

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 : $2 \times 20 = 40$
- ((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 heterogenous 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 valve 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. $15 \times 1 = 15$

2. (a) Write the importance of Freundlich 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

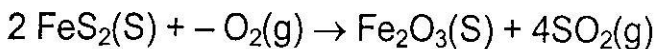
4. (a) Describe Hess's law with example. 3
- (b) A gas mixture has the following composition by volume 5

$$\text{CO}_2 = 8\% ; \text{CO} = 14\% ; \text{O}_2 = 6\% ;$$

$$\text{H}_2\text{O} = 5\% ; \text{CH}_4 = 1\% ; \text{N}_2 = 66\%$$

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



given, $\Delta H^\circ_f \text{FeS}_2(\text{s}) = -42500 \text{ cal}$

$$\Delta H^\circ_f \text{Fe}_2\text{O}_3(\text{s}) = -196500 \text{ cal}$$

$$\Delta H^\circ_f \text{SO}_2(\text{g}) = -70960 \text{ cal}$$

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) Baffles

(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
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