

# Chapter 1. Some Basic Concepts of Chemistry

- Suppose the elements  $X$  and  $Y$  combine to form two compounds  $XY_2$  and  $X_3Y_2$ . When 0.1 mole of  $XY_2$  weighs 10 g and 0.05 mole of  $X_3Y_2$  weighs 9 g, the atomic weights of  $X$  and  $Y$  are  
(a) 40, 30 (b) 60, 40  
(c) 20, 30 (d) 30, 20  
(NEET-II 2016)
- What is the mass of the precipitate formed when 50 mL of 16.9% solution of  $AgNO_3$  is mixed with 50 mL of 5.8%  $NaCl$  solution? (Ag = 107.8, N = 14, O = 16, Na = 23, Cl = 35.5)  
(a) 3.5 g (b) 7 g (c) 14 g (d) 28 g  
(2015)
- If Avogadro number  $N_A$ , is changed from  $6.022 \times 10^{23} \text{ mol}^{-1}$  to  $6.022 \times 10^{20} \text{ mol}^{-1}$ , this would change  
(a) the mass of one mole of carbon  
(b) the ratio of chemical species to each other in a balanced equation  
(c) the ratio of elements to each other in a compound  
(d) the definition of mass in units of grams.  
(2015)
- The number of water molecules is maximum in  
(a) 1.8 gram of water  
(b) 18 gram of water  
(c) 18 moles of water  
(d) 18 molecules of water. (2015)
- A mixture of gases contains  $H_2$  and  $O_2$  gases in the ratio of 1 : 4 (w/w). What is the molar ratio of the two gases in the mixture?  
(a) 16 : 1 (b) 2 : 1 (c) 1 : 4 (d) 4 : 1  
(2015, Cancelled)
- Equal masses of  $H_2$ ,  $O_2$  and methane have been taken in a container of volume  $V$  at temperature  $27^\circ C$  in identical conditions. The ratio of the volumes of gases  $H_2 : O_2 : \text{methane}$  would be  
(a) 8 : 16 : 1 (b) 16 : 8 : 1  
(c) 16 : 1 : 2 (d) 8 : 1 : 2 (2014)
- When 22.4 litres of  $H_{2(g)}$  is mixed with 11.2 litres of  $Cl_{2(g)}$ , each at S.T.P, the moles of  $HCl_{(g)}$  formed is equal to  
(a) 1 mol of  $HCl_{(g)}$  (b) 2 mol of  $HCl_{(g)}$   
(c) 0.5 mol of  $HCl_{(g)}$  (d) 1.5 mol of  $HCl_{(g)}$ .  
(2014)
- 1.0 g of magnesium is burnt with 0.56 g  $O_2$  in a closed vessel. Which reactant is left in excess and how much? (At. wt. Mg = 24, O = 16)  
(a) Mg, 0.16 g (b)  $O_2$ , 0.16 g  
(c) Mg, 0.44 g (d)  $O_2$ , 0.28 g  
(2014)
- $6.02 \times 10^{20}$  molecules of urea are present in 100 mL of its solution. The concentration of solution is  
(a) 0.001 M (b) 0.1 M  
(c) 0.02 M (d) 0.01 M  
(NEET 2013)
- In an experiment it showed that 10 mL of 0.05 M solution of chloride required 10 mL of 0.1 M solution of  $AgNO_3$ , which of the following will be the formula of the chloride ( $X$  stands for the symbol of the element other than chlorine)  
(a)  $X_2Cl_2$  (b)  $XCl_2$  (c)  $XCl_4$  (d)  $X_2Cl$   
(Karnataka NEET 2013)
- Which has the maximum number of molecules among the following?  
(a) 44 g  $CO_2$  (b) 48 g  $O_3$   
(c) 8 g  $H_2$  (d) 64 g  $SO_2$   
(Mains 2011)
- The number of atoms in 0.1 mol of a triatomic gas is ( $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ )  
(a)  $6.026 \times 10^{22}$  (b)  $1.806 \times 10^{23}$   
(c)  $3.600 \times 10^{23}$  (d)  $1.800 \times 10^{22}$   
(2010)



13. 25.3 g of sodium carbonate,  $\text{Na}_2\text{CO}_3$  is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion,  $\text{Na}^+$  and carbonate ions,  $\text{CO}_3^{2-}$  are respectively (Molar mass of  $\text{Na}_2\text{CO}_3 = 106 \text{ g mol}^{-1}$ )  
 (a) 0.955 M and 1.910 M  
 (b) 1.910 M and 0.955 M  
 (c) 1.90 M and 1.910 M  
 (d) 0.477 M and 0.477 M (2010)
14. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be  
 (a) 3 mol (b) 4 mol  
 (c) 1 mol (d) 2 mol (2009)
15. What volume of oxygen gas ( $\text{O}_2$ ) measured at  $0^\circ\text{C}$  and 1 atm, is needed to burn completely 1 L of propane gas ( $\text{C}_3\text{H}_8$ ) measured under the same conditions?  
 (a) 5 L (b) 10 L (c) 7 L (d) 6 L (2008)
16. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of  $\text{PbO}$  and 3.2 g  $\text{HCl}$ ?  
 (a) 0.011 (b) 0.029 (c) 0.044 (d) 0.333 (2008)
17. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be  
 (a)  $\text{CHO}$  (b)  $\text{CH}_4\text{O}$   
 (c)  $\text{CH}_3\text{O}$  (d)  $\text{CH}_2\text{O}$  (2008)
18. An element,  $X$  has the following isotopic composition:  
 $^{200}\text{X} : 90\%$      $^{199}\text{X} : 8.0\%$      $^{202}\text{X} : 2.0\%$   
 The weighted average atomic mass of the naturally occurring element  $X$  is closest to  
 (a) 201 amu (b) 202 amu  
 (c) 199 amu (d) 200 amu (2007)
19. The maximum number of molecules is present in  
 (a) 15 L of  $\text{H}_2$  gas at STP  
 (b) 5 L of  $\text{N}_2$  gas at STP  
 (c) 0.5 g of  $\text{H}_2$  gas  
 (d) 10 g of  $\text{O}_2$  gas. (2004)
20. Which has maximum molecules?  
 (a) 7 g  $\text{N}_2$  (b) 2 g  $\text{H}_2$   
 (c) 16 g  $\text{NO}_2$  (d) 16 g  $\text{O}_2$  (2002)
21. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (at. wt. = 78.4) then minimum molecular weight of peroxidase anhydrous enzyme is  
 (a)  $1.568 \times 10^4$  (b)  $1.568 \times 10^3$   
 (c) 15.68 (d)  $2.136 \times 10^4$  (2001)
22. Molarity of liquid  $\text{HCl}$ , if density of solution is 1.17 g/cc is  
 (a) 36.5 (b) 18.25  
 (c) 32.05 (d) 42.10 (2001)
23. Specific volume of cylindrical virus particle is  $6.02 \times 10^{-2} \text{ cc/g}$  whose radius and length are 7 Å and 10 Å respectively. If  $N_A = 6.02 \times 10^{23}$ , find molecular weight of virus.  
 (a) 15.4 kg/mol (b)  $1.54 \times 10^4 \text{ kg/mol}$   
 (c)  $3.08 \times 10^4 \text{ kg/mol}$  (d)  $3.08 \times 10^3 \text{ kg/mol}$  (2001)
24. In quantitative analysis of second group in laboratory,  $\text{H}_2\text{S}$  gas is passed in acidic medium for precipitation. When  $\text{Cu}^{2+}$  and  $\text{Cd}^{2+}$  react with  $\text{KCN}$ , then for product, true statement is  
 (a)  $\text{K}_2[\text{Cu}(\text{CN})_4]$  more soluble  
 (b)  $\text{K}_2[\text{Cd}(\text{CN})_4]$  less stable  
 (c)  $\text{K}_3[\text{Cu}(\text{CN})_2]$  less stable  
 (d)  $\text{K}_2[\text{Cd}(\text{CN})_3]$  more stable. (2000)
25. Volume of  $\text{CO}_2$  obtained by the complete decomposition of 9.85 g of  $\text{BaCO}_3$  is  
 (a) 2.24 L (b) 1.12 L  
 (c) 0.84 L (d) 0.56 L (2000)
26. Oxidation numbers of  $A$ ,  $B$ ,  $C$  are +2, +5 and -2 respectively. Possible formula of compound is  
 (a)  $A_2(\text{BC}_2)_2$  (b)  $A_3(\text{BC}_4)_2$   
 (c)  $A_2(\text{BC}_3)_2$  (d)  $A_3(\text{B}_2\text{C})_2$  (2000)
27. The number of atoms in 4.25 g of  $\text{NH}_3$  is approximately  
 (a)  $4 \times 10^{23}$  (b)  $2 \times 10^{23}$   
 (c)  $1 \times 10^{23}$  (d)  $6 \times 10^{23}$  (1999)
28. Given the numbers: 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers is  
 (a) 3, 3 and 4 respectively  
 (b) 3, 4 and 4 respectively  
 (c) 3, 4 and 5 respectively  
 (d) 3, 3 and 3 respectively. (1998)



29. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule of haemoglobin is  
(a) 4 (b) 6 (c) 3 (d) 2  
(1998)
30. In the reaction,  
 $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{l})$   
 when 1 mole of ammonia and 1 mole of  $\text{O}_2$  are made to react to completion :  
 (a) All the oxygen will be consumed.  
 (b) 1.0 mole of NO will be produced.  
 (c) 1.0 mole of  $\text{H}_2\text{O}$  is produced.  
 (d) All the ammonia will be consumed.  
(1998)
31. Among the following which one is not paramagnetic? [Atomic numbers; Be = 4, Ne = 10, As = 33, Cl = 17]  
 (a)  $\text{Ne}^{2+}$  (b)  $\text{Be}^+$  (c)  $\text{Cl}^-$  (d)  $\text{As}^+$   
(1998)
32. 0.24 g of a volatile gas, upon vaporisation, gives 45 mL vapour at NTP. What will be the vapour density of the substance? (Density of  $\text{H}_2 = 0.089$ )  
 (a) 95.93 (b) 59.93 (c) 95.39 (d) 5.993  
(1996)
33. The amount of zinc required to produce 224 mL of  $\text{H}_2$  at STP on treatment with dilute  $\text{H}_2\text{SO}_4$  will be  
 (a) 65 g (b) 0.065 g (c) 0.65 g (d) 6.5 g  
(1996)
34. The dimensions of pressure are the same as that of  
 (a) force per unit volume  
 (b) energy per unit volume  
 (c) force  
 (d) energy.  
(1995)
35. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions, is  
 (a) 0.0093 mol (b) 2.10 mol  
 (c) 0.186 mol (d) 0.21 mol.  
(1995)
36. The total number of valence electrons in 4.2 g of  $\text{N}_3^-$  ion is ( $N_A$  is the Avogadro's number)  
 (a)  $2.1 N_A$  (b)  $4.2 N_A$   
 (c)  $1.6 N_A$  (d)  $3.2 N_A$  (1994)
37. A 5 molar solution of  $\text{H}_2\text{SO}_4$  is diluted from 1 litre to a volume of 10 litres, the normality of the solution will be  
 (a) 1 N (b) 0.1 N  
 (c) 5 N (d) 0.5 N (1991)
38. The number of gram molecules of oxygen in  $6.02 \times 10^{24}$  CO molecules is  
 (a) 10 g molecules (b) 5 g molecules  
 (c) 1 g molecules (d) 0.5 g molecules.  
(1990)
39. Boron has two stable isotopes,  $^{10}\text{B}$ (19%) and  $^{11}\text{B}$ (81%). Calculate average at. wt. of boron in the periodic table  
 (a) 10.8 (b) 10.2  
 (c) 11.2 (d) 10.0 (1990)
40. The molecular weight of  $\text{O}_2$  and  $\text{SO}_2$  are 32 and 64 respectively. At  $15^\circ\text{C}$  and 150 mmHg pressure, one litre of  $\text{O}_2$  contains ' $N$ ' molecules. The number of molecules in two litres of  $\text{SO}_2$  under the same conditions of temperature and pressure will be  
 (a)  $N/2$  (b)  $N$   
 (c)  $2N$  (d)  $4N$  (1990)
41. A metal oxide has the formula  $\text{Z}_2\text{O}_3$ . It can be reduced by hydrogen to give free metal and water. 0.1596 g of the metal oxide requires 6 mg of hydrogen for complete reduction. The atomic weight of the metal is  
 (a) 27.9 (b) 159.6  
 (c) 79.8 (d) 55.8 (1989)
42. Ratio of  $C_p$  and  $C_v$  of a gas ' $X$ ' is 1.4. The number of atoms of the gas ' $X$ ' present in 11.2 litres of it at NTP will be  
 (a)  $6.02 \times 10^{23}$  (b)  $1.2 \times 10^{23}$   
 (c)  $3.01 \times 10^{23}$  (d)  $2.01 \times 10^{23}$   
(1989)
43. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene?  
 (a) 2.8 kg (b) 6.4 kg (c) 9.6 kg (d) 96 kg  
(1989)
44. The number of oxygen atoms in 4.4 g of  $\text{CO}_2$  is  
 (a)  $1.2 \times 10^{23}$  (b)  $6 \times 10^{22}$   
 (c)  $6 \times 10^{23}$  (d)  $12 \times 10^{23}$   
(1989)



45. At S.T.P. the density of  $\text{CCl}_4$  vapour in g/L will be nearest to  
 (a) 6.87 (b) 3.42 (c) 10.26 (d) 4.57  
 (1988)
46. One litre hard water contains 12.00 mg  $\text{Mg}^{2+}$ . Milli-equivalents of washing soda required to remove its hardness is  
 (a) 1 (b) 12.16  
 (c)  $1 \times 10^{-3}$  (d)  $12.16 \times 10^{-3}$   
 (1988)
47. 1 cc  $\text{N}_2\text{O}$  at NTP contains  
 (a)  $\frac{1.8}{224} \times 10^{22}$  atoms  
 (b)  $\frac{6.02}{22400} \times 10^{23}$  molecules  
 (c)  $\frac{1.32}{224} \times 10^{23}$  electrons  
 (d) All the above. (1988)

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**Answer Key**

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

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

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

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

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

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

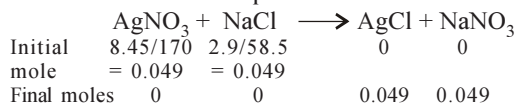
On solving equations (i) and (ii), we get  $y = 30$   
 $x + 2(30) = 100 \Rightarrow x = 100 - 60 = 40$

2. (b) : 16.9% solution of  $\text{AgNO}_3$  means 16.9 g of  $\text{AgNO}_3$  in 100 mL of solution.

16.9 g of  $\text{AgNO}_3$  in 100 mL solution  $\equiv$  8.45 g of  $\text{AgNO}_3$  in 50 mL solution.

Similarly, 5.8% of  $\text{NaCl}$  in 100 mL solution  $\equiv$  2.9 g of  $\text{NaCl}$  in 50 mL solution.

The reaction can be represented as :



$$\therefore \text{Mass of AgCl precipitated} = 0.049 \times 143.3 = 7.02 \approx 7 \text{ g}$$

3. (a) : Mass of 1 mol ( $6.022 \times 10^{23}$  atoms) of carbon = 12 g

If Avogadro number is changed to  $6.022 \times 10^{20}$  atoms then mass of 1 mol of carbon

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

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

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

5. (d) : Number of moles of  $\text{H}_2 = \frac{1}{2}$

$$\text{Number of moles of } \text{O}_2 = \frac{4}{32}$$

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

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

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

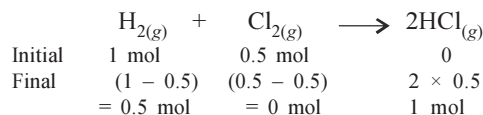
$$n_{\text{H}_2} = \frac{w}{2}; n_{\text{O}_2} = \frac{w}{32}; n_{\text{CH}_4} = \frac{w}{16}$$

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

7. (a) : 1 mole  $\equiv$  22.4 litres at S.T.P.

$$n_{\text{H}_2} = \frac{22.4}{22.4} = 1 \text{ mol}; n_{\text{Cl}_2} = \frac{11.2}{22.4} = 0.5 \text{ mol}$$

Reaction is as,

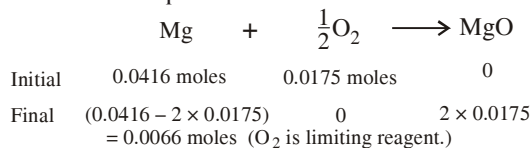


Here,  $\text{Cl}_2$  is limiting reagent. So, 1 mole of  $\text{HCl}_{(g)}$  is formed.

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

$$n_{\text{O}_2} = \frac{0.56}{32} = 0.0175 \text{ moles}$$

The balanced equation is



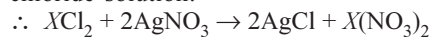
$\therefore$  Mass of Mg left in excess =  $0.0066 \times 24 = 0.16$  g

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

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

10. (b) : Millimoles of solution of chloride  
 $= 0.05 \times 10 = 0.5$

Millimoles of  $\text{AgNO}_3$  solution =  $10 \times 0.1 = 1$   
 So, the millimoles of  $\text{AgNO}_3$  are double than the chloride solution.



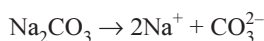
11. (c) : 8 g  $\text{H}_2$  has 4 moles while the others has 1 mole each.

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

13. (b) : Given that molar mass of  $\text{Na}_2\text{CO}_3 = 106$  g

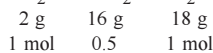
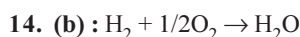
$$\therefore \text{Molarity of solution} = \frac{25.3 \times 1000}{106 \times 250}$$

$$= 0.9547 \text{ M} = 0.955 \text{ M}$$



$$[\text{Na}^+] = 2[\text{Na}_2\text{CO}_3] = 2 \times 0.955 = 1.910 \text{ M}$$

$$[\text{CO}_3^{2-}] = [\text{Na}_2\text{CO}_3] = 0.955 \text{ M}$$

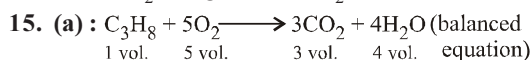


$$10 \text{ g of H}_2 = 5 \text{ mol and } 64 \text{ g of O}_2 = 2 \text{ mol}$$

$\therefore$  In this reaction, oxygen is the limiting reagent so amount of  $\text{H}_2\text{O}$  produced depends on that of  $\text{O}_2$ .

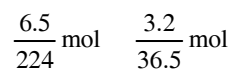
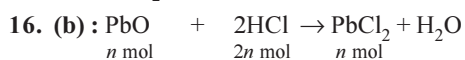
Since 0.5 mol of  $\text{O}_2$  gives 1 mol  $\text{H}_2\text{O}$

$\therefore$  2 mol of  $\text{O}_2$  will give 4 mol  $\text{H}_2\text{O}$



According to the above equation

1 vol. or 1 litre of propane requires to 5 vol. or 5 litre of  $\text{O}_2$  to burn completely.



Formation of moles of lead (II) chloride depends upon the no. of moles of  $\text{PbO}$  which acts as a limiting factor here. So, no. of moles of  $\text{PbCl}_2$  formed will be equal to the no. of moles of  $\text{PbO}$  i.e. 0.029.

17. (c) :

Element	%	Atomic mass	mole ratio	simple ratio
C	38.71	12	$\frac{38.71}{12} = 3.22$	$\frac{3.22}{3.22} = 1$
H	9.67	1	$\frac{9.67}{1} = 9.67$	$\frac{9.67}{3.22} = 3$
O	51.62	16	$\frac{51.62}{16} = 3.22$	$\frac{3.22}{3.22} = 1$

Hence empirical formula of the compound would be  $\text{CH}_3\text{O}$ .

18. (d) : Average isotopic mass of X

$$= \frac{200 \times 90 + 199 \times 8 + 202 \times 2}{90 + 8 + 2}$$

$$= \frac{18000 + 1592 + 404}{100} = 199.96 \text{ a.m.u.} \approx 200 \text{ a.m.u.}$$

19. (a) : At STP, 22.4 L  $\text{H}_2 = 6.023 \times 10^{23}$  molecules

$$15 \text{ L H}_2 = \frac{6.023 \times 10^{23} \times 15}{22.4} = 4.033 \times 10^{23}$$

$$5 \text{ L N}_2 = \frac{6.023 \times 10^{23} \times 5}{22.4} = 1.344 \times 10^{23}$$

$$2 \text{ g H}_2 = 6.023 \times 10^{23}$$

$$0.5 \text{ g H}_2 = \frac{6.023 \times 10^{23} \times 0.5}{2} = 1.505 \times 10^{23}$$

$$32 \text{ g O}_2 = 6.023 \times 10^{23}$$

$$10 \text{ g of O}_2 = \frac{6.023 \times 10^{23} \times 10}{32} = 1.882 \times 10^{23}$$

20. (b) : 1 mole of any element contain  $6.023 \times 10^{23}$  number of molecules.

$$\Rightarrow 1 \text{ g mole of O}_2 = 32 \text{ g O}_2$$

$$\Rightarrow 16 \text{ g of O}_2 = 0.5 \text{ g mole O}_2$$

$$\Rightarrow 1 \text{ g mole of N}_2 = 28 \text{ g N}_2$$

$$\Rightarrow 7 \text{ g N}_2 = 0.25 \text{ g mole N}_2$$

$$\Rightarrow 1 \text{ g mole of H}_2 = 2 \text{ g H}_2$$

$$\Rightarrow 2 \text{ g H}_2 = 1.0 \text{ g mole H}_2$$

$$\Rightarrow 1 \text{ g mole NO}_2 = 14 + 16 \times 2 = 46$$

$$\Rightarrow 16 \text{ g of NO}_2 = 0.35 \text{ mole NO}_2$$

2 g  $\text{H}_2$  (1 g mole  $\text{H}_2$ ) contain maximum molecules.

21. (a) : In peroxidase anhydrous enzyme 0.5% Se is present means, 0.5 g Se is present in 100 g of enzyme. In a molecule of enzyme one Se atom must be present. Hence 78.4 g Se will be present in

$$\frac{100}{0.5} \times 78.4 = 1.568 \times 10^4$$

22. (c) : Density = 1.17 g/cc.

$\Rightarrow$  1 cc. solution contains 1.17 g of HCl

$$\therefore \text{Molarity} = \frac{1.17 \times 1000}{36.5 \times 1} = 32.05$$

23. (a) : Specific volume (vol. of 1 g) cylindrical virus particle =  $6.02 \times 10^{-2}$  cc/g

Radius of virus,  $r = 7 \text{ \AA} = 7 \times 10^{-8} \text{ cm}$

Volume of virus =  $\pi r^2 l$

$$= \frac{22}{7} \times (7 \times 10^{-8})^2 \times 10 \times 10^{-8} = 154 \times 10^{-23} \text{ cc}$$

$$\text{wt. of one virus particle} = \frac{\text{Volume}}{\text{Specific volume}}$$

$$\Rightarrow \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \text{ g}$$

$\therefore$  Molecular wt. of virus = wt. of  $N_A$  particle

$$= \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \times 6.02 \times 10^{23} \text{ g/mol.}$$

$$= 15400 \text{ g/mol} = 15.4 \text{ kg/mol}$$

24. (c) :  $\text{K}_3[\text{Cu}(\text{CN})_2] = 3(+1) + x + 2(-1) = 0$

$$\Rightarrow x = -1$$

As the oxidation no. of 'Cu' is  $-1$  ( $-ve$ ), so this complex is unstable and is not formed.

25. (b) :  $\text{BaCO}_3 \rightarrow \text{BaO} + \text{CO}_2$

$$197.34 \text{ g} \rightarrow 22.4 \text{ L at N.T.P.}$$

$$9.85 \text{ g} \rightarrow \frac{22.4}{197.34} \times 9.85 = 1.118 \text{ L}$$



$\Rightarrow$  9.85 g  $\text{BaCO}_3$  will produce 1.118 L  $\text{CO}_2$  at N.T.P. on the complete decomposition.

**26. (b) :** In  $A_3(BC_4)_2$ ,  $(+2) \times 3 + 2[+5 + 4(-2)]$   
 $\Rightarrow +6 + 10 - 16 = 0$

Hence in the compound  $A_3(BC_4)_2$ , the oxidation no. of 'A', 'B' and 'C' are +2, +5 and -2 respectively.

**27. (d) :** No. of molecules in 4.25 g  $\text{NH}_3$   
 $= \frac{4.25}{17} \times 6.023 \times 10^{23} = 2.5 \times 6.023 \times 10^{22}$

Number of atoms in 4.25 g  $\text{NH}_3$   
 $= 4 \times 2.5 \times 6.023 \times 10^{22} = 6.023 \times 10^{23}$

**28. (d) :** Zeros placed left to the number are never significant, therefore the no. of significant figures for the numbers.

161 cm = 0.161 cm and 0.0161 cm are same, i.e. 3

**29. (a) :** Quantity of iron in one molecule

$$= \frac{67200}{100} \times 0.334 = 224.45 \text{ amu}$$

No. of iron atoms in one molecule of haemoglobin  
 $= \frac{224.45}{56} = 4$

**30. (a) :**  $4\text{NH}_{3(g)} + 5\text{O}_{2(g)} \rightarrow 4\text{NO}_{(g)} + 6\text{H}_2\text{O}_{(l)}$   
 4 mole + 5 mole  $\rightarrow$  4 mole + 6 mole

$\Rightarrow$  1 mole of  $\text{NH}_3$  requires =  $\frac{5}{4} = 1.25$  mole of oxygen

while 1 mole of  $\text{O}_2$  requires =  $\frac{4}{5} = 0.8$  mole of  $\text{NH}_3$ .

As there is 1 mole of  $\text{NH}_3$  and 1 mole of  $\text{O}_2$ , so all oxygen will be consumed.

**31. (c) :**  $\text{Ne}^{2+}(8) \Rightarrow 1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$

$\text{Be}^+(3) \Rightarrow 1s^2 2s^1$

$\text{Cl}^-(18) \Rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6$

$\text{As}^+(32) \Rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p_x^1 4p_y^1$

$\text{Cl}^-$  is not paramagnetic, as it has no unpaired electron.

**32. (b) :** Weight of gas = 0.24 g, Volume of gas = 45 mL = 0.045 litre and density of  $\text{H}_2$  = 0.089.

We know that weight of 45 mL of  $\text{H}_2$  = Density  $\times$  Volume =  $0.089 \times 0.045 = 4.005 \times 10^{-3}$  g

Therefore vapour density

$$= \frac{\text{Weight of certain volume of substance}}{\text{Weight of same volume of hydrogen}}$$

$$= \frac{0.24}{4.005 \times 10^{-3}} = 59.93$$

**33. (c) :**  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$   
 (65 g) (22400 mL)

Since 65 g of zinc reacts to liberate 22400 mL of  $\text{H}_2$  at STP, therefore amount of zinc needed to produce 224 mL of  $\text{H}_2$  at STP

$$= \frac{65}{22400} \times 224 = 0.65 \text{ g}$$

**34. (b) :** Pressure =  $\frac{\text{Force}}{\text{Area}}$

Therefore dimensions of pressure =  $\frac{\text{MLT}^{-2}}{\text{L}^2} = \text{ML}^{-1}\text{T}^{-2}$

and dimensions of energy per unit volume

$$= \frac{\text{Energy}}{\text{Volume}} = \frac{\text{ML}^2\text{T}^{-2}}{\text{L}^3} = \text{ML}^{-1}\text{T}^{-2}$$

**35. (a) :** Volume of oxygen in one litre of air

$$= \frac{21}{100} \times 1000 = 210 \text{ mL}$$

Therefore no. of mol =  $\frac{210}{22400} = 0.0093 \text{ mol}$

**36. (c) :** Each nitrogen atom has 5 valence electrons, therefore total number of electrons in  $\text{N}_3^-$  ion is 16. Since the molecular mass of  $\text{N}_3$  is 42, therefore total number of electrons in 4.2 g of  $\text{N}_3^-$  ion

$$= \frac{4.2}{42} \times 16 \times N_A = 1.6 N_A$$

**37. (a) :**  $5\text{M H}_2\text{SO}_4 = 10\text{N H}_2\text{SO}_4$

$$N_1 V_1 = N_2 V_2 \Rightarrow 10 \times 1 = N_2 \times 10 \Rightarrow N_2 = 1\text{N}$$

**38. (b) :** Avogadro's No.,  $N_A = 6.02 \times 10^{23}$  molecules.

$\therefore 6.02 \times 10^{24}$  CO molecules = 10 moles CO  
 = 10 g atoms of O = 5 g molecules of  $\text{O}_2$

**39. (a) :** Average atomic mass

$$= \frac{19 \times 10 + 81 \times 11}{100} = 10.81$$

**40. (c) :** If 1L of one gas contains  $N$  molecules, 2 L of any gas under the same conditions will contain  $2N$  molecules.

**41. (d) :**  $\text{Z}_2\text{O}_3 + 3\text{H}_2 \rightarrow 2\text{Z} + 3\text{H}_2\text{O}$

Valency of metal in  $\text{Z}_2\text{O}_3$  = 3

0.1596 g of  $\text{Z}_2\text{O}_3$  react with 6 mg of  $\text{H}_2$ .

$$[1 \text{ mg} = 0.001 \text{ g} = 10^{-3} \text{ g}]$$

$\therefore$  1 g of  $\text{H}_2$  react with =  $\frac{0.1596}{0.006} = 26.6$  g of  $\text{Z}_2\text{O}_3$

$\therefore$  Eq. wt. of  $\text{Z}_2\text{O}_3$  = 26.6

Now, Eq. wt. of Z + Eq. wt. of O = Eq. wt. of Z + 8 = 26.6

$\Rightarrow$  Eq. wt. of Z = 26.6 - 8 = 18.6

$\therefore$  At. wt. of Z = 18.6  $\times$  3 = 55.8

$$\left[ \text{Eq. wt.} = \frac{\text{Atomic wt.}}{\text{Valency of metal}} \right]$$

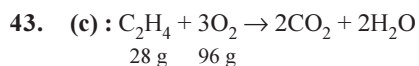
**42. (a) :** Here,  $C_p/C_v = 1.4$ , which shows that the gas is diatomic.

$$22.4 \text{ L at NTP} = 6.02 \times 10^{23} \text{ molecules}$$

$\therefore$  11.2 L at NTP =  $3.01 \times 10^{23}$  molecules

Since gas is diatomic.

$\therefore$  11.2 L at NTP =  $6.02 \times 10^{23}$  atom



$$2.8 \text{ kg } C_2H_4 = \frac{96 \text{ g}}{28 \text{ g}} \times 2.8 \text{ kg}$$

$$= \frac{96}{28} \times 2.8 \times 10^3 \text{ g} = 9.6 \times 10^3 \text{ g} = 9.6 \text{ kg}$$

44. (a) : 1 mol of  $CO_2 = 44 \text{ g}$  of  $CO_2$

$\therefore$  4.4 g  $CO_2 = 0.1 \text{ mol } CO_2 = 6 \times 10^{22}$  molecules

[Since, 1 mole  $CO_2 = 6 \times 10^{23}$  molecules]

$= 2 \times 6 \times 10^{22}$  atoms of O =  $1.2 \times 10^{23}$  atoms of O

45. (a) : 1 mol  $CCl_4$  vapour =  $12 + 4 \times 35.5$

$$= 154 \text{ g} = 22.4 \text{ L}$$

$\therefore$  Density of  $CCl_4$  vapour =  $\frac{154}{22.4} \text{ g L}^{-1}$

$$= 6.875 \text{ g L}^{-1}$$



1g eq.      1g eq.

1g eq. of  $Mg^{2+} = 12 \text{ g}$  of  $Mg^{2+} = 12000 \text{ mg}$

Now, 1000 millieq. of  $Na_2CO_3 = 12000 \text{ mg}$  of  $Mg^{2+}$

$\therefore$  1 millieq. of  $Na_2CO_3 = 12 \text{ mg}$  of  $Mg^{2+}$

47. (d) : As we know,

22400 cc of  $N_2O$  contain  $6.02 \times 10^{23}$  molecules

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

Since in  $N_2O$  molecule there are 3 atoms

$\therefore$  1 cc  $N_2O = \frac{3 \times 6.02 \times 10^{23}}{22400}$  atoms

$$= \frac{1.8 \times 10^{22}}{224} \text{ atoms}$$

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

$$= \frac{1.32}{224} \times 10^{23} \text{ electrons}$$

