Question Bank (G scheme)

Name of Subject: Stoichiometry   **Subject code: 17315**

Semester : Third   **Course: Chemical**

Unit test I

Chapter 1   Gases, Gas mixture & gas-liquid mixtures(18marks)

3 marks question

1. Define Boyles law and Charles law with mathematical expression

2. Give the values and units of R in SI and MKS

3. Write down the expression for average molecular weight and density of gas mixture

4. Write down the gas law for real gases

4 marks question

5. Calculate the weight of SO_2 in a vessel having $2m^3$ volume at 120^0C and 730 mm Hg.

6. A glass vessel of 1 lit capacity contains H_2 at 27^0C and 1 atm pressure. How many moles of H_2 should be removed so that the density of the gas in the vessel will be exactly $1/3^{rd}$ of the original?

7. A sample of gas having volume of $0.5 \ m^3$ is compressed in such a manner so that pressure is increased
by 60%. The operation is done for a fixed mass of gas at constant temperature. Calculate the final volume of gas.

8. Calculate the average molecular weight and density of air at NTP. Air contains 78% N_2, 21% O_2 and 1% Ar by volume(At.Wt of Ar=40)

9. When heated to 100^0C and 720 mm Hg pressure, 17.2 gms of N_2O_4 gas occupies a volume of 11450 cm^3. Assuming that ideal gas law applies, calculate the % dissociation of N_2O_4 to NO_2.

10.Calculate the average molecular weight of flue gas having the following composition by volume

   CO_2=13.1%, O_2=7.7% N_2=79.2%.

Chapter 2 : Material balance without chemical reaction(32marks)

3 marks question

1.Explain the steps involved in solving material balance problems without chemical reactions

4 marks question

2. A single effect evaporator is fed with 10000Kg/hr of weak liquor containing 15% caustic by weight and   is concentrated to get thick liquor containing 40% by weight caustic. Calculate

   a) Kg/hr water evaporated

   b) Kg/hr thick liquor

3. The feed containing 50% benzene and 50% toluene is fed to a distillation column at a rate of 5000Kg/hr. A top product contains 95% benzene and bottom product contains 92% toluene by weight. Calculate the mass flow rates of top and bottom products.

4. A mixture of phenol and water forms two separate liquid phases, one rich in phenol and other rich in water, composition of layers is 70% and 9% by weight phenol respectively. If 500 Kg phenol and 700 Kg water are mixed and layers allowed to separate, what will be weights of two layers?

5. An evaporator is fed with 15000kg/hr of a solution containing 10% NaCl, 15% NaOH and rest water . In operation, water is evaporated and NaCl is precipitated as crystals. The liquor leaving the evaporator contains 45%NaOH, 2% NaCl and rest water. Calculte a) Kg/hr thick liquor b) Kg/hr water evaporated.

6. The groundnut seeds containing 45% oil and 45% solids are fed to expeller, the cake coming out of expeller is found to contain 80% solids and 5% oil. Find % recovery of oil.

7. A sample of coal is found to contain 63% Carbon and 24% ash on weight basis. The analysis of refuse after combustion shows 7% Carbon and rest ash. Calculate % of original carbon unburnt in the refuse.

8. The NH_3-air mixture containing 0.2 Kg NH_3 per Kg dry air enters into absorption system where
ammonia is absorbed in water. The gas leaving the system is found to contain 0.004 Kg NH_3 per Kg air.   Find % recovery of ammonia.

9. Centrifuge is fed with 5000Kg slurry containing 25% solids. Wet solid obtained after filtration is   analyzed to contain 8% moisture and filtrate is found to contain 200 ppm solids. Calculate the weight of filtrate and wet solids.

10. The dilute acid containing 25% H_2SO_4 is concentrated by commercial grade H_2SO_4 containing 98% H_2SO_4 to obtain desired acid containing 65% H_2SO_4 . Find the quantities of the acids required to make 1000Kg of desired acid.

11. It is desired to have a mixed acid containing 40% HNO_3, 43% H_2SO_4 and 17% H_2O by weight. H_2SO_4 of 98% is readily available. Calculate the weight ratio of H_2SO_4 to HNO_3.

12. 2000Kg of wet solids containing 70% solids by weight is fed to tray dryer where it is dried by hot air.   The product finally obtained is found to contain 1% moisture by weight. Calculate Kg of water   removed and Kg of wet solids.