CHAPTER 1

SOME BASIC CONCEPTS OF CHEMISTRY

FACT/DEFINITION TYPE QUESTIONS

1. A mixture of sand and iodine can be separated by
(a) crystallisation (b) distillation
(c) sublimation (d) fractionation

2. Difference in density is the basis of
(a) ultrafiltration (b) molecular sieving
(c) molecular attraction (d) gravity separation

3. Which of the following is an example of a heterogeneous substance?
(a) Bottled water (b) Table salt
(c) Pieces of copper (d) Candle

4. Which of the following substances cannot be separated in to its constituents by physical methods?
(a) Sugar and water solution
(b) Salt and sugar
(c) Solid glucose
(d) Both (a) and (b)

5. Which of the following pair of substances contain element and compound within a pair ?
(A) O_2, CH_4 (B) H_2, O_2
(C) N_2, CO_2 (D) Na, CO
(a) A, C, D (b) B only
(c) C and D (d) All of these

6. Which of the following statements about a compound is incorrect?
(a) A molecule of a compound has atoms of different elements.
(b) A compound cannot be separated into its constituent elements by physical methods of separation.
(c) A compound retains the physical properties of its constituent elements.
(d) The ratio of atoms of different elements in a compound is fixed.

7. Choose the correct combination

	Element	Compound	Mixture
(a)	Ammonia	Sodium	Air
(b)	Water	Sugar	Aqueous sugar solution
(c)	Hydrogen	Oxygen	Water
(d)	Silver	Water	Air

8. Choose the correct statement.
(a) The particle s in liquids are more closely held than gases but less free to move than solids.
(b) The particles of solids are arranged in orderly fashion but they can move as freely as liquids.
(c) The particles of gases are far apart as compared to solids and liquids and their movement is easy and fast.
(d) The particles of gases moves faster than liquids only when the gases are heated.

9. A mixture contains two or more substances in ________ which are called its ________.
(a) fixed ratio, compounds
(b) fixed ratio, elements
(c) any ratio, components
(d) any ratio, elements

10. Which one of these is not a pure compound?
(a) O_3 (b) H_2O_2
(c) H_2O (d) Sucrose solution

11. One fermi is
(a) 10^{-15} cm (b) 10^{-13} cm
(c) 10^{-10} cm (d) 10^{-12} cm

12. The prefix 10^{18} is
(a) giga (b) kilo
(c) exa (d) nano

13. The prefix zepto stands for (in m)
(a) 10^{9} (b) 10^{-12}
(c) 10^{-15} (d) 10^{-21}

14. The unit J Pa^{-1} is equivalent to
(a) m^3 (b) cm^3
(c) dm^3 (d) None of these

15. Which has highest weight ?
(a) 1 m^3 of water (b) A normal adult man
(c) 10 litre of Hg (d) All have same weight

16. Which one of the following set of units represents the smallest and largest amount of energy respectively?
(a) J and erg (b) erg and cal
(c) cal and eV (d) eV and L-atm

17. A measured temperature on Fahrenheit scale is 200 °F. What will this reading be on Celsius scale ?
(a) 40° C (b) 94° C
(c) 93.3 °C (d) 30° C

18. Which of the following is not a SI unit?
(a) metre (b) candela
(c) mole (d) litre

19. The prefix 10^{-24} is
(a) yotta (b) zeta
(c) yocto (d) zepto

20. Many countries use Fahrenheit scale for expressing temperature of atmosphere. If temperature in any such country is measured 41°F then what is its value in celcius scale and would you expect hot or cold atmosphere in that country?
(a) 15°C, cold (b) 25°C, normal
(c) 5°C, cold (d) 41°C, hot

21. A sample was weighted using two different balances. The results were
(i) 3.929 g (ii) 4.0 g
How would the weight of the sample be reported?
(a) 3.93 g (b) 3g
(c) 3.9 g (d) 3.929 g

22. 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.

Students	Readings (i)	(ii)
A	3.01	2.99
B	3.05	2.95

(a) Results of both the students are neither accurate nor precise.
(b) Results of student A are both precise and accurate.
(c) Results of student B are neither precise nor accurate.
(d) Results of student B are both precise and accurate.

23. 0.00016 can be written as ...A... in scientific notaiton. Here, A refers to
(a) 1.6×10^{-4} (b) 24.50×10^{-9}
(c) 2.450×10^{-8} (d) 24.50×10^{-7}

24. If the true value for an experimental result is 6.23 and the results reported by three students X, Y and Z are :
X: 6.18 and 6.28
Y: 6.20 and 6.023
Z: 6.22 and 6.24
Which of the following option is correct :
(a) X precise, Y accurate, Z precise and accurate.
(b) X precise and accurate, Y not precise, Z precise
(c) Both X & Z precise & accurate, Y not precise.
(d) Both X & Y neither precise nor accurate, Z both precise and accurate.

25. In the final answer of the expression

$$\frac{(29.2-20.2)(1.79\times10^{5})}{1.37}$$

the number of significant figures is :
(a) 1 (b) 2
(c) 3 (d) 4

26. The number of significant figures for the three numbers 161 cm, 0.161 cm, 0.0161 cm are
(a) 3,4 and 5 respectively (b) 3,4 and 4 respectively
(c) 3,3 and 4 respectively (d) 3,3 and 3 respectively

27. Given P = 0.0030m, Q = 2.40m, R = 3000m, Significant figures in P, Q and R are respectively
(a) 2, 2, 1 (b) 2, 3, 4
(c) 4, 2, 1 (d) 4, 2, 3

28. If the density of a solution is 3.12 g mL^{-1}, the mass of 1.5 mL solution in significant figures is______.
(a) 4.7 g (b) 4680×10^{-3} g
(c) 4.680 g (d) 46.80 g

29. In which of the following number all zeros are significant?
(a) 0.0005 (b) 0.0500
(c) 50.000 (d) 0.0050

30. The correctly reported answer of addition of 29.4406, 3.2 and 2.25 will have significant figures
(a) 3 (b) 4
(c) 2 (d) 5

31. The number of significant figures in 10.3106 g is
(a) 2 (b) 3
(c) 1 (d) 6

32. Choose the correct option that represents the result of the given calculation to the appropriate number of significant figures:

$$\frac{43.0\times0.0243}{0.340\times4}$$

(a) 0.768 (b) 0.77
(c) 0.76 (d) 0.7683

33. Arrange the numbers in increasing no. of significant figures.
0.002600, 2.6000, 2.6, 0.260
(a) 2.6 < 0.260 < 0.002600 < 2.6000
(b) 2.6000 < 2.6 < 0.002600 < 0.260
(c) 0.260 < 2.6 < 0.002600 < 2.6000
(d) 0.002600 < 0.260 < 2.6 < 2.6000

34. Dimension of pressure are same as that of
(a) Energy (b) Force
(c) Force per unit volume (d) Energy per unit volume

35. n g of substance X reacts with m g of substance Y to form p g of substance R and q g of substance S. This reaction can be represented as, X + Y = R + S. The relation which can be established in the amounts of the reactants and the products will be
(a) n – m = p – q (b) n + m = p + q
(c) n = m (d) p = q

36. 20 g of $CaCO_3$ on heating gave 8.8 g of CO_2 and 11.2 g of CaO. This is in accordance with
(a) The law of conservation of mass.
(b) The law of constant composition.
(c) The law of reciprocal proportion.
(d) None of these

37. Which of the following is the best example of law of conservation of mass?
(a) 12 g of carbon combines with 32 g of oxygen to form 44 g of CO_2
(b) When 12 g of carbon is heated in a vacuum there is no change in mass
(c) A sample of air increases in volume when heated at constant pressure but its mass remains unaltered
(d) The weight of a piece of platinum is the same before and after heating in air

38. Which of the following statements is correct about the reaction given below ?

$$4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(g)$$

(a) Total mass of iron and oxygen in reactants = total mass of iron and oxygen in product therefore, it follows law of conservation of mass.
(b) Total mass of reactants = total mass of product; therefore, law of multiple proportions is followed.
(c) Amount of Fe_2O_3 can be increased by reducing the amount of any one of the reactants (iron or oxygen).
(d) Amount of Fe_2O_3 produced will decrease if the amount of any one of the reactants (iron or oxygen) is taken in excess.

39. In an experiment 4.2 g of $NaHCO_3$ is added to a solution of acetic acid weighing 10.0 g, it is observed that 2.2 g of CO_2 is released into the atmosphere. The residue left behind is found to weigh 12.0 g
The above observations illustrate
(a) law of definite proportions.
(b) law of conservation of mass
(c) law of multiple proportions
(d) None of these

40. In one experiment, 4g of H_2 combine with 32g of O_2 to form 36g of H_2O. In another experiment, when 50g of H_2 combine with 400g of O_2 then 450g of H_2O is formed. Above two experiments follow
(a) The law of conservation of mass
(b) The law of constant composition
(c) Both (a) and (b)
(d) Neither (a) nor (b)

41. Irrespective of the source, pure sample, of water always yields 88.89% mass of oxygen and 11.11% mass of hydrogen. This is explained by the law of
(a) conservation of mass (b) multiple proportions
(c) constant composition (d) constant volume

42. The percentage of copper and oxygen in samples of CuO obtained by different methods were found to be the same. The illustrate the law of
(a) constant proportions (b) conservation of mass
(c) multiple proportions (d) reciprocal proportions

43. The law of definite proportions was given by –
(a) John Dalton (b) Humphry Davy
(c) Proust (d) Michael Faraday

44. Which one of the following pairs of compounds illustrate the law of multiple proportions ?
(a) H_2O and Na_2O (b) MgO and Na_2O
(c) Na_2O and BaO (d) $SnCl_2$ and $SnCl_4$

45. 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

46. Two samples of lead oxide were separately reduced to metallic lead by heating in a current of hydrogen. The weight of lead from one oxide was half the weight of lead obtained from the other oxide. The data illustrates
(a) law of reciprocal proportions
(b) law of constant proportions
(c) law of multiple proportions
(d) law of equivalent proportions

47. In compound A, 1.00g of nitrogen unites with 0.57g of oxygen. In compound B, 2.00g of nitrogen combines with 2.24g of oxygen. In compound C, 3.00g of nitrogen combines with 5.11g of oxygen. These results obey the following law
(a) law of constant proportion
(b) law of multiple proportion
(c) law of reciprocal proportion
(d) Dalton's law of partial pressure

48. Which of the following statements indicates that law of multiple proportion is being followed.
(a) Sample of carbon dioxide taken from any source will always have carbon and oxygen in the ratio 1 : 2.
(b) Carbon forms two oxides namely CO_2 and CO, where masses fo oxygen which combine with fixed mass of carbon are in the simple ration 2 : 1.
(c) When magnesium burns in oxygen, the amount of magnesium taken for the reaction is equal to the amount of magnesium in magnesium oxide formed.
(d) At constant temperature and pressure 200 mL of hydrogen will combine with 100 mL oxygen to produce 200 mL of water vapour.

49. The molecular weight of O_2 and SO_2 are 32 and 64 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) 1N
(c) 2N (d) 4N

50. 10 dm^3 of N_2 gas and 10 dm^3 of gas X at the same temperature contain the same number of molecules, the gas X is
(a) CO_2 (b) CO
(c) H_2 (d) NO

51. One mole of a gas occupies a volume of 22.4 L. This is derived from
(a) Berzelius' hypothesis (b) Gay-Lussac's law
(c) Avogadro's law (d) Dalton's law

52. One of the following combination which illustrates the law of reciprocal proportions ?
(a) N_2O_3, N_2O_4, N_2O_5 (b) NaCl, NaBr, NaI
(c) CS_2, CO_2, SO_2 (d) PH_3, P_2O_3, P_2O_5

53. Equal volumes of two gases A and B are kept in a container at the same temperature and pressure. Avogadro's law is invalid if
(a) the gases are reactive
(b) the gases are non-reactive
(c) gas A has more number of molecules than gas B.
(d) None of these

54. Molecular mass is defined as the
(a) mass of one atom compared with the mass of one molecule
(b) mass of one atom compared with the mass of one atom of hydrogen
(c) mass of one molecule of any substance compared with the mass of one atom of C-12
(d) None of the above

55. 1 amu is equal to
(a) $\frac{1}{14}$ of O-16 (b) $\frac{1}{12}$ of C-12
(c) 1 g of H_2 (d) 1.66×10^{-23} kg

56. The modern atomic weight scale is based on
(a) O^{16} (b) C^{12}
(c) H^1 (d) C^{13}

57. 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 %

58. The average atomic mass of neon based on following data is :

Isotope	Relative abundance
^{20}Ne	0.9051
^{21}Ne	0.0027
^{22}Ne	0.0922

(a) 0.33 u (b) 20.187 u
(c) 6.729 u (d) 18.058 u

59. What is the average atomic mass of bromine from the following data : (abundance is in %)

Isotope	Mass	Abundance
^{79}Br	78.9183361	50.69
^{81}Br	80.916289	49.31

(a) 79.9 (b) 76.6
(c) 75.9 (d) 69.9

60. What is the mass of an atom of oxygen (in gm)?
(a) 2.656×10^{-23} (b) 1.567×10^{-22}
(c) 2.0×10^{-22} (d) 3.5×10^{-23}

61. If the mass of the one atom is found to be 2.324784×10^{-23}g, then this atom can be ?
(a) Oxygen (b) Carbon
(c) Fluorine (d) Nitrogen

62. What is the mass of 1 molecule of CO.
(a) 2.325×10^{-23} (b) 4.65×10^{-23}
(c) 3.732×10^{-23} (d) 2.895×10^{-23}

63. Calculate the volume at STP occupied by 240 gm of SO_2.
(a) 64 (b) 84
(c) 59 (d) 73

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

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

66. 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}

67. Which has maximum number of molecules?
(a) 7 gm N_2 (b) 2 gm H_2
(c) 16 gm NO_2 (d) 16 gm O_2

68. Number of atoms in 558.5 gram 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) $558.5 \times 6.023 \times 10^{23}$

69. The number of molecules in 16 g of methane is
(a) 3.0×10^{23} (b) $\frac{16}{6.02} \times 10^{23}$
(c) 6.023×10^{23} (d) $\frac{16}{3.0} \times 10^{23}$

70. Number of g of oxygen in 32.2 g $Na_2SO_4.10\,H_2O$ is
(a) 20.8 (b) 2.24
(c) 22.4 (d) 2.08

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

72. The number of molecules in 8.96 litre of a gas at 0ºC and 1 atm. pressure is approximately
(a) 6.023×10^{23} (b) 12.04×10^{23}
(c) 18.06×10^{23} (d) 24.08×10^{22}

73. The mass of a molecule of water is
(a) 3×10^{-25} kg (b) 3×10^{-26} kg
(c) 1.5×10^{-26} kg (d) 2.5×10^{-26} kg

74. One mole of CO_2 contains :
(a) 3 g atoms of CO_2
(b) 18.1×10^{23} molecules of CO_2
(c) 6.02×10^{23} atoms of O
(d) 6.02×10^{23} atoms of C

75. Volume of a gas at NTP is $1.12 \times 10^{-7} cm^3$. The number of molecules in it is :
(a) 3.01×10^{12} (b) 3.01×10^{24}
(c) 3.01×10^{23} (d) 3.01×10^{20}

76. How many atoms are contained in one mole of sucrose ($C_{12}H_{22}O_{11}$)?
(a) $20 \times 6.02 \times 10^{23}$ atoms/mol
(b) $45 \times 6.02 \times 10^{23}$ atoms/mol
(c) $5 \times 6.02 \times 10^{23}$ atoms/mol
(d) None of these

77. One litre oxygen gas at S.T.P will weigh :
(a) 1.43 g (b) 2.24 g
(c) 11.2 g (d) 22.4 g

78. Number of moles of NaOH present in 2 litre of 0.5 M NaOH is :
(a) 1.5 (b) 2.0
(c) 1.0 (d) 2.5

79. O_2, N_2 are present in the ratio of 1 : 4 by weight. The ratio of number of molecules is :
(a) 7 : 32 (b) 1 : 4
(c) 2 : 1 (d) 4 : 1

80. How many moles of $Al_2(SO_4)_3$ would be in 50 g of the substance ?
(a) 0.083 mole (b) 0.952 mole
(c) 0.481 mole (d) 0.140 mole

81. The mass of 1 mole of electrons is
(a) 9.1×10^{-28}g (b) 1.008 mg
(c) 0.55 mg (d) 9.1×10^{-27} g

82. 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

83. 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

84. The weight of one molecule of a compound $C_{60}H_{122}$ is
(a) 1.2×10^{-20} gram (b) 1.4×10^{-21} gram
(c) 5.025×10^{23} gram (d) 6.023×10^{23} gram

85 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

86. Empirical formula of hydrocarbon containing 80% carbon and 20% hydrogen is :
(a) CH_3 (b) CH_4
(c) CH (d) CH_2

87. The empirical formula of a compound is CH_2. One mole of this compound has a mass of 42 grams. Its molecular formula is :
(a) C_3H_6 (b) C_3H_8
(c) CH_2 (d) C_2H_2

88. A compound contains 54.55 % carbon, 9.09% hydrogen , 36.36% oxygen. The empirical formula of this compound is
(a) C_3H_5O (b) $C_4H_8O_2$
(c) $C_2H_4O_2$ (d) C_2H_4O

89. In a hydrocarbon, mass ratio of hydrogen and carbon is 1:3, the empirical formula of hydrocarbon is
(a) CH_4 (b) CH_2
(c) C_2H (d) CH_3

90. 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) CH_3O (b) CH_2O
(c) CHO (d) CH_4O

91. A hydrocarbon is composed of 75% carbon. The empirical formula of the compound is
(a) CH_2 (b) CH_3
(c) C_2H_5 (d) CH_4

92. 12 gm of Mg (atomic mass 24) will react completely with hydrochloric acid to give
(a) One mol of H_2
(b) 1/2 mol of H_2
(c) 2/3 mol of O_2
(d) both 1/2 mol of H_2 and 1/2 mol of O_2

93. 20.0 kg of $N_{2(g)}$ and 3.0 kg of $H_{2(g)}$ are mixed to produce $NH_{3(g)}$. The amount of $NH_{3(g)}$ formed is
(a) 17 kg (b) 34 kg
(c) 20 kg (d) 3 kg

94. 20.0 kg of H_2(g) and 32 kg of O_2(g) are reacted to produce H_2O(l). The amount of H_2O (l) formed after completion of reaction is
(a) 62 kg (b) 38 kg
(c) 42 kg (d) 72 kg

95. 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

96. 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) 1.0 mole of H_2O is produced
(b) 1.0 mole of NO will be produced
(c) all the oxygen will be consumed
(d) all the ammonia will be consumed

97. What is the molarity of 0.2N Na_2CO_3 solution?
(a) 0.1 M (b) 0 M
(c) 0.4 M (d) 0.2 M

98. The molar solution of H_2SO_4 is equal to :
(a) N/2 solution (b) N solution
(c) 2N solution (d) 3N solution

99. Volume of water needed to mix with 10 mL 10N HNO_3 to get 0.1 N HNO_3 is :
(a) 1000 mL (b) 990 mL
(c) 1010 mL (d) 10 mL

100. One kilogram of a sea water sample contains 6 mg of dissolved O_2. The concentration of O_2 in the sample in ppm is
(a) 0.6 (b) 6.0
(c) 60.0 (d) 16.0

101. 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) 1N (b) 0.1N
(c) 5N (d) 0.5N

102. With increase of temperature, which of these changes?
(a) Molality (b) Weight fraction of solute
(c) Molarity (d) Mole fraction

103. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of urea solution is
(a) 0.02 M (b) 0.01 M
(c) 0.001 M (d) 0.1 M
(Avogadro constant, $N_A = 6.02 \times 10^{23}$ mol^{-1})

104. Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M first solution + 520 ml of 1.2 M second 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

STATEMENT TYPE QUESTIONS

105. Which of the following statements are correct ?
(i) Both solids and liquids have definite volume.
(ii) Both liquids and gases do not have definite shape.
(iii) Both solids and gases take the shape of the container.
(a) (i) and (iii) (b) (ii) and (iii)
(c) (i) and (ii) (d) (i), (ii) and (iii)

106. Choose correct option based on following statements. Here T stands for true statement and F for false statement.
(i) Homogeneous mixture has uniform composition throughout.
(ii) All components of a heterogeneous mixture are observable to naked eyes.
(iii) All solutions are homogeneous in nature.
(iv) Air is an example of heterogeneous mixture.
(a) TTFF (b) TFTF
(c) FFTT (d) TFFF

107. Read the following and choose the incorrect statements.
(i) Both weight and mass are same quantities used for measurement of amount of matter present in a substance
(ii) Mass and weight of a substance vary from one place to another due to change in gravity.
(iii) SI unit of mass is kilogram and while SI unit of weight is gram.
(a) (i) and (iii) (b) (ii) and (iii)
(c) (i) and (ii) (d) All of these

108. Moon takes 27.3 days to complete one orbit around the Earth. Now read the following statements and choose the correct code. Here T is for true statement and F is for 'False statement'.
(i) Moon takes 655.2 hours to complete one orbit around the Earth.
(ii) Moon takes 39312 seconds to complete one orbit around the earth.
(iii) Moon takes 1638 minutes to complete one orbit around the Earth.
(a) F T F (b) T T T
(c) T F F (d) T F T

109. Give the correct order of initials T or F for following statements. Use T if statement is true and F if it is false.

(i) Gay-Lussac's law of gaseous volumes is actually the law of definite proportion by volume.
(ii) Law of conservation of mass is true for physical change, but not for chemical change.
(iii) The percentage of oxygen in H_2O_2 is different from that in H_2O. Hence, it violates law of definite proportions.
(iv) Fixed mass of A reacts with two different masses of B (say x and y), then the ratio of x/y can be any positive integer.
(v) At STP, 5 mL of N_2 and H_2 have different no. of molecules.

(a) TTFTF (b) FTTFT
(c) TFFTF (d) TFTTF

110. Consider the following statements.

(i) Atoms of H, O, N and C have identical properties but different mass.
(ii) Matter is divisible into atoms which are further indivisible.
(iii) The ratio of N: H in NH_3 is 1 : 3 and N : O in nitric oxide is 2 : 1.
(iv) Dalton's atomic theory support law of conservation of mass.

Which of the following pairs of statements is true according to Dalton's atomic theory ?

(a) (i) and (ii) (b) (ii) and (iii)
(c) (ii) and (iv) (d) (i) and (iv)

111. Choose the correct option based on following statements. Here 'T' stands for true and 'F' stands for false statement.

(i) Molecular mass of cane sugar ($C_{12}H_{22}O_{11}$) is 182 amu.
(ii) 1 mole of cane sugar contains 6.022×10^{23} molecules of cane sugar.
(iii) 34.20 g of cane sugar contains 6.022×10^{21} molecules of cane sugar.

(a) TTF (b) TFT
(c) FTF (d) FTT

MATCHING TYPE QUESTIONS

112. Match the items of Column I, II and III appropriately and choose the correct option from the codes given below.

Column I (Multiple)	Column II (Prefix)	Column III (Symbol)
(A) 10^{-15}	(p) Kilo	(i) m
(B) 10^{-3}	(q) yotta	(ii) f
(C) 10^{3}	(r) milli	(iii) k
(D) 10^{24}	(s) femto	(iv) Y

(a) A – (s), (ii); B – (r), (i); C – (p), (iii); D – (q), (iv)
(b) A – (p), (ii); B – (q), (iii); C – (r), (i); D – (s), (iv)
(c) A – (q), (iv); B – (p), (ii); C – (p), (i); D – (r), (iii)
(d) A – (r), (iii); B – (p), (ii); C – (s), (i); D – (q), (iv)

113. Match the columns

Column-I (Number)	Column-II (Significant figures)
(A) 29900.	(p) 2
(B) 290	(q) 1
(C) 1.23×1.331	(r) 4
(D) 20.00	(s) 3
(E) 2.783 – 1	(t) 5

(a) A – (r), B – (q), C – (t), D – (p), E – (s)
(b) A – (t), B – (p), C – (s), D – (r), E – (q)
(c) A – (p), B – (t), C – (s), D – (r), E – (q)
(d) A – (t), B – (s), C – (r), D – (q), E – (p)

114. Match the columns

Column-I (Laws of chemical combinations)	Column-II (Scientist)
(A) Law of definite proportions	(p) Antoine Lavoisier
(B) Law of multiple proportions	(q) Gay Lussac
(C) Law of conservation of mass	(r) Dalton
(D) Law of gaseous volumes	(s) Joseph Proust

(a) A – (s), B – (r), C – (p), D – (q)
(b) A – (p), B – (r), C – (s), D – (q)
(c) A – (r), B – (p), C – (s), D – (q)
(d) A – (q), B – (s), C – (r), D – (p)

115. Match the columns

Column-I	Column-II
(A) $C_6H_5NH_2$	(p) 84
(B) C_6H_6	(q) 100
(C) C_6H_{12}	(r) 93
(D) $CaCO_3$	(s) 78

(a) A – (p), B – (r), C – (q), D – (s)
(b) A – (r), B – (s), C – (p), D – (q)
(c) A – (r), B – (p), C – (q), D – (s)
(d) A – (r), B – (q), C – (s), D – (p)

116. Match the columns.

Column-I	Column-II
(A) 88 g of CO_2	(p) 0.25 mol
(B) 6.022×10^{23} molecules of H_2O	(q) 2 mol
(C) 5.6 litres of O_2 at STP	(r) 1 mol
(D) 96 g of O_2	(s) 6.022×10^{23} molecules
(E) 1 mol of any gas	(t) 3 mol

(a) A – (q), B – (r), C – (p), D – (t), E – (s)
(b) A – (r), B – (q), C – (p), D – (t), E – (s)
(c) A – (q), B – (p), C – (r), D – (t), E – (s)
(d) A – (q), B – (r), C – (p), D – (s), E – (t)

117. Match the mass of elements given in Column I with the number of moles given in Column II and mark the appropriate choice. Choose the correct codes formt he options given below.

	Column-I		**Column-II**
(A)	28 g of He	(p)	2 moles
(B)	46 g of Na	(q)	7 moles
(C)	60 g of Ca	(r)	1 mole
(D)	27 g of Al	(s)	1.5 mole

(a) A – (s), B – (r), C – (q), D – (p)
(b) A – (p), B – (r), C – (q), D – (s)
(c) A – (r), B – (q), C – (p), D – (s)
(d) A – (q), B – (p), C – (s), D – (r)

118. Match the columns.

	Column-I (Physical quantity)		**Column-II (Unit)**
(A)	Molarity	(p)	mol
(B)	Mole fraction	(q)	Unitless
(C)	Mole	(r)	mol L^{-1}
(D)	Molality	(s)	mol kg^{-1}

(a) A – (r), B – (q), C – (s), D – (p)
(b) A – (r), B – (p), C – (q), D – (s)
(c) A – (r), B – (q), C – (p), D – (s)
(d) A – (q), B – (r), C – (p), D – (s)

ASSERTION-REASON TYPE QUESTIONS

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
(c) Assertion is correct, reason is incorrect
(d) Assertion is incorrect, reason is correct.

119. **Assertion :** Significant figures for 0.200 is 3 whereas for 200 it is 1.
Reason : Zero at the end or right of a number are significant provided they are not on the right side of the decimal point.

120. **Assertion :** 1.231 has three significant figures.
Reason : All numbers right to the decimal point are significant.

121. **Assertion :** One atomic mass unit is defined as one twelfth of the mass of one carbon - 12 atom.
Reason : Carbon-12 isotope is the most abundant isotope of carbon and has been chosen as standard.

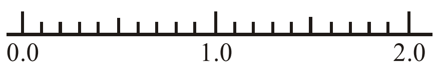
122. **Assertion :** Volume of a gas is inversely proportional to the number of moles of gas.
Reason : The ratio by volume of gaseous reactants and products is in agreement with their mole ratio.

123. **Assertion :** Equal moles of different substances contain same number of constituent particles.
Reason : Equal weights of different substances contain the same number of constituent particles.

124. **Assertion :** The empirical mass of ethene is half of its molecular mass.
Reason : The empirical formula represents the simplest whole number ratio of various atoms present in a compound.

CRITICAL THINKING TYPE QUESTIONS

125. What are the significant figure(s) in a broken "ruler" show below?



(A) 1 (B) 2
(C) 3 (D) 0
(a) A, B and C (b) A, B, D
(c) A only (d) A and B

126. Which one of the following sets of compounds correctly illustrate the law of reciprocal proportions?
(a) P_2O_3, PH_3, H_2O (b) P_2O_5, PH_3, H_2O
(c) N_2O_5, NH_3, H_2O (d) N_2O, NH_3, H_2O

127. If we consider that 1/6, in place of 1/12, mass of carbon atom is taken to be the relative atomic mass unit, the mass of one mole of a substance will
(a) decrease twice
(b) increase two fold
(c) remain unchanged
(d) be a function of the molecular mass of the substance

128. 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

129. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms?
(a) 1.25×10^{-2} (b) 2.5×10^{-2}
(c) 0.02 (d) 3.125×10^{-2}

130. 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

131. 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}

132. 1 c.c. N_2O at NTP contains :

(a) $\frac{1.8}{224}\times10^{22}$ atoms

(b) $\frac{6.02}{22400}\times10^{23}$ molecules

(c) $\frac{1.32}{224}\times10^{23}$ electrons

(d) All of the above

133. How much time (in hours) would it take to distribute one Avogadro number of wheat grains if 10^{20} grains are distributed each second ?

(a) 0.1673 (b) 1.673
(c) 16.73 (d) 167.3

134. Arrange the following in the order of increasing mass (atomic mass: O = 16, Cu = 63, N = 14)

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

135. If 1.5 moles of oxygen combines with Al to form Al_2O_3, the mass of Al in g [Atomic mass of Al = 27] used in the reaction is

(a) 2.7 (b) 54
(c) 40.5 (d) 81

136. 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

137. In a compound C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular weight of compound is 108. Molecular formula of compound is

(a) $C_2H_6N_2$ (b) C_3H_4N
(c) $C_6H_8N_2$ (d) $C_9H_{12}N_3$.

138. The empirical formula of an acid is CH_2O_2, the probable molecular formula of acid may be :

(a) $C_3H_6O_4$ (b) CH_2O
(c) CH_2O_2 (d) $C_2H_4O_2$

139. A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g. of CO_2. The empirical formula of the hydrocarbon is :

(a) C_2H_4 (b) C_3H_4
(c) C_6H_5 (d) C_7H_8

140. Which of the following is the correct empirical and molecular formulae of a compound, if the molecular mass of a compound is 80 and compound contains 60% of C, 5% of H and 35% of N ?

(a) C_2H_2N ; $C_4H_4N_2$ (b) $C_3H_4N_2$; $C_6H_8N_4$
(c) $C_2H_4N_2$; $C_4H_8N_4$ (d) C_2H_2N ; C_2H_2N

141. Which of the following is the correct empirical and molecular formulae of a compound, if the molecular mass of a compound is 93 and compound containing 77.43% of C, 7.53% of H and 15.05% of N ?

(a) $C_3H_{3.5}N_{1.5}$ and C_6H_7N
(b) C_6H_7N and C_6H_7N
(c) C_3H_3N and C_6H_7N
(d) C_3H_3N and $C_6H_6N_2$

142. Liquid benzene (C_6H_6) burns in oxygen according to the equation $2C_6H_6(l)+15O_2(g)\longrightarrow 12CO_2(g)+6H_2O(g)$
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, C_6H_6 = 78)

(a) 74 L (b) 11.2 L
(c) 22.4 L (d) 84 L

143. Assuming fully decomposed, the volume of CO_2 released at STP on heating 9.85 g of $BaCO_3$ (Atomic mass, Ba = 137) will be

(a) 2.24 L (b) 4.96 L
(c) 1.12 L (d) 0.84 L

144. The mass of $BaCO_3$ produced when excess CO_2 is bubbled through a solution of 0.205 mol $Ba(OH)_2$ is :

(a) 81 g (b) 40.5 g
(c) 20.25 g (d) 162 g

145. For the reaction $Fe_2O_3 + 3CO_2 \rightarrow 2Fe + 3CO_2$, 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

146. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl ?

(a) 0.044 (b) 0.333
(c) 0.011 (d) 0.029

147. Fat is an important source of energy and water, this is important for the desert animals like camel which store fat in its hump and provide water and energy. How many grams and moles of H_2O are produced from the combustion of fat $C_{57}H_{110}O_6$ from 450 gram of fat stored in hump of camel ?

$$C_{57}H_{110}O_6 + \frac{163}{2}O_2 \rightarrow 57CO_2 + 55H_2O$$

(a) 500.56 , 27.80 (b) 450, 26.80
(c) 580, 25.0 (d) 400, 26.6

148. Which of the following option represents correct limiting reagents in reactions (i), (ii) and (iii) respectively.

(i) $\underset{(26g)}{C} + \underset{(20g)}{O_2} \rightarrow CO_2$

(ii) $\underset{(60g)}{N_2} + \underset{(80g)}{3H_2} \rightarrow 2NH_3$

(iii) $\underset{(100g)}{P_4} + \underset{(200g)}{3O_2} \rightarrow P_4O_6$

(a) C, N_2, O_2 (b) C, N_2, P_4

(c) O_2, H_2, P_4 (d) O_2, N_2, P_4

149. 10 mL of 2(M) NaOH solution is added to 200 mL of 0.5 (M) of NaOH solution. What is the final concentration ?

(a) 0.57 (M) (b) 5.7 (M)

(c) 11.4 (M) (d) 1.14 (M)

150. If maximum fluoride ion presence was set to be 4 ppm number of moles of fluoride in 10 ml drinking water ?

(a) 2.10×10^{-3} (b) 2.10×10^{-2}

(c) 3.10×10^{-3} (d) 3.3×10^{-2}

151. The increasing order of molarity with 25 gm each of NaOH, LiOH, $Al(OH)_3$, KOH, $B(OH)_3$ in same volume of water?

(a) $Al(OH)_3 < B(OH)_3 < KOH < NaOH < LiOH$

(b) $LiOH < NaOH < KOH < B(OH)_3 < Al(OH)_3$

(c) $LiOH < NaOH < B(OH)_3 < KOH < Al(OH)_3$

(d) $NaOH < LiOH < B(OH)_3 < Al(OH)_3 < KOH$

HINTS AND SOLUTIONS

FACT/DEFINITION TYPE QUESTIONS

1. **(c)** By sublimation since I_2 sublimes.
2. **(d)** It forms the basis of gravity separation.
3. **(d)** Candle is a heterogeneous mixture of wax and threads. Copper is an element while bottled water and table salt are compounds.
4. **(c)** Glucose is a pure substance hence its constituents cannot be separated by simple physical method.
5. **(a)** In case of B, none of O_2 and H_2 is a compound since compound consist of two or more different atoms.
6. **(c)**
7. **(d)** Silver is an element, water is a compound and air is a mixture.
8. **(c)** Attraction between particles in solid is maximum and hence their movement is minimum amongst the phases.
   Attraction between particles in gases is minimum and hence their movements is maximum amongst the three phases.
   Attraction between the particles and their movements in liquids is intermediate i.e., between solids and gases.
9. **(c)** A mixture may contain any number of components in any ratio.
   e.g. air is a mixture of various gases.
10. **(d)** It is a solution and is a mixture of sucrose and water.
11. **(b)** One fermi is 10^{-13} cm.
12. **(c)** Exa = 10^{18}
13. **(d)** 1 zepto = 10^{-21}
14. **(a)** Joule is the unit of work and Pascal is unit of pressure.

$$JPa^{-1} = \frac{J}{Pa} = \frac{Work}{Pressure} = \frac{Nm}{Nm^{-2}} = m^3$$

15. **(a)** 1 m^3 of water 10^6 cm^3 of water

$\therefore$ Mass of 10^6 cm^3 water

$= 10^6\ cm^3 \times 1\ g\ cm^3$ ($\because$ density of $H_2O = 1\ g\ cm^3$)

$$= 10^6\ g = \frac{10^6}{10^3}\ kg = 10^3\ kg = 1000\ kg$$

(b) Weight of normal adult man = 65 kg

$\therefore$ Weight of 1 m^3 of water is highest.

(c) Density of Hg = 13.6 g cm^{-3}

Volume of Hg = 10 L = 10 × 1000 = 10^4 cm^3

$\therefore$ Weight of Hg = 13.6 × 10^4 = 136000 g = 136 kg

16. **(d)** Smallest and largest amount of energy respectively are eV and L-atm.

$$1\ eV = 1.6 \times 10^{-19}\ J$$
$$1L\text{-}atm = 101.325\ J$$

17. **(c)**
18. **(d)** Litre (L) is not an SI unit. It is used for measurement of volume of liquids.
19. **(c)** yocto = 10^{-24}
20. **(c)** $°C = \frac{5}{9}(°F - 32) = \frac{5}{9}(41 - 32) = 5°C$

    It will be cold.
21. **(a)** Out of two 3.929 g is more accurate and will be reported as 3.93 after rounding off.
22. **(b)**
23. **(a)** 0.00016 can be written as 1.6×10^{-4} in scientic notation.
24. **(d)** Both Y and X are neither precise nor accurate as the two values in each of them are not close. With respect to X & Y, the values of Z are close & agree with the true value. Hence, both precise & accurate.
25. **(c)** On calculation we find

$$\frac{(29.2 - 20.2)(1.79 \times 10^5)}{1.37} = 1.17 \times 10^6$$

As the least precise number contains 3 significant figures therefore, answers should also contains 3 significant figures.

26. **(d)** We know that all non-zero digits are significant and the zeros at the beginning of a number are not significant. Therefore number 161 cm, 0.161 cm and 0.0161cm have 3, 3 and 3 significant figures respectively.
27. **(b)** Given P = 0.0030m, Q = 2.40m & R = 3000m. In P(0.0030) initial zeros after the decimal point are not significant. Therefore, significant figures in P(0.0030) are 2. Similarly in Q (2.40) significant figures are 3 as in this case final zero is significant. In R = (3000) all the zeros are significant hence, in R significant figures are 4 because they come from a measurement.
28. **(a)**
29. **(c)** If zero is used to locate the decimal point it is considered as a significant figure. In 50.000 all zero are significant.
30. **(a)** Sum of the figures 29.4406, 3.2 and 2.25 is 34.8906. The sum should be reported to the first place of decimal as 3.2 has only one decimal place. After rounding off the sum is 34.9. Hence number of significant figures is three.
31. **(d)** 10.3106 g has 6 significant figures. Since all non-zero digits are significant and a zero becomes significant if it appears between two non-zero digits.
32. **(b)** $\frac{43.0 \times 0.0243}{0.340 \times 4} = 0.7683088$

    The least precise term has two significant figures (leaving the exact number). Hence after rounding off correct answer is 0.77.

33. (a) 2.6 has two significant figures.
0.260 has three significant figures.
0.002600 has four significant figures.
2.6000 has five significant figures.

34. (d) $\frac{\text{Energy}}{\text{volume}}$ which can be shown
Pressure
$$= \frac{\text{Force}}{\text{area}} = \frac{\text{Work (energy/distance)}}{\text{Area}} = \frac{\text{Energy}}{\text{Volume}}$$

35. (b) $\underset{ng}{X} + \underset{mg}{Y} \rightleftharpoons \underset{pg}{R} + \underset{qg}{S}$
$n + m = p + q$ by law of conservation of mass.

36. (a) $\underset{20\,g}{CaCO_3} \rightarrow \underset{8.8\,g}{CaO} + \underset{11.2\,g}{CO_2}$
mass of reactant = mass of products = 20g.
Hence the law of conservation of mass is obeyed.

37. (a) **38. (a)**

39. (b) $\underset{4.2g}{NaHCO_3} + \underset{10.0g}{CH_3COOH} \longrightarrow \underset{12.0g}{\text{Residue}} + \underset{2.2g}{CO_2} \uparrow$
Mass of reactants = 4.2 + 10.0 = 14.2 g
Mass of products = 12.0 + 2.2 = 14.2 g
Hence, given reaction illustrate law of conservation of mass.

40. (c) I experiment : $\frac{\text{mass of } H_2 \text{ combined}}{\text{mass of } O_2 \text{ combined}} = \frac{4}{32} = \frac{1}{8}$

II experiment : $\frac{\text{mass of } H_2 \text{ combined}}{\text{mass of } O_2 \text{ combined}} = \frac{50}{400} = \frac{1}{8}$

Hence both law of conservation of mass and constant composition is obeyed.

41. (c) The H : O ratio in water is fixed, irrespective of its source. Hence it is law of constant composition.

42. (a) Constant proportions according to which a pure chemical compound always contains same elements combined together in the same definite proportion of weight.

43. (c)

44. (d) $SnCl_2$ $SnCl_4$
$119 : 2 \times 35.5$ $119 : 4 \times 35.5$
Chlorine ratio in both compounds is
$= 2 \times 35.5 : 4 \times 35.5 = 1 : 2$

45. (d) In CuO and Cu_2O the O : Cu is 1 : 1 and 1 : 2 respectively. This is law of multiple proportion.

46. (c)

47. (b) Law of multiple proportion. As the ratio of oxygen which combine with fix weights of 1 g of nitrogen bears a simple whole number ratio
0.57 : 1 : 12 : 1.7031 : 2 : 3

48. (b)

49. (c) According to Avogadro's law "equal volumes of all gases contain equal number of molecules under similar conditions of temperature and pressure". Thus if 1 L of one gas contains N molecules, 2 L of any other gas under the same conditions of temperature and pressure will contain 2N molecules.

50. (b) The number of molecules of N_2 and X are same. Hence they must have the same molecular weights.
$\therefore$ X is CO.

51. (c)

52. (c) In law of reciprocal proportions, the two elements combining with the third element, must combine with each other in the same ratio or multiple of that Ratio of S and O when combine with C is 2 : 1. Ratio of S and O is SO_2 is 1 : 1

53. (d) Avogadro's law is independent of the reactive or unreactive nature of the gases.
According to Avogadro's law equal volumes of gases at the same temperature and pressure should contain equal number of molecules.

54. (c)

55. (b) 1 amu = $\frac{1}{12}$ of the mass of C-12.

56. (b) The modern atomic weight scale is based on C^{12}.

57. (d) Molecular weight of $ZnSO_4.7H_2O$
$= 65 + 32 + (4 \times 16) + 7(2 \times 1 + 16) = 287.$
$\therefore$ percentage mass of zinc (Zn)
$= \frac{65}{287} \times 100 = 22.65\%$

58. (b) Average atomic mass of neon
$= 20 \times 0.9051 + 21 \times 0.0027 + 22 \times 0.0922$
$= 20.187$ u

59. (a) $(78.9183361) \times (0.5069) + (80.916289) \times (0.4931)$

60. (a) Mass of oxygen atom is 15.995 amu, becasue 1 amu = 1.66056×10^{-24} g, hence 15.995 × value of 1 amu give the value equal to option (a).

61. (d) $\frac{2.824784 \times 10^{-23}}{1.66056 \times 10^{-24}} = 14$ amu
Where 1.66056×10^{-24} is equal to one atomic mass (amu)

62. (b) Gram molecular weight of CO = 12 + 16 = 28 g
6.023×10^{23} molecules of CO weight 28 g
1 molecule of CO weighs $= \frac{28}{6.02 \times 10^{23}} = 4.65 \times 10^{-23}$ g

63. (b) Molecular weight of $SO_2 = 32 + 2 \times 16 = 64$
64 g of SO_2 occupies 22.4 litre at STP
240 g of SO_2 occupies $= \frac{22.4}{64} \times 240 = 84$ litre at STP

64. (a) 1 mol CCl_4 vapour $= 12 + 4 \times 35.5$
$= 154$ g $\equiv 22.4$ L at STP
$\therefore$ Density $= \frac{154}{22.4}\,gL^{-1} = 6.875\,gL^{-1}$

65. (b) 6.02×10^{23} molecules of CO = 1 mole of CO
6.02×10^{24} CO molecules = 10 moles CO
= 10 g atoms of O = 5 g molecules of O_2

66. **(a)** $4.4\text{ g } CO_2 = \frac{4.4}{44} = 0.1 \text{ mol } CO_2$ (mol. wt. of $CO_2 = 44$)
$= 6 \times 10^{22}$ molecules $= 2 \times 6 \times 10^{22}$ atoms of O.

67. **(b)** 2g of H_2 means one mole of H_2, hence contains 6.023×10^{23} molecules. Others have less than one mole, so have less no. of molecules.

68. **(a)** Fe (no. of moles) $= \frac{558.5}{55.85} = 10$ moles $= 10N_A$ atoms.
No. of moles in 60 g of C = 60/12 = 5 moles = $5N_A$ atoms.

69. **(c)** 16 g CH_4 is 1 mol. Hence number of molecules = Avogadro number = 6.023×10^{23}.

70. **(c)** M. Wt of $Na_2SO_4.10H_2O$ is 322 g which contains 224 g oxygen.
$\therefore$ 32.2 g will contain 22.4 g oxygen.

71. **(a)** 21% of 1 litre is 0.21 litre.
22.4 litres = 1 mole at STP
$\therefore$ 0.21 litre $= \frac{0.21}{22.4} = 0.0093$ mol

72. **(d)** At S.T.P. 22.4 litre of gas contains 6.023×10^{23} molecules
$\therefore$ molecules in 8.96 litre of gas
$$= \frac{6.023\times10^{23}\times8.96}{22.4} = 24.08\times10^{22}$$

73. **(b)** Mass of one molecule of Water
$$= \frac{18}{6.023\times10^{23}} = 3\times10^{-23}\text{ g} = 3\times10^{-26}\text{ Kg}$$

74. **(d)** 1 molecule of CO_2 has one atom of C and two atoms of oxygen.
$\therefore$ 1 mole of CO_2 has $= 6.02 \times 10^{23}$ atoms of C
$= 2 \times 6.02 \times 10^{23}$ atoms of O

75. **(a)** Given, $V = 1.12 \times 10^{-7}\text{ cm}^3$
22400 cm^3 at NTP $= 6.02 \times 10^{23}$ molecules
$\therefore$ $1.12 \times 10^{-7}\text{ cm}^3$ at NTP $= \frac{6.02\times10^{23}}{22400}\times1.12\times10^{-7}$
$= 3.01 \times 10^{12}$ molecules.

76. **(b)** Total atoms in 1 molecule of $C_{12}H_{22}O_{11}$
$= 12 + 22 + 11 = 45$
$\therefore$ Total atoms in 1 mole of $C_{12}H_{22}O_{11}$
$= 45 \times 6.02 \times 10^{23}$ atoms/mol.

77. **(a)** 22.4 L of O_2 at STP = 32 g
$\therefore$ 1 L of O_2 at STP $= \frac{32}{22.4}\times1 = 1.428\text{ g} = 1.43\text{ g}$

78. **(c)** Given $V = 2$ L, Molarity = 0.5M, Moles = ?
Molarity $= \frac{\text{No. of moles of solute}}{V\text{ of solution in L}}$ or $0.5 = \frac{\text{Moles}}{2}$
$\therefore$ Moles $= 2 \times 0.5 = 1.0$

79. **(a)** Let mass of $O_2 = 1$ g
$\therefore$ Mass of $N_2 = 4$g
No. of molecules of $O_2 = \frac{1}{32}$
No. of molecules of $N_2 = \frac{4}{28}$
Ratio of no. of molecules $= \frac{1}{32} : \frac{4}{28} = \frac{1}{32} : \frac{1}{7} = 7 : 32$

80. **(d)** No. of moles $= \frac{\text{weight}}{\text{mol. wt.}} = \frac{50}{342} = 0.14$ mole

81. **(c)** Mass of 1 electron $= 9.11 \times 10^{-28}$ g
$\therefore$ Mass of 1 mole (6.02×10^{23}) electrons
$= 9.11 \times 10^{-28} \times 6.02 \times 10^{23}$g
$= 55 \times 10^{-5}\text{ g} = 55 \times 10^{-5} \times 10^3\text{ mg} = 0.55$ mg.

82. **(b)**
$$\underset{\substack{10g \\ \left(\frac{10}{2}=5\text{ mol}\right)}}{H_2} + \underset{\substack{64g \\ \left(\frac{64}{32}=2\text{ mol}\right)}}{\frac{1}{2}O_2} \longrightarrow H_2O$$
In this reaction oxygen is the limiting agent. Hence amount of H_2O produced depends on the amount of O_2 taken
$\because$ 0.5 mole of O_2 gives $H_2O = 1$ mol
$\therefore$ 2 mole of O_2 gives $H_2O = 4$ mol

83. **(c)**

	No. of molecules
Moles of $CO_2 = \frac{44}{44} = 1$	N_A
Moles of $O_3 = \frac{48}{48} = 1$	N_A
Moles of $H_2 = \frac{8}{2} = 4$	$4N_A$
Moles of $SO_2 = \frac{64}{64} = 1$	N_A

84. **(b)** Molecular weight of $C_{60}H_{122} = (12 \times 60) + 122 = 842$.
Therefore weight of one molecule
$$= \frac{\text{Molecular weight of } C_{60}H_{122}}{\text{Avagadro's number}}$$
$$= \frac{842}{6.023\times10^{23}} = 1.4\times10^{-21}\text{ g}$$

85. **(c)** 50% of X (Atomic mass 10), 50% of Y (Atomic mass 20).
Relative number of atoms of X $= \frac{50}{10} = 5$ and than Y $= \frac{50}{20} = 2.5$
Simple Ratio 2 : 1. Formula X_2Y

86. **(a)**

Element	%	Atomic mass	Relative no.of atoms	Simple ratio of atoms
C	80	12	$\frac{80}{12} = 6.66$	$\frac{6.66}{6.66} = 1$
H	20	1	$\frac{20}{1} = 20.0$	$\frac{20.0}{6.66} = 3$

$\therefore$ Empirical formula is CH_3

87. (a) Empirical formula of compound = CH_2
Molecular mass of the compound = 42
$\therefore\ n = 42/14 = 3$
$\therefore$ Hence molecular formula = C_3H_6

88. (d) C 54.55 54.55/12 = 4.5 4.5/2.27 = 2
H 9.09 9.09/1 = 9.09 9.09/2.27 = 4
O 36.36 36.36/16 = 2.27 2.27/2.27 = 1
Hence empirical formula of the compound = C_2H_4O

89. (a) Mass ratio of H : C = 1 : 12
However, given mass ratio of H : C = 1 : 3
Therefore, for every C atom, there are 4 H atoms, hence empirical formula = CH_4

90. (a)

Element	Percentage	Atomic weight	Atomic ratio	Simple ratio
C	38.71	12	$\frac{38.71}{12} = 3.23$	$\frac{3.23}{3.23} = 1$
H	9.67	1	$\frac{9.67}{1} = 9.67$	$\frac{9.67}{3.23} = 3$
O	100 – (38.71 + 9.67) = 51.62	16	$\frac{51.62}{16} = 3.23$	$\frac{3.23}{3.23} = 1$

Thus empirical formula is CH_3O.

91. (d)

Element	%	At. Mass	Rel.No. of Atoms	Simple Ratio
C	75	12	75/12 = 6.25	1
H	25	1	25/1 = 25	4

$\therefore$ Empirical formula is CH_4.

92. (b)
$$\underset{\substack{1\text{ mole}\\ \frac{1}{2}\text{ mole}}}{Mg} + 2HCl \rightarrow MgCl_2 + \underset{\substack{1\text{ mole}\\ \frac{1}{2}\text{mole (12g of Mg} = \frac{1}{2}\text{mol)}}}{H_2 \uparrow}$$

93. (a) We know that
$N_2 + 3H_2 \rightarrow 2NH_3$
28 g 6 g 34 g
14 g 3 g 17 g
Here given H_2 is 3 kg and N_2 is 20 kg but 3 kg of H_2 can only react with 14 g of N_2 and thus the obtained NH_3 will be of 17 kg.

94. (d) $2H_2 + O_2 \longrightarrow 2H_2O$
4g 32g 36g
4kg 32 kg 36kg

95. (c) $C_2H_4 + 3\,O_2 \longrightarrow 2CO_2 + 2H_2O$
28 g 96 g
$\because$ 28 g of C_2H_4 undergo complete combustion by = 96 g of O_2
$\therefore$ 2.8 kg of C_2H_4 undergo complete combustion by = 9.6 kg of O_2.

96. (c) According to stoichiometry they should react as follow
$4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$
4 mole of NH_3 requires 5 mole of O_2.
1 mole of NH_3 requires = $\frac{5}{4} = 1.25$ mole of O_2.
Hence O_2 is consumed completely.

97. (a) $\text{Molarity} = \text{Normality} \times \dfrac{\text{Equivalent mass}}{\text{Molecular mass}}$
$$= 0.2 \times \frac{M}{2 \times M} = 0.1\ M$$

98. (a) $\text{Molarity} = \dfrac{\text{Normality}}{\text{Replaceable hydrogen atom}}$
$\because$ H_2SO_4 is dibasic acid.
$\therefore$ Molar solution of H_2SO_4 = N/2 H_2SO_4

99. (b) Given $N_1 = 10N$, $V_1 = 10$ ml, $N_2 = 0.1N$, $V_2 = ?$
$$N_1V_1 = N_2V_2$$
or $10 \times 10 = 0.1 \times V_2$
or $V_2 = \dfrac{10 \times 10}{0.1}$, $V_2 = 1000$ ml
Volume of water to be added
$= V_2 - V_1 = 1000 - 10 = 990$ ml.

100. (b) $\text{ppm} = \dfrac{\text{Mass of solute}}{\text{Mass of solution}} \times 10^6$
$$\therefore \text{ppm} = \frac{6 \times 10^{-3}}{1000} \times 10^6 = 6.$$

101. (a) 5 M H_2SO_4 = 10 N H_2SO_4,
($\because$ Basicity of $H_2SO_4 = 2$)
$N_1V_1 = N_2V_2$,
$10 \times 1 = N_2 \times 10$ or $N_2 = 1$ N

102. (c) Among all the given options molarity is correct because the term molarity involve volume which increases on increasing temperature.

103. (b) Moles of urea present in 100 ml of sol.= $\dfrac{6.02 \times 10^{20}}{6.02 \times 10^{23}}$
$$\therefore M = \frac{6.02 \times 10^{20} \times 1000}{6.02 \times 10^{23} \times 100} = 0.01M$$
[$\because$ M = Moles of solute present in 1L of solution]

104. (b) From the molarity equation.
$M_1V_1 + M_2V_2 = MV$
Let M be the molarity of final mixture,
$$M = \frac{M_1V_1 + M_2V_2}{V} \text{ where } V = V_1 + V_2$$
$$M = \frac{480 \times 1.5 + 520 \times 1.2}{480 + 520} = 1.344\ M$$

STATEMENT TYPE QUESTIONS

105. (c) Both solids and liquids have definite volume, but gases do not.
Solids have their own shape, but liquids and gases takes the shape of the container in which they are put in.

106. (b) For statement (ii), it is not necessary that all components of a heterogeneous mixture are observable to naked eyes for example blood is a heterogeneous mixture whose components are not visible to naked eyes. For statement (iv) air is a homogeneous mixture of various gases.

107. (d) Mass of a substance is the amount of matter present in it while weight is the force exerted by gravity on an object.
Mass is constant while weight may vary from one place to another due to gravity.
SI unit of both mass and weight is kilogram.

108. (c) 27.3 days = 27.3 × 24 hours
= 655.2 hours
27.3 days = 27.3 × 24 × 60 minutes
= 39312 minutes
27.3 days = 27.3 × 24 × 60 × 60 seconds
= 2358720 seconds

109. (c) For statement (i), T = The other name of Gay-Lussac's law is law of definite proportions by volume.
For statement (ii), F = Law of conservation of mass is valid for both physical and chemical change.
For statement (iii), F = Law of definite proportion is valid for each compound individually and not for comparing two different compounds.
For statement (iv), T = x/y must be a simple whole number ratio and must be a positive integer.
For statement (v), F = Equal volumes of all gases under similar conditions of temperature and pressure contain equal number of molecules.

110. (c) For statement (i) : H, O, C, N = All have different chemical properties.
For statement (ii) : It is true as per Dalton's postulate.
For statement (iii) : N : O = 1 : 1 (NO)
For statement (iv) : Dalton's postulates says, atoms can neither be created nor destroyed.

111. (c) Molecular mass of cane sugar ($C_{12}H_{22}O_{11}$)
$= 12 \times 12 + 22 \times 1 + 11 \times 16$
= 342 amu
1 mole of cane sugar ($C_{12}H_{22}O_{11}$) = 342 g
(Molecular mass of cane sugar = 342 g)
342 g of cane sugar contain = 6.022×10^{23} molecules

$$34.20 \text{ g of cane sugar contain} = \frac{6.022 \times 10^{23}}{342} \times 34.20$$

$= 6.022 \times 10^{22}$ molecules.

MATCHING TYPE QUESTIONS

112. (a)

113. (b) Terminal zeros are not significant if there is no decimal i.e., 290 contains two significant figures whereas in 29900. there are 5 significant figures; 1.23 × 1.331 = 1.63713 but keeping the mind the 1.23 has only few significant figures i.e., only three significant figures, so result should also be reported in three significant figures only. Thus 1.6373 should be rounded off to 1.64. Value 1.783 is rounded off to 2, so has only one significant figure.

114. (a) **115. (b)** **116. (a)**

117. (d) $A : 28 \text{ g of He} = \frac{28}{4} = 7 \text{ mol}$

$B : 46 \text{ g of Na} = \frac{46}{23} = 2 \text{ mol}$

$C : 60 \text{ g of Ca} = \frac{60}{40} = 1.5 \text{ mol}$

$D : 27 \text{ g of Al} = \frac{27}{27} = 1 \text{ mol}$

118. (c)

ASSERTION- REASON TYPE QUESTIONS

119. (c)

120. (d) 1.231 has four significant figures all no. from left to right are counted, starting with the first digit that is not zero for calculating the no. of significant figure.

121. (b)

122. (d) We know that from the reaction $H_2 + Cl_2 \rightarrow 2HCl$ that the ratio of the volume of gaseous reactants and products is in agreement with their molar ratio.The ratio of $H_2 : Cl_2 : HCl$ volume is 1: 1: 2 which is the same as their molar ratio. Thus volume of gas is directly related to the number of moles. Therefore, the assertion is false but reason is true.

123. (c) Equal moles of different substances contain same number of constituent particles but equal weights of different substances do not contain the same number of consituent particles.

124. (a)

CRITICAL THINKING TYPE QUESTIONS

125. (b) For, 0.0 significant figure is zero. For 0.1 to 0.9 significant figure will be 1 whereas from 1.0 to 2.0 significant figures will be 2.

126. (a) In law of reciprocal proportions, the two elements combining with the third element, must combine with each other in the same ratio or multiple of that ratio. P_2O_3, PH_3 and H_2O correctly illustrate the law of reciprocal proportions. Ratio in the number of atoms of hydrogen and oxygen combining with one P is 3 : 1.5 i.e., 2 : 1.

127. (a) Relative atomic mass

$$= \frac{\text{Mass of one atom of the element}}{1/12^{\text{th}} \text{ part of the mass of one atom of Carbon} - 12}$$

or $\frac{\text{Mass of one atom of the element}}{\text{mass of one atom of the C} - 12} \times 12$

Now if we use $^1/_6$ in place of $^1/_{12}$ the formula becomes

$$\text{Relative atomic mass} = \frac{\text{Mass of one atom of element}}{\text{Mass of one atom of carbon}} \times 6$$

$\therefore$ Relative atomic mass decrease twice

128. (a) No. of molecules in different cases

(a) $\because$ 22.4 litre at STP contains

$= 6.023 \times 10^{23}$ molecules of H_2

$\therefore$ 15 litre at STP contains $= \frac{15}{22.4} \times 6.023 \times 10^{23}$

$= 4.03 \times 10^{23}$ molecules of H_2

(b) $\because$ 22.4 litre at STP contains

$= 6.023 \times 10^{23}$ molecules of N_2

$\because$ 5 litre at STP contains $= \frac{5}{22.4} \times 6.023 \times 10^{23}$

$= 1.344 \times 10^{23}$ molecules of N_2

(c) $\because$ 2 gm of $H_2 = 6.023 \times 10^{23}$ molecules of H_2

$\because$ 0.5 gm of $H_2 = \frac{0.5}{2} \times 6.023 \times 10^{23}$

$= 1.505 \times 10^{23}$ molecules of H_2

(d) Similarly 10 g of O_2 gas

$= \frac{10}{32} \times 6.023 \times 10^{23}$ molecules of O_2

$= 1.88 \times 10^{23}$ molecules of O_2

Thus (a) will have maximum number of molecules

129. (d) 1 Mole of $Mg_3(PO_4)_2$ contains 8 mole of oxygen atoms

$\therefore$ 8 mole of oxygen atoms $\equiv$ 1 mole of $Mg_3(PO_4)_2$

0.25 mole of oxygen atom $\equiv \frac{1}{8} \times 0.25$ mole of $Mg_3(PO_4)_2$

$= 3.125 \times 10^{-2}$ mole of $Mg_3(PO_4)_2$

130. (c) $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

$1 \text{ gram cm}^{-3} = \frac{1 \text{ gram}}{\text{cm}^3}$

$\text{Volume} = \frac{\text{Mass}}{\text{Density}} = \frac{1 \text{ gram}}{1 \text{ gram cm}^{-3}} = 1 \text{cm}^3$

$\therefore$ Volume occupied by 1 gram water = 1 cm^3

or Volume occupied by

$\frac{6.023 \times 10^{23}}{18}$ molecules of water = 1 cm^3

[$\therefore$ 1g water $= \frac{1}{18}$ moles of water]

Thus volume occupied by 1 molecule of water

$= \frac{1 \times 18}{6.023 \times 10^{23}} \text{cm}^3 = 3.0 \times 10^{-23} \text{ cm}^3.$

131. (b) The number of atoms in 0.1 mole of a triatomic gas

$= 0.1 \times 3 \times 6.023 \times 10^{23.}$

$= 1.806 \times 10^{23}$

132. (d) At NTP 22400 cc of $N_2O = 6.02 \times 10^{23}$ molecules

$\therefore$ 1 cc $N_2O = \frac{6.02 \times 10^{23}}{22400}$ molecules

$= \frac{3 \times 6.02 \times 10^{23}}{22400}$ atoms $= \frac{1.8}{224} \times 10^{22}$ atoms

No. of electrons in a molecule of $N_2O = 7 + 7 + 8 = 22$

Hence no. of electrons

$= \frac{6.02 \times 10^{23}}{22400} \times 22$ electrons $= \frac{1.32 \times 10^{23}}{224}$

133. (b) If 10^{20} grains are distributed in one sec, 6.023×10^{23} grains will be distributed in

$\frac{6.023 \times 10^{23} \times 1}{10^{20} \times 60 \times 60} = 1.673$ hrs

134. (a) Mass of 6.023×10^{23} atoms of oxygen = 16 g

Mass of one atom of oxygen

$= \frac{16}{6.023 \times 10^{23}} = 2.66 \times 10^{-23}$ g

Mass of 6.023×10^{23} atoms of nitrogen = 14 g

Mass of one atom of nitrogen

$= \frac{14}{6.023 \times 10^{23}} = 2.32 \times 10^{-23}$ g

Mass of 1×10^{-10} mole of oxygen $= 16 \times 10^{-10}$

Mass of 1 mole of copper = 63 g

Mass of 1 mole of oxygen = 16 g

Mass of 1×10^{-10} mole of copper $= 63 \times 1 \times 10^{-10}$

$= 63 \times 10^{-10}$

So, the order of increasing mass is II < I < III < IV.

135. (b) The equation for the formation of Al_2O_3 can be represented as

$$\underset{2\text{ moles}}{2Al} + \underset{1.5\text{ moles}}{3/2O_2} \longrightarrow \underset{1\text{ mole}}{Al_2O_3}$$

Thus, 1 mole of alumina is obtained by the reaction of 1.5 moles of oxygen and 2 moles of aluminium. Thus, the amount of aluminium

$= 2 \times 27$ g $= 54$ g. [mol. mass of Al = 27]

136. (c) (a) Weight of H_2 = mole × molecular wt.

$= 0.2 \times 2 = 0.4$ g

(b) $6.023 \times 10^{23} = 1$ mole

Thus $6.023 \times 10^{22} = 0.1$ mole

Weight of $N_2 = 0.1 \times 28 = 2.8$ g

(c) Weight of silver = 0.1 g

(d) Weight of oxygen $= 32 \times 0.1 = 3.2$ g

137. (c)

	Percentage	R.N.A	Simplest ratio
C	9	$\frac{9}{12}=\frac{3}{4}$	3
H	1	$\frac{1}{1}=1$	4
N	3.5	$\frac{3.5}{14}=\frac{1}{4}$	1

Empirical formula $= C_3H_4N$
$(C_3H_4N)_n = 108$
$(12\times3+4\times1+14)_n = 108$
$(54)_n = 108$
$n=\frac{108}{54}=2$
$\therefore$ molecular formula $= C_6H_8N_2$

138. (c) The acid with empirical formula CH_2O_2 is formic acid, H—COOH.

139. (d) $\because$ 18 gm, H_2O contains = 2 gm H

$\therefore$ 0.72 gm H_2O contains $=\frac{2}{18}\times0.72$ gm $=0.08$ gm H

$\because$ 44 gm CO_2 contains = 12 gm C

$\therefore$ 3.08 gm CO_2 contains $=\frac{12}{44}\times3.08=0.84$ gm C

$\therefore$ $C:H=\frac{0.84}{12}:\frac{0.08}{1}=0.07:0.08=7:8$

$\therefore$ Empirical formula $= C_7H_8$

140. (a) Let 100 g of compound be there.

Number of moles of Nitrogen $=\frac{35}{14}=2.5$

Number of moles of Hydrogen $=\frac{5}{1.008}=4.9$

Number of moles of Carbon $=\frac{60}{12.01}=4.9$

Since 2.5 is the smallest value division by it give ratio
N : H : C
1 : 1.96 : 1.96
= 1 : 2 : 2
Empirical formula $= C_2H_2N$
Empirical formula weight = 2 × 12 + 2 + 14 = 40
Molecular mass = 80
Molecular formulae = n (C_2H_2N)

$= 2\ (C_2H_2N)\left(n=\frac{80}{40}\right) = C_4H_4N_2$

141. (b) Let 100 g of compound be there.

Number of moles of C $=\frac{77.43\text{g}}{12.01\text{g / mol}}=6.44$

Number of moles of H $=\frac{7.53\text{g}}{1.008\text{g / mol}}=7.47$

Number of moles of N $=\frac{15.05}{14.00\text{g / mol}}=1.075$

1.074 is the smallest value, division by it gives a ratio of C : H : N
= 5.9 : 6.9 : 1
= 6 : 7 : 1
Empirical formula $= C_6H_7N$
Empirical formula weight = 6 × 12 + 7 + 14 = 93

$n=\frac{\text{Molecular mass}}{\text{Empirial formula weight}}=1$

Molecular formula = 1 × C_6H_7N = C_6H_7N

142. (d) $\underset{2(78)}{2C_6H_6}+\underset{15(32)}{15O_2(g)}\rightarrow12CO_2(g)+6H_2O(g)$

$\because$ 156 gm of benzene required oxygen = 15 × 22.4 litre

$\therefore$ 1 gm of benzene required oxygen $=\frac{15\times22.4}{156}$ litre

$\therefore$ 39 gm of Benzene required oxygen

$=\frac{15\times22.4\times39}{156}=84.0$ litre

143. (c) $\underset{197\text{ gm}}{BaCO_3}\rightarrow BaO+CO_2$

$\because$ 197 gm of $BaCO_3$ released carbon dioxide = 22.4 litre at STP

$\therefore$ 1 gm of $BaCO_3$ released carbon dioxide $=\frac{22.4}{197}$ litre

$\therefore$ 9.85 gm of $BaCO_3$ released carbon dioxide

$=\frac{22.4}{197}\times9.85=1.12$ litre

144. (b) $\underset{n\text{ mol}}{Ba(OH)_2}+CO_2\longrightarrow\underset{n\text{ mol}}{BaCO_3}+H_2O$

n mol $Ba(OH)_2 = n$ mol $BaCO_3$

$\therefore$ 0.205 mol $Ba(OH)_2\equiv0.205$ mol $BaCO_3$

Wt. of substance = No. of moles × Molecular mass
$=0.205\times197.3=40.5$ g

145. (a)

Fe_2O_3	+	3CO	→	2Fe	+	$3CO_2$
1 vol.		3 vol.		2 vol.		3 vol.
1 mol.		3 mol.		2 mol.		3 mol.

($\because$ vol% = mol%)

One gram mol of any gas occupies 22.4 litre at NTP. 1 mol of Fe_2O_3 requires 3 mol of CO for its reduction i.e., 1 mol of Fe_2O_3 requires 3 × 22.4 litre or 67.2 dm^3 CO to get itself reduced.

146. (d) Writing the equation for the reaction, we get

PbO	+	2HCl	$\longrightarrow$	$PbCl_2$	+	H_2O
207 + 16 = 223 g		2 × 36.5 = 73g		207 + 71 = 278g		

No. of moles of PbO $=\frac{6.5}{223}=0.029$

No. of moles of HCl $=\frac{3.2}{36.5}=0.0877$

Thus PbO is the limiting reactant 1 mole of PbO produce 1 mole $PbCl_2$.
0.029 mole PbO produces 0.029 mole $PbCl_2$.

147. (a) $C_{57}H_{110}O_6 + \frac{163}{2}O_2 \rightarrow 57CO_2 + 55H_2O$

890 gram of fat produces 990 gram of H_2O

450 gram fat produces $\left(\frac{990}{890}\times 450\right)$

$= 500.56$ g of H_2O

Moles of $H_2O = \frac{500.56\text{g}}{18\text{g/mol}} = 27.80$

148. (d) $n_C = \frac{26\text{g}}{12\text{g/mol}} = 2.16$

$n_{O_2} = \frac{20\text{g}}{32\text{g/mol}} = 0.625$

O_2 will be a limiting reagent in reaction (i)

$n_{N_2} = \frac{60\text{g}}{28\text{g/mol}} = 2.14$

$n_{H_2} = 40$

According to balanced equation,
1 mol of N_2 requires 3 mole of N_2
2.14 mol of N_2 require 6.42 mol of N_2
N_2 will be a limiting reagent in reaction (ii)

$n_{P_4} = \frac{100\text{g}}{4\times 31} = 0.86$ $\quad n_{O_2} = 6.25$

According to balanced equation
1 mol of P_4 require 3 mol of O_2
0.86 mol of P_4 require 2.58 mol of O_2
So P_4 is a limiting reagent in reaction (iii)

149. (a) From molarity equation
$M_1V_1 + M_2V_2 = MV_{(total)}$

$2\times\frac{10}{1000} + 0.5\times\frac{200}{1000} = M\times\frac{210}{1000}$

$120 = M\times 210$

$M = \frac{120}{210} = 0.57$ M

150. (a) 1 ppm = 1 mg / 1 litre (for liquids)
4 ppm = 4 mg / 1 litre
1 litre contains 4 mg of fluoride ions

10 ml contains $\frac{4}{1000}\times 10 = 0.04$ mg

Number of moles of fluoride = $\frac{0.04\text{g}}{19\text{g/mol}}$

$= 2.10 \times 10^{-3}$

151. (a) Molarity (M) $= \frac{\text{No. of moles of solute}}{\text{Volume of solution in litres}}$

Molarity $\propto n_{solute}$

$n_{NaOH} = \frac{25}{40} = 0.625$

$n_{LiOH} = \frac{25}{24} = 1.04$

$n_{Al(OH)_3} = \frac{25}{(17+3\times 17)} = 0.32$

$n_{KOH} = \frac{25}{(39+17)} = 0.45$

$n_{B(OH)_3} = \frac{25}{(11+17\times 3)} = 0.403$