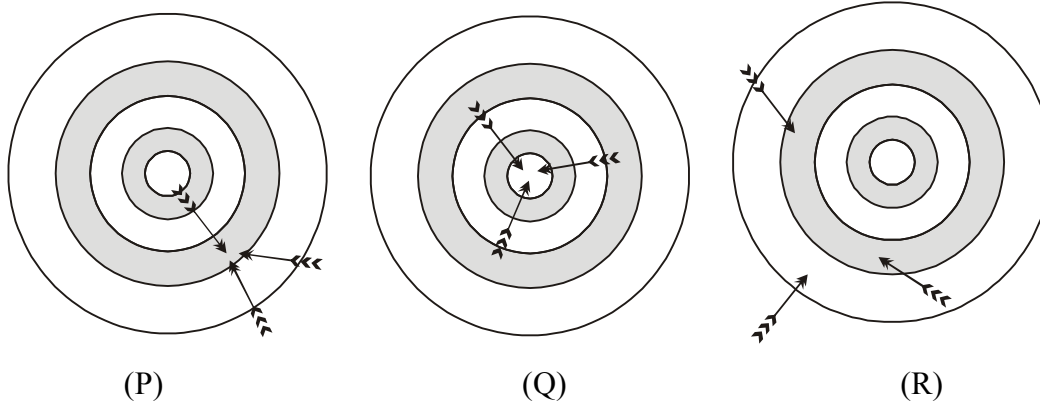
- Identify the wrong statement in the following (AIEEE 2008).
 - CFCs are responsible for ozone layer depletion.
 - Greenhouse effect is responsible for global warming.
 - Ozone layer does not permit I.R. radiation from the sun to reach the earth.
 - Acid rain is mostly because of oxides of 'N' and 'S'.
- In the reaction
$$2Al_{(s)} + 6HCl_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 6Cl^{-}_{(aq)} + 3H_{2(g)}$$
 (AIEEE 2007)
 - 6L $HCl_{(aq)}$ is consumed for every 3L, $H_{2(g)}$ produced.
 - 33.6L $H_{2(g)}$ is produced regardless of temperature and pressure for every mole of Al that reacts.
 - 67.2L $H_{2(g)}$ at STP, is produced for every mole Al that reacts.
 - 11.2L $H_{2(g)}$ at STP, is produced for every mole $HCl_{(aq)}$ consumed.
- Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenyl amine as indicator. The number of moles of Mohr's salt required per mole of dichromate is (IIT JEE 2007)
 - 3
 - 4
 - 5
 - 6
- Which has maximum number of atoms ? (IIT JEE 2003)
 - 24g of C (12)
 - 56g of Fe(56)
 - 27g of Al (27)
 - 108g of Ag (108)
- What volume of hydrogen gas at 273K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) from the reduction of boron trichloride by hydrogen (AIEEE 2003)
 - 89.6L
 - 67.2L
 - 44.8L
 - 22.4L
- In an organic compound of molar mass 108g/mol, C,H and N atoms are present in 9:1:3.5 by weight Molecular formula can be (AIEEE 2002)
 - $C_6H_8N_2$
 - $C_6H_{10}N$
 - $C_5H_6N_3$
 - $C_4H_{18}N_3$

7. Number of atoms in 560 g of Fe (atomic mass = 56) is (AIEEE 2002)
 (a) twice that of 70 g N. (b) half that of 20 g H
 (c) both (a) and (b) (d) None of these
8. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is (IIT JEE 2001)
 (a) $\frac{\text{Molar mass}}{2}$ (b) $\frac{\text{Molar mass}}{6}$
 (c) $\frac{\text{Molar mass}}{3}$ (d) same as molar mass
9. Mixture X = 0.02 mole of $[Co(NH_3)_5SO_4]Br$ and 0.02 mole of $[Co(NH_3)_5Br]SO_4$ was prepared in 2L of Solution
 1L of mixture X + excess $AgNO_3 \rightarrow Y$
 1L of mixture X + excess $BaCl_2 \rightarrow Z$
 Number of mole of Y and Z are (IIT JEE 2003)
 (a) 0.01, 0.01 (b) 0.02, 0.01
 (c) 0.01, 0.02 (d) 0.02, 0.02
10. How many moles of electron weight one kilogram? (IIT JEE 2002)
 (a) 6.023×10^{23} (b) $\frac{1}{9.108} \times 10^{31}$
 (c) $\frac{6.023}{9.108} \times 10^{54}$ (d) $\frac{1}{9.108 \times 6.023} \times 10^8$
11. An Oxide of metal contains 60% of the metal. What will be the equivalent weight of the metal?
 (a) 12 (b) 40 (c) 24 (d) 48
12. A container is filled with 2L of water. What will be the volume of water in m^3 ?
 (a) 2×10^3 (b) 1×10^3 (c) 2×10^{-3} (d) 1×10^{-3}
13. The mass of carbon -12 atom considered in the definition of a mole is
 (a) 0.012Kg (b) 0.12g (c) 120 mg (d) None of these
14. The drug which is used for treating AIDS victims is
 (a) Azidothymidine (b) Cis-platin
 (c) Taxol (d) All of these
15. Chose the incorrect statement .
 (a) The constituents of a compound cannot be separated into simpler substances by physical methods.
 (b) An element consists of only one type of particles and these particles may be atoms or molecules.
 (c) The properties of a compound are same as its constituent elements.
 (d) Atoms of different elements are different in nature.

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16. Which of the following is a pair of physical and chemical property respectively of a substance ?
(a) acidity & combustibility (b) colour & density
(c) basicity & colour (d) density & acidity.
17. What is the symbol of S.I. unit for the amount of substance ?
(a) N_A (b) n (c) mole (d) mol
18. What is the symbol of a multiple '10⁹' ?
(a) G (b) E (c) n (d) Z
19. Find the correct relation.
(a) $^{\circ}F = \frac{9}{5}(^{\circ}C) - 32$ (b) $^{\circ}C = \frac{5}{9}(^{\circ}F + 32)$
(c) Both & (a) and (b) (d) Neither (a) nor (b)
20. In chemistry a number is represented in the form $N \times 10^n$. This method of expressing the number is called scientific notation. What is the value of 'N' here.
(a) 1 to 10 (b) 0.1 to 9.99
(c) 10 to 100 (d) Any value can be taken
21. What is the correct scientific notation for 0.00016 ?
(a) 1.6×10^{-4} (b) 16×10^{-5}
(c) 0.16×10^{-3} (d) cannot be determined.
22. How many significant digits are there in 0.25 ?
(a) 1 (b) 2 (c) 3 (d) cannot be determined.
23. Which of the following number contains three significant digits ?
(a) 0.200 (b) 0.030 (c) 0.0052 (d) 0.002
24. What is the number of neutrons in Zn^{2+} ion
(Atomic mass number = 70) (IITJEE 1979)
(a) 34 (b) 36 (c) 38 (d) 40
25. The same amount of Zinc is treated separately with excess of sulphuric acid and excess of sodium hydroxide.
What will be the ratio of volumes of hydrogen evolved ? (IITJEE 1979)
(a) 1 : 1 (b) 1 : 2 (c) 2 : 1 (d) 9 : 4
26. 2.76g of silver carbonate on being strongly heated yields a residue weighing (IITJEE 1979)
(a) 2.16g (b) 2.48 g (c) 2.32 g (d) 2.64 g
27. Find the total number of electrons in one molecule of carbon dioxide.
(a) 22 (b) 44 (c) 66 (d) 88
28. A gaseous mixture contains oxygen and nitrogen in the ratio of 1 : 4 by weight. Therefore, the ratio of their number of molecules is
(a) 1 : 4 (b) 1 : 8 (c) 7 : 32 (d) 3 : 16
29. Identify the incorrect unit conversion factor.
(a) $\frac{1cm^3}{1mL}$ (b) $\frac{1cm}{10mm}$ (c) $\frac{60s}{1min}$ (d) None of these

30. 90 g KClO_3 on heating gives 2.96g KCl and 1.92g oxygen. Which of the following laws is illustrated by this statement ?
 (a) Law of definite proportion (b) Law of mass conservation
 (c) Law of multiple proportion (d) Avogadro's law.
31. Match the following property.
- | A | B |
|--------------------------------------|---------------|
| (i) Law of Multiple proportions. | (p) Richter |
| (ii) Law of Combining volumes | (q) Proust |
| (iii) Law of Reciprocal proportions. | (r) GayLussac |
| (iv) Law of Constant composition. | (s) Dalton |
- (a) i - s, ii - p, iii - r, iv - q (b) i - s, ii - r, iii - p, iv - q
 (c) i - s, ii - r, iii - q, iv - p (d) i - q, ii - r, iii - p, iv - s
32. Two oxides of a metal 'M' contain 27.6% and 30.0% of oxygen respectively. If the formula of the first oxide is M_3O_4 , find that of the second.
 (a) M_2O_3 (b) M_2O (c) MO_2 (d) M_3O_2
33. Naturally occurring Boron consists of two isotopes having atomic masses 10.01 and 11.01 respectively. Calculate the percentage of both the isotopes in natural Boron (Atomic mass of natural Boron = 10.81)
 (a) 20% and 80% (b) 80% and 20%
 (c) 25% and 75% (d) 75% and 25%
34. Calculate the mass percent of Na and S in sodium sulphate.
 (a) Na = 16.2%, S = 22.54% (b) Na = 32.39%, S = 11.26%
 (c) Na = 22.54%, S = 32.39% (d) Na = 32.39%, S = 22.54%
35. Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% oxygen by mass.
 (a) FeO (b) Fe_2O_3 (c) Fe_3O_4 (d) Fe_3O_2
36. Calculate the amount of carbon dioxide that can be produced when 1 mole of carbon is burnt in 16 g of dioxygen.
 (a) 44g (b) 22g (c) 88g (d) 11 g
37. Calculate the concentration of nitric acid in moles per litre which has a density, 1.41 g/mL. %w/w of nitric acid is
 (a) 15.44M (b) 0.064M (c) 0.077M (d) 12.87M
38. In a reaction : $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightarrow 2\text{NH}_{3(g)}$, 2000g N_2 reacts with 1000g H_2 which reactant will left unreacted ? How much ?
 (a) N_2 , 2428g (b) H_2 , 428.6g
 (c) N_2 , 571.4g (d) H_2 , 571.4g
39. Calculate the number of sulphate ions in 100mL of 0.001M ammonium sulphate solution.
 (a) 6.022×10^{-19} (b) 6.022×10^{19}
 (c) 6.022×10^{20} (d) 6.022×10^{-20}
40. Calculate the molarity of a solution of ethanol in water in which mole fraction of ethanol is 0.040.
 (a) 2.31M (b) 0.213M (c) 0.0213M (d) 23.1M

41. Some statements are given below based on the pictures. Identify true and false statements.



- (i) 'P' and 'Q' both indicates precision and accuracy.
 (ii) 'Q' indicates precision and accuracy while 'R' indicates neither precision nor accuracy.
 (iii) 'P' indicates precision but not accuracy.
 (iv) 'Q' indicates both precision and accuracy
- (a) FTTT (b) TTTT (c) TTFT (d) FTFT
42. The normality of 0.3M phosphorous acid is (IITJEE 1999)
 (a) 0.1 (b) 0.9 (c) 0.3 (d) 0.6
43. An aqueous solution of 6.3g oxalic acid dihydrate is made upto 250 mL. The volume of 0.1 N NaOH required to completely neutralize 10 mL of this solution is
 (a) 40 mL (b) 20 mL (c) 10 mL (d) 4 mL
44. The pair of the compounds in which both the metals are in the highest possible oxidation state is
 (a) $[Fe(CN)_6]^{3-}$, $[Co(CN)_6]^{3-}$ (b) CrO_2Cl_2 , MnO_4^-
 (c) TiO_3 , MnO_2 (d) $[Co(CN)_6]^{3-}$, MnO_3
45. In the analysis of 0.0500 g sample of feldspar, a mixture of the chlorides of sodium and potassium is obtained, which weighs 0.1180 g. Subsequent treatment of the mixed chlorides with silver nitrate gives 0.2451g of silver chloride. What is the percentage of a sodium oxide and potassium oxide in feldspar ?
 (a) 10.62% Na_2O , 3.58% K_2O (b) 3.58% Na_2O , 10.62% K_2O
 (c) 10.62% Na_2O , 35.8% K_2O (d) 35.8% Na_2O , 10.62% K_2O
46. 5.5 g of a mixture of $FeSO_4 \cdot 7H_2O$ and $Fe_2(SO_4)_3 \cdot 9H_2O$ requires 5.4 mL of 0.1N $KMnO_4$ solution for complete oxidation. Calculate the number of mole of $Fe_2(SO_4)_3 \cdot 9H_2O$ in the mixture.
 (a) 0.0095 (b) 0.15 (c) 0.0952 (d) 1.52
47. A compound contains 28% of nitrogen and 72% of a metal by weight. Three atoms of the metal combine with two atoms of nitrogen. Find the equivalent weight of the metal.
 (a) 12 (b) 24 (c) 36 (d) 48
48. The density of a 3M $Na_2S_2O_3$ solution is 1.25 g per mL, What is the molalities of Na^+ and $S_2O_3^{2-}$ ions ?
 (a) 3.865, 7.732 (b) 7.732, 3.865 (c) 1.933, 7.732 (d) 7.732, 1.933

49. Haemoglobin present in blood contain 3.72% by mass iron. Calculate the number of iron atoms in 2.0g of haemoglobin.
 (a) 4.53×10^{26} (b) 4.53×10^{23} (c) 5.95×10^{19} (d) 8×10^{20}
50. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms (AIEEE 2006)
 (a) 0.02 (b) 3.125×10^{-2} (c) 1.25×10^{-2} (d) 2.5×10^{-2}
51. The unit $J Pa^{-1}$ is equivalent to
 (a) m^3 (b) cm^3 (c) dm^3 (d) none of these
52. The density of Al metal is $2.7 gcm^{-3}$. An irregularly shaped piece of aluminium weighing 40.0g is added to a 100mL graduated cylinder containing 50.0mL of water. upto what height the water level will rise in the cylinder ?
 (a) 14.8mL (b) 79.6mL (c) 64.8mL (d) 50mL
53. A sample of clay after drying partially was found to contain 50% silica and 7% water. The original sample of clay had 12% water, What is the percentage of silica in the original sample?
 (a) 50% (b) 5% (c) 43% (d) 47%
54. In which of the following pairs percent composition of element is not same ?
 (a) benzene and ethyne (b) But - 2 - ene and Cyclobutane
 (c) glucose and fructose (d) phenol and ethanol
55. What weight of CuO will be required to provide 200Kg copper
 (a) 200Kg (b) 79.5Kg (c) 250Kg (d) 100Kg
56. Choose the proper option after studying following statement (T = True, F = False)
 1. The percent composition of vinyl chloride and its polymer PVC are same.
 2. The percent composition of phosphorous trioxide (P_2O_3) is half than that of its dimer phosphorous hexoxide (P_4O_6) for each of the elements present in them.
 (a) T, F (b) F, T (c) T, T (d) F, F
57. Impure sample of ZnS contains 42.34% Zn. What is the percentage of pure ZnS in the sample ?
 (a) 67% (b) 63% (c) 58% (d) 37%
58. If the atomic mass of carbon were set at 50 amu, what would be the value of Avogadro's number ?
 (a) 5.01×10^{24} (b) 6.022×10^{23} (c) 1.66×10^{24} (d) none of these
59. For which of the following compounds molecular weight cannot be determined from atomic weights ?
 (a) $Fe_4 [Fe(CN)_6]$ (b) TiO_2
 (c) $TiO_{1.12}$ (d) none of these
60. Which one of the following contains greatest number of oxygen atoms ?
 (a) 1.0g of O atoms (b) 1.0g of O_2
 (c) 1.0g of O_3 (d) All have same number of atoms

61. Which of the following chemical equation is incorrectly balanced ?
- (a) $Sb_2S_3 + 12HCl \rightarrow 2H_3SbCl_6 + 3H_2S$
- (b) $3IBr + 4NH_3 \rightarrow NI_3 + 3NH_4Br$
- (c) $2KrF_2 + 2H_2O \rightarrow 2Kr + 2O_2 + 4HF$
- (d) $PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$
62. Match the following
- | Column -I | Column -II |
|---------------|---------------------|
| (i) Cl_2O_3 | (P) basic anhydride |
| (ii) Li_2O | (Q) acid anhydride |
| (iii) CO_2 | (R) base |
- (a) (i) - (q) (ii) - (p) (iii) - (q)
- (b) (i) - (r) (ii) - (q) (iii) - (p)
- (c) (i) - (p) (ii) - (q) (iii) - (r)
- (a) (i) - (p) (ii) - (q) (iii) - (p)
63. How many g of NaOH can be obtained by reaction of 1 Kg of Na_2CO_3 with $Ca(OH)_2$?
- (a) 106 g (b) 850 g (c) 755g (d) 943 g
64. How much calcium oxide (CaO) can be obtained by heating 200 Kg of lime stone that is 95% pure $CaCO_3$?
- (a) 56Kg (b) 190Kg (c) 170Kg (d) 107Kg
65. Calculate the amount of NaOH required to neutralize 100 mL 0.1M H_2SO_4 .
- (a) 40g (b) 0.4 g (c) 80 g (d) 0.8 g
66. 3g of an oxide of a metal is converted into chloride and it yielded 5 g of chloride. Find the equivalent weight of the metal.
- (a) 33.25 (b) 3.325 (c) 12 (d) 20
67. A compound contains two oxygen atoms, four carbon atoms and number of hydrogen atoms is double of carbon atoms. What is the density of vapour of this compound ?
- (a) 88 (b) 44 (c) 132 (d) 72
68. The number of molecules in 100 mL of each of O_2 , NH_3 and CO_2 at STP are
- (a) $CO_2 < O_2 < NH_3$ (b) $NH_3 < O_2 < CO_2$
- (c) $NH_3 = CO_2 < O_2$ (d) $NH_3 = O_2 = CO_2$
69. Which of the following represents the formula of a compound which contains 26% nitrogen and 74% oxygen ?
- (a) N_2O (b) NO (c) NO_2 (d) N_2O_5
70. NKg^{-1} is the unit of
- (a) momentum (b) velocity (c) Pressure (d) acceleration

71. Which one of the following statements is incorrect ?
- All elements are homogeneous system
 - Compounds made up of a number of elements are heterogeneous.
 - A mixture is not always heterogeneous
 - Smoke is a heterogeneous mixture.
72. A balanced chemical equation is in accordance with
- Avogadro's law.
 - Law of constant proportions
 - Law of conservation of mass
 - Law of gaseous volumes.
73. The atomic weights of two elements X and Y are 20 and 40 respectively. If 'a' gm of X contains 'b' atoms, how many atoms are present in '2a' gm of Y ?
- b
 - a
 - 2b
 - $\left(\frac{a}{2}\right)$
74. If the components of air are N_2 , 78%, O_2 , 21% ; Ar, 0.9% and CO_2 , 0.1% by volume, what will be the molecular weight of air ?
- 28.9
 - 32.4
 - 16.4
 - 14.5
75. Calculate the molarity of a solution obtained by mixing 50 mL of 0.5 M H_2SO_4 and 75 mL of 0.25 M H_2SO_4 .
- 0.375 M
 - 0.35 M
 - 0.045 M
 - 0.45 M
76. Which of the following has the highest normality ?
- 1 M H_2SO_4
 - 1 M H_3PO_3
 - 1 M H_3PO_4
 - 1 M HNO_3
77. In an experiment, 4 gm of M_2O_x oxide was reduced to 2.8 gm of the metal. If the atomic mass of the metal is 56 gm/mol, the number of oxygen atoms in the oxide is (AFMC 2010)
- 1
 - 2
 - 3
 - 4
78. Match the following
- | Column - I | Column - II |
|------------|----------------|
| (i) femto | (P) 10^9 |
| (ii) yotta | (Q) 10^{-15} |
| (iii) giga | (R) 10^{-18} |
| (iv) atto | (S) 10^{24} |
- i - q, ii - p, iii - r, iv - s
 - i - s, ii - q, iii - p, iv - r
 - i - q, ii - s, iii - p, iv - r
 - i - r, ii - s, iii - p, iv - q
79. The total number of atoms of all elements present in mole of ammonium dichromate is
- 19
 - 6.023×10^{23}
 - 114.47×10^{23}
 - 84×10^{23}
80. 0.32 gm of a metal on treatment with an acid gave 112 mL of hydrogen at STP. Calculate the equivalent weight of the metal
- 58
 - 32
 - 11.2
 - 24

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81. For a reaction $A + 2B \rightarrow C$, the amount of C formed by starting the reaction with 5 moles of A and 8 moles of B is
(a) 5 moles (b) 8 moles (c) 16 moles (d) 4 moles
82. 100 mL of PH_3 on heating forms P and H_2 . The volume change in the reaction is
(a) an increase of 50 mL (b) an increase of 100 mL
(c) an increase of 150 mL (d) a decrease of 50 mL
83. An organic compound made of C, H, and N contains 20% nitrogen. Its molecular weight is (WBJEE 2009)
(a) 70 (b) 140 (c) 100 (d) 65
84. Volume occupied by one molecule of water ($d = 1 \text{ gm cm}^{-3}$) is
(a) $9 \times 10^{-23} \text{ cm}^3$ (b) $6.02 \times 10^{-23} \text{ cm}^3$ (c) $3 \times 10^{-23} \text{ cm}^3$ (d) $5.5 \times 10^{-23} \text{ cm}^3$
85. Calculate the number of moles in 1 m^3 gas at STP.
(a) 4.46 (b) 44.6 (c) 446 (d) 4460
86. An ore contains 1.24% of the mineral argentite Ag_2S by mass. How many grams of this ore would have to be processed in order to obtain 1.0 g of pure solid silver?
(a) 23.15 g (b) 69.45 g (c) 92.6 g (d) 46.3 g
87. Find the electric charge in coulomb of 9.0 gm of Al^{3+} ions.
(a) 9.6×10^4 (b) 6.9×10^4 (c) 2.9×10^5 (d) 4.80×10^{-19}
88. Which of the following is not a homogeneous mixture?
(a) smoke (b) air (c) Brass (d) Aqueous solution of sugar
89. Which of the following has the largest number of atoms?
(a) 0.5g atom of Cu (b) 0.635g of Cu
(c) 0.25 moles of Cu atom (d) 1 g of Cu
90. 27 g of Al (at mass = 27) will react with oxygen equal to (IIT 1978)
(a) 24 g (b) 8 g (c) 40 g (d) 10 g
91. Two containers P and Q of equal volumes contain 6 g of O_2 and SO_2 respectively at 300K and 1 atmosphere. Then
(a) No. of molecules in P is less than that in Q
(b) No. of molecules in Q is less than that in P
(c) No. of molecules in P and Q are same.
(d) cannot be determined
92. Which of the following pairs of substances illustrates the law of multiple proportions?
(a) CO and CO_2 (b) NaCl and NaBr
(c) H_2O and D_2O (d) MgO and $\text{Mg}(\text{OH})_2$

In each of the following questions, two statements are given, one is Assertion (A) and the other is Reason (R). Examine the statements carefully and mark the correct answer according to the instructions given below :

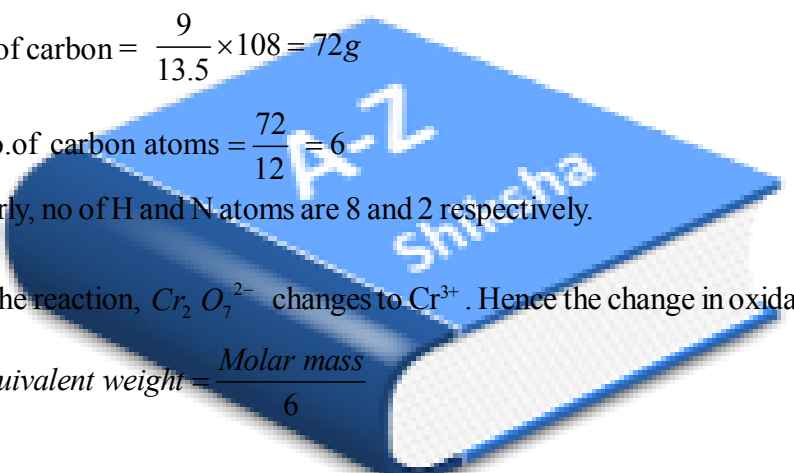
- (a) If both A and R are correct and R is the correct explanation of A.
(b) If both A and R are correct and R is not the correct explanation of A.
(c) If A is correct R is wrong.
(d) If both A and R are false.

93. A : Normality of 0.1M H_2SO_4 is 0.2N.
R : H_2SO_4 is a dibasic acid.
94. A : 1 Gram molecule of sulphur also represents 1 gram atom of sulphur.
R : Atomicity of sulphur is one.
95. A : In the equation $NH_3 + HCl \rightarrow NH_4Cl$, Gay-Lussac's law is not applicable to NH_4Cl .
R : NH_4Cl is not a gas,.
96. A : Atomic mass of sodium is 23 u.
R : An atom of sodium is 23 times heavier than an atom of ^{12}C .
97. A : Pure water, irrespective of its source always contain hydrogen and oxygen in the ratio 1 : 8 by mass.
R : Total mass of reactants and products remains constant during physical or chemical change.
98. A : Mass numbers of most of the elements are fractional.
R : Mass numbers are obtained by comparing with mass number of ^{12}C .
99. A : The mass of the products formed in a reaction depends upon the limiting reactant.
R : Limiting reactant reacts completely in the reaction.
100. A : Cinnabar is a chemical compound whereas brass is mixture.
R : Cinnabar always contain 6.25 times mercury than sulphur by weight. Brass can have any proportion of Cu and Zn.
101. A : 1 L of O_2 and 1 L of O_3 contains the same number of moles under identical conditions.
R : Under identical conditions, 1 L of O_2 and 1 L of O_3 contain the same number of oxygen atoms.
102. A : The standard unit for expressing atomic mass is amu.
R : Now a days amu is represented by 'u'.

ANSWER KEY

1 c	2 d	3 d	4 a	5 b	6 a	7 c	8 b	9 a	10 d	11 a	12 c	13 a	14 a	15 c
16 d	17 d	18 a	19 d	20 a	21 a	22 b	23 a	24 d	25 a	26 c	27 a	28 c	29 d	30 b
31 b	32 a	33 a	34 d	35 b	36 b	37 a	38 d	39 b	40 a	41 a	42 d	43 a	44 b	45 b
46 a	47 a	48 b	49 c	50 b	51 a	52 c	53 d	54 d	55 c	56 a	57 b	58 d	59 d	60 d
61 c	62 a	63 c	64 d	65 d	66 a	67 b	68 d	69 d	70 d	71 b	72 c	73 a	74 a	75 b
76 c	77 c	78 c	79 c	80 b	81 d	82 a	83 a	84 c	85 b	86 c	87 a	88 a	89 a	90 a
91 b	92 a	93 a	94 d	95 a	96 c	97 b	98 d	99 a	100 a	101 c	102 b			

SOLUTIONS/HINTS

3. (d)
→ The redox reaction between potassium dichromate and Mohr's salt is :
→ $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$
4. (a)
→ Number of particles \propto Number of moles
→ No. of moles of carbon = $\frac{24}{12} = 2$
5. (b)
→ $2BCl_3 + 3H_2 \rightarrow 2B + 6HCl$
2 mol 3 mol 2 mol
= 21.6 g
→ $V = \frac{nRT}{P} = \frac{3 \times 0.0821 \times 273}{1} = 67.2L$
6. (a)
→ mass of carbon = $\frac{9}{13.5} \times 108 = 72g$
→ \therefore No. of carbon atoms = $\frac{72}{12} = 6$
→ similarly, no of H and N atoms are 8 and 2 respectively.
8. (b)
→ During the reaction, $Cr_2O_7^{2-}$ changes to Cr^{3+} . Hence the change in oxidation number of Cr is 6.
→ \therefore Equivalent weight = $\frac{\text{Molar mass}}{6}$
9. (a)
→ In 2L solution, there are 0.02 mol Br^- ions and 0.02 mole SO_4^{2-}
 \therefore 1 L of mixture X contains 0.01 mol Br^- and 0.01 mol SO_4^{2-} ions.
→ Hence, Y = 0.01 mol AgBr
Z = 0.01 mol $BaSO_4$
10. (d)
→ Mass of an electron = $9.108 \times 10^{-31} Kg$
→ No. of electrons in 1 Kg = $\frac{1}{9.108 \times 10^{-31}}$
$$= \frac{1}{9.108 \times 10^{-31} \times 6.023 \times 10^{23} mol^{-1}}$$
$$= \frac{10^8}{9.108 \times 6.023} mol$$
- 

11. (a)
 → mass of metal = 60 g
 ∴ mass of oxygen = 40 g
 → mass of oxygen = mass of metal
 $40 \text{ g} = 60 \text{ g}$
 $8 \text{ g} = (?)$
 $= \frac{8 \times 60}{40} = 12$

25. (a)
 (i) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
 (ii) $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

26. (c)
 $Ag_2CO_{3(s)} \xrightarrow{\Delta} Ag_2O_{(s)} + CO_{2(g)}$
 $1 \text{ mol} \quad 1 \text{ mol}$
 ∴ $0.01 \text{ mol} \quad 0.01 \text{ mol}$
 → Therefore mass of residue (Ag_2O) = $0.01 \times \text{molar mass of } Ag_2O$
 $= 0.01 \times 232 = 2.32 \text{ g}$

28. (c)
 → The ratio by weight = $\frac{1}{4}$
 → ∴ Ratio of moles = $\frac{1/32}{4/28} = \frac{28}{4 \times 32} = \frac{7}{32}$

32. (a)
 → Let 'x' be the atomic mass of metal 'M'
 → In the oxide M_3O_4 , the mass of 'M' = 72.4 and that of 'O' = 27.6

$$\therefore M \frac{72.4}{x} O \frac{27.6}{16} = M_3O_4$$

$$\therefore \frac{72.4}{x} : \frac{27.6}{16} = 3 : 4$$

$$\therefore x = 56$$

- For second oxide, the mass of 'M' = 70 and that of 'O' = 30

$$\therefore M \frac{70}{56} O \frac{30}{16}$$

$$= M_{1.25} O_{1.875}$$

$$= M_1 O_{1.5} \quad \text{OR} \quad M_2 O_3$$

33. (a)

→ Let the % of isotope with atomic mass 10.01 be 'x'

∴ % of isotope with atomic mass 11.01 = 100-x

$$\rightarrow \text{Avg at mass} = \frac{10.01x + (100-x)11.01}{100} = 10.81(\text{Given})$$

37. (a)

→ 69% w/w means 100 g nitric acid solution contain 69 g of nitric acid by mass.

$$\rightarrow \therefore \text{moles of } HNO_3 = \frac{69}{63} = 1.095$$

$$\rightarrow \text{Vol. of 100 g nitric acid solution} = \frac{100}{1.41} = 0.07092 L$$

$$\therefore \text{moles per litre} = \frac{1.095}{0.07092} = 15.44$$

38. (d) $N_2 + 3H_2 \rightarrow 2NH_3$

28 g 6 g

2000 g (?)

$$= \frac{2000 \times 6}{28} = 428.6 g$$

→ But we are given 1000 g H_2 Therefore 1000 - 428.6 = 571.4 g H_2 will left.

39. 3(b)

$$\rightarrow \text{No of moles of } (NH_4)_2SO_4 = \text{molarity} \times \text{vol(L)} \\ = 0.001 \times 0.1 = 0.0001$$

$$\therefore \text{No. of } SO_4^{2-} \text{ ions} = 0.0001 \times 6.022 \times 10^{23} = 6.022 \times 10^{19}$$

40. (a)

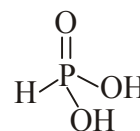
$$\rightarrow X_{ETOH} = \frac{n_{(ETOH)}}{n_{(ETOH)} + n_{(H_2O)}} \therefore 0.04 = \frac{n_{(ETOH)}}{n_{(ETOH)} + 55.55}$$

$$\therefore n_{(ETOH)} = 2.31$$

42. (d)

→ phosphorous acid (H_3PO_3) is a dibasic acid. Its structure is as follows :

$$\rightarrow \text{Normality} = \text{basicity} \times \text{Molarity} \\ = 2 \times 0.3 = 0.6$$



43. (a)

→ Equivalent of $H_2C_2O_4 \cdot 2H_2O$ in 10ml = Equivalent of NaOH

$$\therefore \frac{6.3 \times 1,0000}{63 \times 250 \times 0.1} = V \\ = 40 mL$$

44. (b)
 → The oxidation states of various metals are :

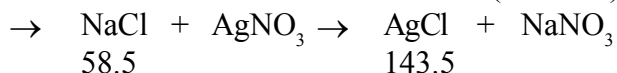
(a) $Fe = +3, Co = +3$

(b) $Cr = +6, Mn = +7$

(c) $Ti = +6, Mn = +4$

(d) $Co = +3, Mn = +6$

45. (b)
 → Suppose amount of NaCl in the mixture = 'x' g
 ∴ The amount of KCl in the mixture = (0.118 - x) g



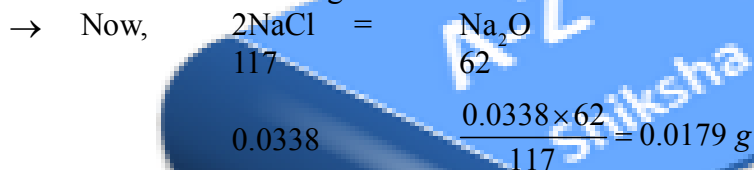
$$\therefore x \quad \frac{143.5 \times x}{58.5} \text{ g} \dots\dots\dots (i)$$

$$\rightarrow \text{Similarly AgCl obtained from KCl} = \frac{143.5 \times (0.118 - x)}{74.5} \text{ g} \dots\dots\dots (ii)$$

→ But (i) + (ii) = 0.2451 g (Given)

∴ Amount of NaCl = 0.0338 g

Amount of KCl = 0.0842 g



$$\therefore \% \text{ of } \text{Na}_2\text{O} = \frac{0.0179 \times 100}{0.5} = 3.58\% \dots\dots$$

46. (a)
 → Weight of $FeSO_4 \cdot 7H_2O = \frac{5.4 \times 0.1 \times 278}{1000} = 0.150 \text{ g}$

→ Moles of $Fe_2(SO_4)_3 \cdot 9H_2O = \frac{5.35}{562} = 0.0095$

47. (a)
 → $\text{Equivalent weight} = \frac{\text{Atomic Weight}}{\text{Valency}}$

48. (b)
 → $m = \frac{1000 M}{1000d - MM_s}, \quad M = \text{Molarity of solution}$
 $d = \text{density of solution}$
 $M_s = \text{Molar mass of solute}$
 $= \frac{1000 \times 3}{1000 \times 1.25 - 3 \times 158} = 3.865$

51. (a)

$$\frac{J}{Pa} = \frac{Work}{Pressure} = \frac{Nm}{Nm^{-2}} = m^3$$

52. (c)

$$\rightarrow d = \frac{m}{v}$$

$$\rightarrow \therefore V = \frac{m}{d} = \frac{40}{2.7} = 14.8 \text{ cm}^3$$

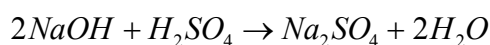
\rightarrow Water level in cylinder = 50 + 14.8 = 64.8 mL

65. (d)

\rightarrow 0.1M H_2SO_4 = 1000mL solution contains 0.1 mol H_2SO_4

\therefore 100mL solution contains 0.01 mol H_2SO_4

$\rightarrow \therefore$ mass of H_2SO_4 = 0.01 \times 98 = 0.98 g



2(40)g 98g

(?) \therefore 0.98g

$$= \frac{80 \times 0.98}{98} = 0.8g$$

66. (a)

$$\rightarrow \frac{Wt. \text{ of metal oxide}}{Wt. \text{ of metal Chloride}} = \frac{Eq. \text{ wt. of metal} + Eq. \text{ wt. of oxide}}{Eq. \text{ wt. of metal} + Eq. \text{ wt. of Chloride}}$$

$$\therefore \frac{3}{5} = \frac{E + 8}{E + 35.5} \quad \therefore E = 33.25$$

67. (b)

\rightarrow M.F. $C_4H_8O_2$

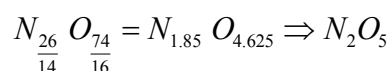
\therefore Molar mass = 88

$$\therefore \text{Vapour density} = \frac{88}{2} = 44$$

68. (b)

\rightarrow Equal volumes under identical conditions contain equal no. of molecules

69. (d)



70. (d)

$\rightarrow F = ma$

$$a = \frac{f}{m} = \frac{N}{Kg} = NKg^{-1}$$

73. (a)

$$\text{No of moles of X} = \frac{a}{20}$$

$$\therefore \text{No. of atoms of X} = \frac{a}{20} \times N = b(\text{given})$$

$$\therefore a = \frac{20b}{N}$$

$$\text{No. of moles of Y} = \frac{2a}{40}$$

$$\begin{aligned} \therefore \text{No. of atoms of Y} &= \frac{2a}{40} \times N \\ &= \frac{2}{40} \times \frac{20b}{N} \times N = b \end{aligned}$$

74. (a)

$$\text{Mol. wt. of air} = \frac{78 \times 28 + 21 \times 32 + 0.9 \times 40 + 0.1 \times 44}{78 + 21 + 0.9 + 0.1}$$

75. (b)

$$\rightarrow \text{No. of moles of } 0.05\text{L H}_2\text{SO}_4 = 0.5 \times 0.05 = 0.025$$

$$\rightarrow \text{No. of moles of } 0.075\text{L H}_2\text{SO}_4 = 0.25 \times 0.075 = 0.01875$$

$$\therefore \text{Total no. of moles} = 0.025 + 0.01875 = 0.04375$$

$$\text{Total vol} = 0.05\text{L} + 0.075\text{L} = 0.125\text{L}$$

$$\therefore \text{Molarity} = \frac{0.04375}{0.125} = 0.35\text{M}$$

77. (c)

$$\rightarrow 1 \text{ Mol M}_2\text{O}_x = (2 \times 56 + 16x) \text{ gm}$$

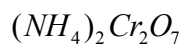
$$\rightarrow \text{Now, } (2 \times 56 + 16x) \text{ gm of oxide} = 112 \text{ gm metal}$$

$$\therefore 4 \text{ gm of oxide} = \frac{112 \times 4}{112 + 16x} \text{ gm metal}$$

$$\rightarrow \text{But } \frac{112 \times 4}{112 + 16x} = 2.8 (\text{given}) \quad \therefore x = 3$$

79. (c)

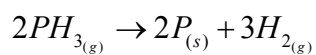
\rightarrow Molecular formula of ammonium dichromate is



80. (b)

$$\text{Eq. wt of metal} = \frac{\text{wt of metal} \times 11200}{\text{vol. of H}_2 \text{ in ml displaced at STP}}$$

82. (a)



$$2mL \qquad \qquad 3mL$$

$$\therefore 100ml \qquad \qquad (?)$$

$$= \frac{100 \times 3}{2} = 150ml$$

$$\therefore \text{Increase} = 50mL$$

85. (b)

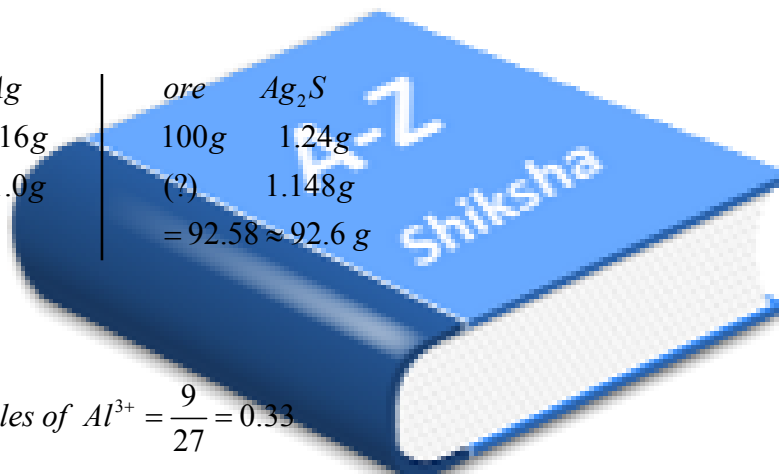
$$1m^3 = 1000L$$

$$\text{At STP, } 22.4L = 1mol$$

$$\therefore 1000L = \frac{1000}{22.4} = 44.6$$

86. (c)

Ag_2S	Ag	ore	Ag_2S
248g	216g	100g	1.24g
(?)	$\therefore 1.0g$	(?)	1.148g
= 1.148g		= 92.58 \approx 92.6 g	



87. (a)

$$\text{No. of moles of } Al^{3+} = \frac{9}{27} = 0.33$$

$$\therefore \text{No. of } Al^{3+} \text{ ions} = 0.33 \times 6.022 \times 10^{23} = 2 \times 10^{23}$$

$$\therefore \text{Electric charge} = 3 \times 1.602 \times 10^{-19} \times 2 \times 10^{23} = 9.6 \times 10^{+4} \text{ Coulomb}$$