Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. Industrial Chemistry – SEMESTER 2

Summer 2022 EXAMINATION

Course Title: Unit Processes

Course Code: 101310203

Total Printed Pages : 02

Date: 05/05/2022 **Time: 02.00 pm to 04.00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) Heat transfer, flow of fluids, material handling, filtration, distillation, extraction, drying etc. are Important:

a. Chemical operation **b.** Unit operations
c. Unit process **d.** Chemical process

(2) H_2SO_4 protonates nitric acid to form a:

a. Sulfate ion **b.** Nitrite ion
c. Nitryl ion or nitronium ion **d.** None

(3) The Swiss firm of M. Biazzi has the agitator provides intensive agitation is of:

a. Box type **b.** Plate type
c. Suspended type **d.** Turbine type

(4) Esterification proceeds by attack of an alcohol molecule on the acid's slightly positive:

a. Carbonyl carbon **b.** Carbonyl oxygen
c. Alkyl carbon **d.** None

(5) The addition of carboxylic acids to the double bonds of isobutylene and trimethyl ethylene gives:

a. Primary ester **b.** Secondary ester
c. Acid **d.** Tertiary esters

(6) The reaction of ketene with alcohols to produce esters during this reaction ketene produces:

a. Acid **b.** No by-products
c. Alkoxide **d.** None

(7) In mercaptans, the alkyl group is bound to:

a. Nitrogen **b.** Oxygen
c. Sulfur **d.** Fluorine

(8) Butylenes and amylenes are obtained from butanes and pentanes, respectively by:

a. Dehydration **b.** Dehalogenation
c. Dehydrogenation **d.** Dehydrohalogenation

(9) In the aliphatic paraffin series, the lower members, which are more volatile, exhibit a _____ that is absent in the insoluble, nonvolatile higher members:

a. Sedative effect **b.** Narcotic effect
c. Hypnotic effect **d.** Antielementic effect

(10) Transformation of a primary alcohol to an aldehyde is illustrated as:

a. Dehydrogenation **b.** Halogenation
c. Sulfation **d.** Dehydration

(11) The principle disadvantages of nitric acid as a partial oxidizing agent arises from the tendency to act as a:

a. Oxidizing agent **b.** Sulfonating agent
c. Nitrating agent **d.** Hydrolyzing agent

(12) In the following reaction, the elimination of water is because of the use of catalyst:

$2n\ CO + (2n+1)\ H_2 \rightarrow C_nH_{2n+2} + nH_2O$:

a. Sulphur **b.** $K_2Cr_2O_7$
c. KMnO4 **d.** Cobalt

Q.2 Attempt **Any Eight** of the following. **(16)**

(1) Enlist Nitration products of iso-pentane.
(2) Write reaction of olefins with Nitrogen di oxide.
(3) Why catalyst is required for the esterification?
(4) Enlist the products obtained by hydration of olefins.
(5) Give the Menschutkin's comparative study of the relative rates of esterification and the equilibrium constant for primary and allyl alcohol.
(6) Give the types of alkylated compound with suitable example.
(7) Write the reaction for the manufacturing of Ethyl benzene.
(8) Describe Tubular Reactor used in alkylation with diagram.
(9) Explain the oxidation in a single bubble column.
(10) Write a Synthesis of Hydrocarbons from CO and H_2.

Q. 3 Construction, working and safety measures of Batch and Continuous nitrator. **(08)**

OR

Q.3 Write the manufacturing process with schematic diagram for m-Dinitrobenzene. **(08)**

Q. 4 Write a note on Esters by addition to unsaturated systems. **(08)**

OR

Q. 4 What is hydrolysis? Elaborate different hydrolyzing agent used for hydrolysis. **(08)**

Q. 5 Write a note on alkylating agent. **(08)**

OR

Q. 5 Describe various reactors used in alkylation with suitable diagram. **(08)**

Q. 6 Write a note on oxidizing agent. **(08)**

OR

Q. 6 Elaborate Methanol production by using synthesis gas with schematic diagram. **(08)**

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Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. INDUSTRIAL CHEMISTRY

Semester 2 Examination

101310204: Heat Transfer Operations and Stoichiometry

Friday, 6th May 2022

Time: 2:00 pm to 4:00 pm **Total Marks: 60**

Instructions:

Attempt all questions.

Numbers to the right indicate full marks for each question.

Q-1. Answer the following multiple choice question. **[12]**

1. An insulator should have_____.
   a. High thermal conductivity b. Low thermal conductivity
   c. Less resistance to heat flow d. None of the above
2. What is the unit of heat transfer co-efficient?
   a. W/ m b. J/sec.m.K c. J/sec.m^2.K d. W/sec
3. Heating of room by steam radiator is an example of_____.
   a. Drying b. Conduction c. Convection d. Radiation
4. Heat flux is the rate of heat transferred per unit_____.
   a. Time b. Time*Area c. Area d. Density
5. Multipass exchangers are used for_____.
   a. Lowering heat load b. Its simplicity in construction
   c. High heat transfer co-efficient d. Reducing pressure
6. Baffle spacing should be
   a.< ID of shell b. >ID of shell c. < 1/5 ID of shell d. < ID of tube
7. Fouling factor depend on_____.
   a. Fin length b. Fin thickness c. Density of fluid d. Scales formed
8. In a shell & tube heat exchanger,
   a. Square pitch gives more heat transfer area than triangular pitch
   b. Triangular pitch gives more heat transfer area than square pitch
   c. Both square & triangular pitch give same heat transfer area
   d. Cleaning facility is same in both square & triangular pitch
9. Heat transfer occurs by natural convection because change in temperature causes difference in----
   a. Density b. Weight c. Heat capacity d. Viscosity
10. No. of moles reacted to produce product to total no. of moles of reacted is called _____.
    a. Yield b. Molarity c. Selectivity d. Mole ratio
11. 1 poise = _____gm/cm.sec
    a. 0.10 b. 1.00 c. 10.00 d. 2.00
12. 1 mole of compound = _____ of compound.
    a. Moleculer mass b. gm/moleculer mass
    c. Moleculer mass/gm d. gms

Q-2 **Answer any eight of following.** [16]

1. What is Fourier's law of heat conduction?
2. Write the equation for heat transfer through spherical surface system.
3. Enlist the important requirements of insulating materials.
4. Define the dimensionless numbers used in forced convection calculations.
5. What is LMTD? Write the equation for parallel flow heat exchanger.
6. Discuss the effect of scale formation in heat exchangers.
7. How corrosive fluid is deal in a shell & tube exchanger? Justify it.
8. Write the correct sequence for thermal conductivity of three states of matter.
9. What is heat of mixing?
10. Define the term % limiting & excess reactant.

Q-3 Pipe of diameter 40mm with length 1000cm carrying an air at the outer surface temperature at 363K. (ρ = 1.06 Kg/m^3, μ = 0.072 Kg/m.hr, Cp = 1.005 KJ/Kg.K, K = 0.029 KJ/hr.m.K, β = 0.00072). Determine the rate of heat transfer at 303K *if pipe is kept* ***Vertical*** *position.* (08)

OR

Q-3 *If pipe is kept* ***Horizontal*** *position.* (08)

Q-4 In shell & tube heat exchanger, oil (70kg/min.) flowing through the tube side is cooled from 323K to 307K using water (36kg/min.) entering at 288K shell side. The internal diameter of shell 0.8m contains 20 tubes, each having outer diameter 0.030m and internal diameter 0.027m. K_m = 0.02 kJ/min.m.K

	Density (kg/m^3)	Heat capacity (kJ/kg.K)	Thermal conductivity (kJ/min.m.K)	Viscosity (kg/m.min)
Oil	910	2.0	0.012	2.52
Water	1000	4.18	0.036	0.06

Calculate the length of S&T heat exchanger for ***counter flow***. (08)

OR

Q-4 for ***parallel flow***. (08)

Q-5 100kg of solution contains 55% Benzene, 28% Toluene and 17% Xylene by weight is in contact with its vapour at 100^{0}C. Calculate molar composition and total pressure in liquid phase. (Vapour pressure in kPa of Xylene=28, Toluene = 74.6 & Benzene = 178.6) (08)

OR

Q-5 A mixture of Phenol and Water forms to separate liquid phases, one rich in phenol and the other rich in water. The composition of both layers is as follows, Phenol rich layer: 70% Phenol, Water rich layer: 9% Phenol. If 700kg water and 500kg Phenol are added, determine the weight of phenol rich and water rich layer. (08)

Q-6 At 100 kmole/hr rate CO_2 is flowing and heated from 25^{0}C to 110^{0}C. Calculate the heat transferred in kW. (a = 21.3655, b = 64.28 x 10^{-3}, c = - 41.05 x 10^{-6}, d = 9.79 x10^{-9}) Cp CO_2 in KJ/KmolK. (08)

OR

Q-6 100 kmole/hr stream of N_2 gas is flowing. It is heated from 30^{0}C to 100^{0}C Determine the heat that must be transferred in KJ/second. Cp N_2 (a = 29.5909, b = - 5.141 x 10^{-3}, c = 11.1829 x 10^{-6}, d = - 4.968 x10^{-9}) in KJ/KmolK. (08)

____Good Luck____

Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. Industrial Chemistry – SEMESTER 2

Summer 2022 EXAMINATION

Course Title: Petrochemical Technology

Course Code: 101310205

Total Printed Pages : 03

Date: 07/05/2022 **Time: 02.00 pm to 04.00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) Non-associated natural gas contains a higher ratio of _____

a. Ethane **b.** Methane
c. Aromatic **d.** Napthenic

(2) Propane and butane are recovered from natural gas and sold as_____

a. CNG **b.** PNG
c. LPG **d.** NGL

(3) _____ is the first major operation for refining of crude oils.

a. Fractional Distillation **b.** Extraction
c. Adsorption **d.** Absorption

(4) _____ are major reactions in catalytic reforming process.

a. Dehydrocyclization **b.** Isomerization
c. Hydrocracking **d.** All of these

(5) _____ is major reactions in catalytic cracking process.

a. Rupture of C-C **b.** Rupture of C-S
c. Rupture of C-N **d.** None of these

(6) In _____process, part of the coke produced is used to provide the process heat.

a. Delayed Coking **b.** Fluid Coking
c. Steam Cracking **d.** VisBreaking

(7) The two major chemicals viz. ammonia and methanol are produced from_____

a. Synthesis Gas **b.** Natural Gas
c. Water Gas **d.** Flue Gas

(8) Carbon disulphide is primarily used for production of _____

a. Nylon b. Rayon
c. Freon d. Neon

(9) _____ directs the reaction towards the desired products

a. Selective Catalyst b. Non-selective Catalyst
c. Promoter d. Inhibitor

(10) _____ is known as king of petrochemicals

a. Ethane b. Propane
c. Ethylene d. Propylene

(11) Synthetic ethanol was produced by indirect hydration of ethylene in the presence of_____

a. Hydrochloric acid b. Nitric acid
c. Phosphoric acid d. Sulphuric acid

(12) Phthalic anhydride is produced by oxidation of _____

a. o-Xylene b. m-Xylene
c. p-Xylene d. Toluene

Q.2 Attempt **any eight** of the following. **(16)**

(1) Define the term Crude Oil and give its classification.
(2) What is tar sand?
(3) What is Visbreaking? Enlist its aim
(4) What is reflux ratio in distillation?
(5) What is Natural Gas liquid? Enlist its various streams.
(6) Define the terms fluid coking and flexicoking.
(7) Propylene is known as crown prince of petrochemicals. Why?
(8) What is synthesis gas?
(9) Differentiate between associated and non-associated natural gas
(10) What are chloromethanes? How they are produced?

Q. 3 What is natural gas?Give its classification and Discuss in detail various techniques of natural gas treatment. **(08)**

OR

Q.3 Define the term Crude Oil. Give composition of crude oil and discuss various methods of crude oil characterization. **(08)**

Q. 4 What is Thermal cracking Process? Give its aim, feed and products. Write a detailed note on coking. **(08)**

OR

Q. 4 What is Catalytic cracking Process? Give its aim, feed and products. Write a detailed note on catalyst used and process for catalytic cracking. **(08)**

Q. 5 Present a detailed account of ammonia synthesis starting from synthesis gas including: **(08)**
i.Primary reformer ii. Secondary reformer iii. Shift conversion
iv. Methanation and v. Ammonia production

OR

Q. 5 Write a detailed note on various chemicals produced from direct reaction of methane (08)

Q. 6 Discuss various alkylations of benzene and present a detail account of production of styrene. (08)

OR

Q. 6 Discuss nitration of toluene to produce Toluidines and Toluene diisocyanates. (08)

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Seat No. _____ Enrolment No. _____

The Charutar Vidyamandal University

M.Sc. (Industrial Chemistry), Semester- 2
May - 2022
Subject: 101310208—Air Pollution Control Technology
Monday, 9th May – 2022

Time: 02:00 P.M. to 04:00 P.M. **Total Marks: 60**

Note: i) Attempt all the questions.
ii) Figures to right indicate full marks.
iii) Draw neat diagrams wherever it requires.

Q-1 **Answer the following Multiple Choice Questions.** **Marks (12)**

1. What is the full form of VOCs?
   a) Volatile Organic Compounds
   b) Volatile Organic Carbon
   c) Volatile Organic Components
   d) Volatile Organic Composition
2. Acid rain on the precipitation is defined as one which has a pH less than_____.
   a) 5.6
   b) 4.6
   c) 6.5
   d) 5.8
3. Which of the following is a secondary air pollutant?
   a) SPM
   b) PAN
   c) SO_2
   d) NO_2
4. In _____ inversion cloud layer absorbs incoming solar energy with the slow net downward flow.
   a) Radiation
   b) smock
   c) Subsidence
   d) rain
5. There are about _____ classes of plume behaviour.
   a) 5
   b) 6
   c) 7
   d) None of above
6. Lapes rate is _____ of temperature gradient.
   a) Negative
   b) More
   c) Positive
   d) minimum
7. What kind of product was manufactured by the Union Carbide plant in Bhopal, India?
   a) Paints
   b) Poison gas
   c) Pesticide
   d) Plastics
8. When did the Chernobyl nuclear disaster take place?
   a) 1980
   b) 1985
   c) 1982
   d) 1986
9. What was the main reason for the Chernobyl accident?
   a) Tsunami
   b) Earthquake
   c) Flawed reactor design
   d) Vent failure

10. Which of the following is not a discrete variable?

a) Height
b) Weight
c) Blood pressure
d) Temperature

11. What is primary data?

a) It is the data collected by a particular person or organisation for his Or her use from the primary sources
b) It is the data collected by some other person or organisation for his Or her use but the investigator can also use it.
c) It is the data that deals with the enumeration, organisation & Graphical representation.
d) All of these.

12. _____may be defined as the relative frequency of occurrence with which an event is expected to occur.

a) Frequency
b) Standard deviation
c) Probability
d) All of these

Q-2 Answer the following short questions. (**Any Eight**) **(16)**

1. Define air pollution.
2. List out the air pollutants that affect plants.
3. What is an acid raid?
4. Explain the effects of 'wind direction and speed' on air pollution.
5. What is the importance of location for air sampling?
6. What is stack sampling?
7. Write the aldehydes photochemical reaction.
8. What is sulfurous smog?
9. Define Survey.
10. What is a group frequency distribution?

Q-3 What are the effects of air pollution on human health and farm animals? **(08)**

OR

Q-3 What is aeroallergen? Describe its sources and its health effects. **(08)**

Q-4 List out the metrological factors that influence air pollution and discuss atmospheric stability and temperature inversions. **(08)**

OR

Q-4 Discuss in brief the sampling and analytical technique for NO_2 pollutants. **(08)**

Q-5 Briefly explain the causes and effects of the 'London smog disaster' **(08)**

OR

Q-5 Explain the theory of the formation of photochemical smog. **(08)**

Q-6 Discuss with suitable examples the general rules like several ways, permutations, and combinations of probability to know the number of different possibilities of certain events **(08)**

OR

Q-6 **a)** Define: Standard Deviation. **(08)**
b) When $\bar{x} = 40$, $\bar{y} = 36$, $\sigma_x = 6$, $\sigma_y = 8$ and $r = 0.6$.. Find the two lines of regression. Predict y when x = 21, and predict x when y = 45.

All the Best!

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