AVIRAL CLASSES
IIT-JEE | NEET | FOUNDATIONS

CHEMISTRY
CRASH COURSE

LECTURE - 01

TOPICS : Mole Concept

1. 14 g of element X combine with 16 g of oxygen. On the basis of this information, which of the following is a correct statement (Atomic weight of oxygen = 16)

   (a) The element of X could have an atomic weight of 7 and its oxide the formula XO

   (b) The element X could have an atomic weight of 14 and its oxide the formula X_2O

   (c) The element X could have an atomic weight of 7 and its oxide the formula X_2O

   (d) The element X could have the atomic weight of 14 and its oxide the formula XO_2.

2. A gas is found to have the formula $(CO)_x$. Its vapour density is 70. The value of x must be

   (a) 7 (b) 4

   (c) 5 (d) 6

3. The total number of electrons present in 18 mL of water (density of water is 1 g mL^{-1}) is

   (a) 6.02×10^{23} (b) 6.02×10^{22}

   (c) 6.02×10^{24} (d) 6.02×10^{25}

4. A metal oxide has the formula M_2O_3. It can be reduced by H_2 to give free metal and water. 0.1596 g M_2O_3 required 6 mg of H_2 for complete reduction. The atomic mass of the metal is

   (a) 27.9 (b) 79.8

   (c) 55.8 (d) 159.8

5. The density of a liquid is 1.2 g/mL. There are 35 drops in 2 mL. The number of molecules in 1 drop is (molecular weight of liquid = 70)

   (a) $\frac{1.2}{35}N_A$ (b) $\left(\frac{1}{35}\right)^2 N_A$

   (c) $\frac{1.2}{(35)^2}N_A$ (d) $1.2\ N_A$

6. How many millilitres (mL) of 1 M H_2SO_4 solution is required to neutralise 10 mL of 1 M NaOH solution ?

   (a) 2.5 mL (b) 5.0 mL

   (c) 10.0 mL (d) 20.0 mL

7. In a solution, the concentration of $CaCl_2$ is 5 M and concentration of $MgCl_2$ is 5 m. If hte specific gravity of the solution is 1.05, the concentration of Cl^- i n the solution is

   (a) 10 M (b) 20 M

   (c) 18.5 M (d) 17.12 M

8. 50.0 kg of $N_{2(g)}$ and 10.0 kg of $H_{2(g)}$ are mixed to produce $NH_{3(g)}$. Identify the limiting reagent in the production of NH_3 in this situation.

   (a) Nitroge

   (b) Hydrogen

   (c) can not be predicated

   (d) None of these

9. 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) 0.339 (b) 0.011

   (c) 0.029 (d) 0.044

10. If density of 3 M of NaCl is 1.25 g mL^{-1}, the molality of the same solution will be

    (a) 3 m (b) 2.50 m

    (c) 1.75 m (d) 2.79 m

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LECTURE - 01

TOPICS : Mole Concept (SOLUTION)

1. **(c) :** If atomic weight of X is 7 and 14 g of X combine with 16 g of O, the molecular oxide will be X_2O.

2. **(c) :** Molecular mass of $(CO)_x = 2 \times 70 = 140$
E.F mass = 12 + 16 = 28
Hence, $x = \frac{140}{28} = 5$

3. **(c) :** 18 mL H_2O = 18 g H_2O = 1 mol
$= 6.02 \times 10^{23}$ molecules
as there are ten electrons in H_2O, Avogadro's number should be multiplied with 10.
$= 10 \times 6.02 \times 10^{23}\ e^- = 6.02 \times 10^{24}\ e^-$.

4. **(c) :** $\underset{(2x+48)\text{ g}}{M_2O_3} + \underset{6\text{ g}}{3H_2} \rightarrow 2M + 3H_2O$
x = atomic mass of metal
$\because$ 0.006 g H_2 reduces 0.1596 g M_2O_3
$\therefore$ 6 g H_2 will reduce $\frac{0.1596}{0.006} \times 6\text{ g } M_2O_3 = 159.6\ M_2O_3$
$2x + 48 = 159.6 \Rightarrow 2x = 111.6 \Rightarrow x = 55.8$

5. **13. (c) :** Volume of one drop = $\frac{2}{35}$ mL
Number of moles in one drop = $\frac{2 \times 1.2}{35 \times 70} = \frac{1.2}{(35)^2}$
Number of molecules in one drop = $\frac{1.2}{(35)^2} \times N_A$
(N_A = Avogadro's number)

6. **(b):** 1 M H_2SO_4 = 2 N H_2SO_4
1 M NaOH = 1 N NaOH
$N_1V_1 = N_2V_2$
$(H_2SO_4)\quad (NaOH)$
$2 \times V_1 = 1 \times 10$ or $V_1 = 5$ mL

7. **(d):** $\frac{1}{M} = \frac{1}{\rho}\left(\frac{1}{m} + 10^{-3} \times M'\right)$
$M' = 24 + 71 = 95$; $\rho = 1.05$
$\therefore \quad \frac{1}{M} = \frac{1}{1.05}\left(\frac{1}{5} + 0.095\right)$
or $M = 3.56$ or $\frac{1}{M} = 0.28095$
$\therefore$ Molarity of $MgCl_2 = 3.56$
$\therefore$ Concentration of $Cl^- = 5 \times 2 + 3.56 \times 2 = 17.12$ M

8. **(b):** The balanced chemical reaction is
$N_2 + 3H_2 \rightleftharpoons 2NH_3$
From the above balanced equation, 1 mol of $N_{2(g)}$ reacts with 3 moles of $H_{2(g)}$.
$\therefore$ Moles of $N_2 = \frac{50{,}000\text{ g}}{28\text{ g mol}^{-1}} = 1785.71$ mol
or, Moles of $H_2 = \frac{10{,}000\text{ g}}{2.016\text{ g mol}^{-1}} = 4960.3$ mol

$\therefore$ 1785.7 mol of N_2 react with 3×1785.7 mol = 5357.1 mol but we have 4960.3 mol of H_2 only. Therefore, H_2 is a limiting reagent.

9. **(c) :** The reaction equation is
$PbO + 2HCl \rightarrow PbCl_2 + H_2O$.
Molar mass of PbO = 223 g mol^{-1}.
Now, moles of PbO = $\frac{6.5}{223}$ = 0.029 mol
and moles of HCl = $\frac{3.2}{36.5}$ = 0.088 mol
1 mol of PbO reacts with 2 moles of HCl.
Therefore, PbO is a limiting reagent.
0.029 mol of PbO will produce $PbCl_2$ = 0.029 mol

33. (b): Mol. mass = mass of 22.4 L at STP
$= \frac{10}{5.6} \times 22.4 = 40$
E.F. mass of HF = 1 + 19 = 20.
Hence $n = \frac{40}{20} = 2$
$\therefore$ Molecular formula = (Empirical formula)$_n$
$= (HF)_2 = H_2F_2$

10. **(d):** Molarity = 3 mol L^{-1}

Mass of NaCl in 1 L solution = $3 \times 58.5 = 175.5$ g

Mass of 1 L solution = $1000 \times 1.25 = 1250$ g

Mass of water in solution = $1250 - 175.5 = 1074.5$ g

$$\therefore \quad \text{Molality} = \frac{\text{No. of moles of solute}}{\text{Mass of solvent (in kg)}} = \frac{3 \text{ mol}}{1.0745 \text{ kg}}$$

$$= 2.79 \text{ m}$$