# OLD

# 2016

## M.Sc. Part–I Examination

## CHEMISTRY

### PAPER—IV

*The figures in the margin indicate full marks.*

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

*Illustrate the answers wherever necessary.*

## *(Industrial Chemistry)*

### *For Old Syllabus*

*Full Marks* : 75

*Time* : 3 Hours

Answer questions for Group–A and Group–B.

Answer *five* questions taking at least *two* from Group–A & B.

### Group–A

**1.** (a) Give the detailed classification of incompressible fluids.

(b) Explain with a neat sketch the working principles of a Rotameter. State its merits and demerits over other flowmeters.

(c) Water at 25°C flows horizontally from a pressure vessel through a venturemeter to the atmosphere. If the pressure of the vessel is 1.7 atm (g) and the throat area is half the area of entry area of the venturimeter, calculate the pressure at the throat. 3+6+6

**2.** (a) Explain with a neat sketch the operation of a plate and frame filter press.

(b) Derive the rate expression for filtration operation of a filter press at constant pressure. 7+8

**3.** (a) State and explain Fourier's law for molecular transport of heat.

(b) What is the significance of Prandtl Number ? How is Nusselt Number related with this number under turbulent condition ?

(c) Derive the expression of LMTD for a counter-current 1-1 shell and tube heat exchanger. 3+5+7





**4.** Write short notes on any *three* of the following unit processes :

(i) Sulfonation ;

(ii) Esterification ;

(iii) Nitration ; and

(iv) Hydrogenation. 5×3

**5.** (a) Discuss wood carbonization process in detail.

(b) Discuss the origin of coal in detail.

(c) Write the significance of various parameters in Proximate analyse of coal.

(d) Define crude oil and discuss the types of sulphur and oxygen compounds present on crude oil.

(e) Write the reforming reactions. 3+3+3+3+3

## Group–B

**6.** (a) An aqueous solution of pyridine containing 27% (bt wt.) pyridine and 73% (by wt.) water is to be extracted with chlorobenzene. The feed and solvent are mixed well in batch extractor and the mixture is

then allowed to stand for phase separation. The extract phase contains 11% pyridine, 88.1% cholorbenzene and 0.9% water by weight. The raffinate phase contains 5% pyridine and 95% water by weight. Calculate

(i) The quantities of two phases,

(ii) The weight ratio of solvent to feed based on 100 kg of feed.

(b) The producer gas made from the coke has the following composition by volume

$CO$ : 28.0%

$CO_2$ : 3.5%

$O_2$ : 0.5%

$N_2$ : 68.0%

The gas is burned with such a quantity of air that the oxygen from air is 20% in excess of the net oxygen required for complete combustion. If the combustion is 98% complete, calculate the wright of the gaseous product formed per 100 kg of gas burned.

7+8

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

(b) Derive an expression for the rate of molecular diffusion of gas A through a stagnant layer of another





gas B.

(c) Ammonia gas is diffusing through a layer of stagnant air 2.5 mm thick at a constant rate. Conditions are fixed so that the gas contains 50% ammonia by volume at one boundary of the stagnant layer. The ammonia diffusion to other boundary is quickly absorbed and its concentration is negligible at the plane. The temperature is 20°C and the pressure is atmospheric and the diffusivity value at these condition is 0.18 sq.cm/sce. Calculate the rate of diffusion of ammonia through air layer in gm.moles/$(hr.cm^2)$.

3+5+7

**8.** (a) Define ore and mineral.

(b) Minerals are ore but all ores are not mineral. Explain the statement.

(c) Write the principle and detail description of magnetic separator.

3+4+8

**9.** (a) Write the classification refractory materials.

(b) Describe the manufacturing process of ceramics.

(c) Write a note on the additives used for ceramics.

4+8+3

**10.** (a) Give few examples of major types of conventional fuels.

(b) What are synthetic fuel ?

(c) Describe the processing of crude petroleum for the production of various conventional fuels.

3+2+10

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