PG/IIS/CEM-204/15

M.Sc. 2nd Semester Examination, 2015

CHEMISTRY

PAPER – CEM- 204

Full Marks : 40

Time : 2 hours

Answer any **four** questions

The figures in the right hand margin indicate marks

All symbols are of usual significance

1. (*a*) Differentiate between 3

(*i*) Extraction and Leaching

(*ii*) Adsorption and Desorption.

(*b*) State and explain Fick's law of diffusion. 2

(*c*) Explain the term molecular diffusion and Eddy diffusion. 3

(*d*) Show that $D_{AB} = D_{BA}$. 2

2. (*a*) Alcohol vapour is diffusing through a layer of water vapour under equimolar counter diffusion at 35°C and 1 atm. pressure. The molar concentration of alcohol on the two sides of the gas film (water vapour) 0·3 mm thick are 80 % and 10 % respectively. Assuming the diffusivity of alcohol-water vapour to be 0·18 cm^2/s. (*i*) Calculate the rate of diffusion of alcohol and water vapour in kg/hr through on area of 100 cm^2 ; (*ii*) if the water vapour layer is stagnent, estimate the rate of diffusion of alcohol vapour. 6

(*b*) Ammonia diffuses through nitrogen gas under equimolar counter diffusion at a total pressure of $1{\cdot}013 \times 10^5$ Pa and at a temperature of 298 K. The diffusion path is 0·15 m. The partial pressure of ammonia at are point is $1{\cdot}5 \times 10^4$ Pa and at the other point is 5×10^3 Pa. Diffusivity under the given condition is $2{\cdot}3 \times 10^{-5}$ m^2/s. Calculate the flux of ammonia. 4

3. (*a*) Comment on the origin of coal. 3

(*b*) Discuss the significance various parameters in proximate analysis of coal. 3

(*c*) Define crude petroleum. 2

(*d*) Write the function of desalting operation of crude oil. 2

4. (*a*) Define fuel and mention about its classification. 2

(*b*) Discuss the charcoal manufacturing process. 2

(*c*) Write the function of carbonization of coal. 2

(*d*) Differentiate the thermal and catalytic cracking process. 2

(*e*) Write the reactions and operating conditions of the Fischer-Tropsch process. 2

5. (*a*) What are the available refractory materials ? 3

(*b*) Discuss the manufacturing process of a refractory. 4

(*c*) Write the major uses of refractory. 3

6. (*a*) Define Ore. 1

(*b*) What constitutes mineral beneficiation ? 2

(*c*) Draw schematic diagram of an agitetion-type flotation cell. 2

(*d*) Name two flotation cells used in industry. 1

(*e*) Write the function of surfactant used in flotation cell. 2

(*f*) Write the principle of magnetic separation used in mineral beneficiation process. 2

7. (*a*) The rate constant of a chemical reaction increases by 100 times when the temperature is increase from 400K to 500 K. Assuming transition theory is valid, calculate the value of E/R. 3

(*b*) For the liquid phase zero-order reaction $A \rightarrow B$, the conversion of A in a CSTR is found to be 0·3 at a space velocity of 0·1 min^{-1}. What will be the conversion for a PFR with a space velocity of 0·2 min^{-1} ? Assume that all the other operating conditions are same for CSTR and PER. 4

(*c*) Discuss the flow pattern in ideal PFR and CSTR reactor. 3
