M.Sc 1st Semester Examination, 2009

CHEMISTRY

PAPER — CH-1104

Full Marks : 40

Time : 2 hours

Answer any **four** questions

The figures in the right-hand margin indicate marks

1. (*a*) Write short notes on any *three* of the following : 2x3

(*i*) Potential flow

(*ii*) Time dependent fluid flow

(*iii*) Reynold's number

(*iv*) Turbulence.

(*b*) (*i*) What is viscosity? Calculate the dimensions of viscosity?

(*ii*) What is kinematic viscosity? State the advantage of considering kinematic viscosity over absolute viscosity? 4

2. For a certain equipment it is required for a pump to with draw fluid of specific gravity 1·84 from a tank through a 3″ Schedule 40 steel pipe (cross sectional area : 0·0513 ft^2). The pump runs only at 60% of its capacity. The velocity of the fluid in the line is 3 ft/s. The pump with draws fluid and discharges through a 2″ Schedule 40 steel pipe (cross sectional area : 0·0233 ft^2) to an overhead storage tank. The end of the discharge pipe is 50 ft above the level of the fluid in the feed tank. Friction losses in the entire piping system is 10 ft-lbf/lb. What pressure must the pump develop? What is the power of the pump? 10

3. (*a*) Formulate steady state conduction of heat through a solid slab. 5

(*b*) Give an example of a black body? State and explain the laws of black body radiation. 1 + 4

4. A flat furnace wall is constructed of a 4·5″ layer of sil-o-cel brick with a thermal conductivity of 0·08 Btu/ft-h-°F backed by a 9″ layer of common brick of conductivity 0·8 Btu/ft-h-°F. Temperature of the inner face of the wall is 1400 °F and that of the outer face is 170°F.

(*a*) Calculate heat loss through the wall.

(*b*) Calculate the interface temperature between refractory brick and the common brick. 5 + 5

5. Write short notes on any *one* of the following industrial processes : 10

(*i*) Hydrogenation

(*ii*) Sulphonation

(*iii*) Oxidation.

6. (*a*) The analysis of a sample of babul bark yields 5·8% moisture, 12·6% tannin, 8·3% soluble non-tannin organic matter and the rest lignin. In order to extract tannin out of the bark, a counter current extraction process is employed. The residue from the extraction process is analyzed and found to contain 0·92% tannin and 0·65% soluble non-tannin organic matter on a dry basis. Find the percentage of tannin recovered on the basis of the original tannin present in the bark. 8

(*b*) Calculate the dimension of K in the following equation :

$$q = \frac{K.A\,(T_i - T_0)}{r_0 - r_i}$$

where q = heat flow, A = area, $(r_0 - r_i)$ = radius difference and $(T_i - T_0)$ = temperature difference. 2

7. (*a*) Define ore? 2

(*b*) What is beneficiation of ore? 2

(*c*) State, in general, what different physical processes involved in processing of ore? 6