PG/IIS/CH - 1204/10

M.Sc. 2nd Semester Examination, 2010

CHEMISTRY

(*Chemical Technology*)

PAPER—CH-1204

Full Marks : 40

Time : 2 hours

Answer any **four** questions, taking at least **two** from each Group

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

GROUP—A

1. (*a*) Explain different forms of moisture present in coal.

(*b*) Crude oil is found to contain 87·1% carbon, 12·5% hydrogen and 0·4% sulphur by weight. Its GCV at 298 K is 45071 kJ/kg oil. Calculate its NCV at 298 K.

Given: latent heat of water vapour: 2442·5 kJ/kg. 5 + 5

2. (*a*) Differentiate between the following:

(*i*) Coal and coke

(*ii*) Proximate analysis and ultimate analysis

(*iii*) Theoretical oxygen demand and Excess air.

(*b*) State Calderwood equation for the calculation of GCV based on ultimate analysis of fuel.

(*c*) State examples of waste industrial gases used as fuel. (3 x 2) + 2 + 2

3. (*a*) Define refractories. Classify refractories on the basis of refractoriness.

(*b*) Discuss the following properties of refractories:

(*i*) spalling

(*ii*) slag resistance.

(*c*) Mention the uses of alumina refractories.

$2 + 2 + (2 + 2) + 2$

4. Describe in brief the manufacture of a common refractory. 10

GROUP–B

5. (*a*) State and explain Fick's law of diffusion.

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

(*c*) Sherwood number in mass transfer is analogous to which dimensionless group in heat transfer.

(*d*) Write the significance of Schmidt number.

(*e*) The convective heat transfer coefficient for laminar flow over a flat plate is calculated by the following equation,

$$Nu = 0{\cdot}664\ Re_L^{\frac{1}{2}}\ Pr^{\frac{1}{3}}$$

write the similar equation for mass transfer. 2 x 5

6. In a gas mixture of H_2 and O_2, steady state equimolar counter diffusion is occuring at the total pressure of 100 kPa and temperature of 20°C. If the partial pressure of O_2 at two phases 0·01 m apart and perpendicular to the direction of diffusion an 15 kPa and 5 kPa respectively and the mass diffusion flux of O_2 in the mixture is $1{\cdot}6 \times 10^{-5}$ kmole/m².s. Derive the appropriate expression to calculate the molecular diffusivity and calculate its value. 10

7. (*a*) Write short notes on the following : $2\frac{1}{2} \times 2$

(*i*) Chemical treatment of ore

(*ii*) Physical treatment of ore.

(*b*) Describe one process for concentration of ore minerals. 5