2019

Part – II

INDUSTRIAL CHEMISTRY

(Major)

Paper – III

Full Marks – 100

Time : 4 Hours

The Questions are of equal value for any group / half. The figures in the right-hand margin indicate marks. Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and other **four** questions taking *one* question from each group.

1. Answer any **twenty** questions : 2×20=40

((a) Define the term 'Yield' & 'Selectivity'.

(b) Define the term 'Gold Number'. What is its significance.

(c) What is heat of formation?

(d) Explain the term 'Boiler Economy'.

(e) Write an example of Auto Catalysis reaction.

(f) Define the terms limiting reactant and excess reactant.

(g) What do you mean by heterogenious catalysis? Explain with an example.

(h) What is adiabatic flame temperature?

(i) What do you mean by azeotropic distillation?

(j) What is combined feed ratio?

(k) What is "Tie rod" ? Why it is used?

(l) Define the term "NPSH". Why it is so important?

(m) What do you mean by pass operation?

(n) Write one example of two way and three way valves.

(o) What is "Katal"?

(p) What do you mean by "Biming of Pump"?

(q) What is filter aids? Write its uses.

(r) State the importance of non-return value in industrial use.

(s) Write down the differences between Absorption and Adsorption with example.

(t) What is aniline point ?

(u) Write the expression for 'Freundlich isotherm'.

(v) What phenomenon is responsible for gas masks effectiveness ?

(w) Write the significance of critical point in a drying curve.

(x) What is meant by flooding of a packed column ?

(y) Define molality and molarity.

(z) What is the main difference between fan and a blower ?

GROUP – A

Answer any **one** of the following. 15×1=15

2. (a) Write the importance of Freudlich Adsorption isotherm and hence describe how the constants of its empirical formula can be evaluated ? 3

(b) Show the reaction mechanism of a homogeneous catalysed reaction. Also prove that the rate of reaction depend on concentration of the substrate and catalyst. 6

(c) Write the differences between lyophobic sol and lyophilic sol with examples. 3

(d) Give the difference between physical and chemical adsorption. 3

3. (a) Write short notes on the following : 3+3

(i) Sol-gel emulsion

(ii) Associated Colloids.

(b) What do you mean by Sol ? Mention one method for sol preparation. 3

(c) Write two applications of adsorption process. 2

(d) Draw a picture of soap micells and discuss its uses as cleaning agent. 4

GROUP – B

Answer any **one** of the following : 15×1=15

4. (a) Describe Hess's law with example. 3

(b) A gas mixture has the following composition by volume 5

CO_2 = 8% ; CO = 14% ; O_2 = 6% ;

H_2O = 5% ; CH_4 = 1% ; N_2 = 66%

Calculate the density of the gas mixture at 30°C and 1 atm.

(c) Calculate the standard heat of formation of the following reaction. 7

$$2\,FeS_2(S) + -\,O_2(g) \rightarrow Fe_2O_3(S) + 4SO_2(g)$$

given, $\Delta H°_f\ FeS_2(s) = -\,42500$ cal

$\Delta H°_f\ Fe_2O_3(s) = -196500$ cal

$\Delta H°_f\ SO_2(g) = -70960$ cal

5. (a) Write short notes on : 3+3

(i) Trouton's Rule

(ii) Henry's Law

(b) A single effect evaporator concentrating a weak liquor containing 10% solids to 50% solids (by weight) is fed with 5000 kg/hr of weak liquor. Calculate 6

(i) Water evaporated per hour

(ii) Flow rate of thick liquor

(c) Discuss the role of recycling operation in industry. 3

GROUP – C

Answer any **one** of the following : 15×1=15

6. (a) Differentiate between drying and evaporation. *Explain a typical drying rate* curve when spray dryer is used. 5

(b) With a neat sketch describe the operation of a continuous distillation column. 5

(c) Mention two methods of packing for an absorption column with their relative advantages and disadvantages. 5

7. (a) What is Extraction? Describe the working principle of extraction equipment. 6

(b) Explain the role of relative volatility in distillation operation. 3

(c) Mention two important properties of packing material used in gas-liquid contactors. 2

(d) What is Azeotropic distillation? 2

(e) Contrast between plate & packed column. 2

GROUP – D

Answer any **one** of the followings : 15×1=15

8. (a) Draw a neat sketch of 1, 2 pass shell and tube heat exchanger used in industry and show –

(i) Buffles

(ii) Nozzles

(iii) Tubes

(iv) Channel cover. 5

(b) Name the different type of fuels used in the boiler. Also write a principles of co-generation boiler. 5

(c) What is LMTD ? Draw a temperature profile of counter current flow and find out LMTD. 5

9. (a) Write the name of different type pump and valves used in chemical industry. 5

(b) Why plate and frame type heat exchangers are advantageous over shell and tube heat exchangers. 3

(c) Write down the calorific value and composition of LPG and Coal. 3

(d) Draw a neat diagram of waste water treatment pump plant to remove BOD from it. 4