

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIFTH SEMESTER EXAMINATION, DECEMBER 2019

THIRD YEAR [BATCH 2017-20]

INDUSTRIAL CHEMISTRY [Honours]

Date : 16/12/2019

Time : 11 am – 1 pm

Paper : V[Gr-B]

Full Marks : 50

[Use a separate Answer Book for each Unit]

Unit-I

Answer any four questions from question nos. 1 to 6 : [4×5]

1.
 - i) Give definition of "Petroleum" as per the "Petroleum Act, 1934". [1]
 - ii) Write the elemental composition in percentage by weight of chemical elements present in Petroleum. [1]
 - iii) Give the percentage composition by weight of hydrocarbons present in crude oil. [1]
 - iv) How is crude oil explored the reservoirs in the earth's crust? Name the different method which are employed in mining of crude oil. Give a graph sketch of mining of crude oil. [2]
2. Define/explain the following terms : [1×5]
 - i) API gravity
 - ii) Diesel Index
 - iii) Aniline point
 - iv) Smoke point
 - v) pour point
3. How do aromatic content change – increase, decrease or remain virtually unaltered during the following processes
FCC, Hydrocracking, Reforming. Give reason and chemical reactions where applicable. [5]
4. The paraffin(P),Olefin(O),Naphthene(N) and Aromatic (A) analysis and the FBP of boiling curves of certain refinery streams are given below. Identify the streams stating your logic.(Identification means stating whether it is straight run or project from fcc,coker,visbreaker or reformer etc) [5]

FBP C	P	O	N	A (vol %)
90	55	0	40	5
180	30	0	44	26
90	64	10	25	1
100	35	1	3	61
220	34	23	11	32

5. A petrol sample contains 84% carbon and 16% hydrogen by weight. Its flue gas composition by volume as follows carbondioxide – 12.1 %; Carbon monoxide 1.1 % ; oxygen – 1.3 % and nitrogen 85.5 %. Calculate —
 - i) minimum air for complete combustion of 1.0 kg petrol.

- ii) Actual air supplied per kg of petrol
- iii) Calorific values of the petrol sample.

[2+2+1]

6. Answer the following in connection with the reforming operation used in refinery

- a) Feed stock used
- b) Reaction involved
- c) catalyst used

[2+2+1]

Answer any two questions from question nos. 7 to 10:

[2×5]

7. Match catalyst with process

Processes : Reforming, HDS, FCC, HDN, Hydrocracking

Catalysts : Pt on Zeolite, Pt on Al_2O_3 , Zeolite Y, Co-Mo, Ni-Mo

[5]

8. Gary gives the following approximately relations for yield of different products from coker:

Coke wt% = 1.6 (wt% Conradson carbon)

Gas (C 4 -) wt% = 7.8 + 0.144 (wt% Conradson carbon)

Gasolin. wt% = 11.29 – 0.343 (wt% Conradson carbon)

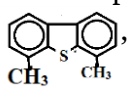
Gas oil wt% = 100 – wt% coke – wt% gas – wt% gasoline

A vacuum column residue with Conradson carbon of 18 % is to be fed to a delayed coker unit at a rate of 1200 tons/day.

What will be the production rates of different products?

Also if all gas oil is recycled, what will be the recycle ratio?

[5]

9. A gas oil contains 100 ppm (wt basis) S, 70 of which is present as  and rest 30 as , is to be desulfurised to 10 ppm .

How much H_2 (in normal m^3 /kg oil) will be required

(First write down the reactions involved, and specify the the moles of hydrogen consumed per atom of S removed, and hence per gm of S removed. (S at wt 32) Note which type of sulphur will be removed faster. Make any reasonable assumption for the quantification)

[5]

10. Write short notes on —

[1×5]

- a) What is meant by sweet and sour crude?
- b) Desulfurization process used in refinery?
- c) Write the clause reactions of sulphur recovery.
- d) viscosity Index.
- e) Cetane number

Unit - II

Answer any four questions from question nos. 11 to 16:

[4×5]

11. a) What is the basic difference between unit operation and unit process in the study of chemical Engineering?

[1]

b) Write the Names of Industrial Nitrating agent.

[1]

c) What is Mixed Acid in the Unit process of nitration? Show how NO_2^+ (Nitronium Ion) is produced in the Mixed acid with help of equation. What is "dynamite" discovered by Alfred Nobel? State the application of dynamite in Civil Engineering.

[3]

12. a) Discuss Thermodynamics of Nitration process. [3]
b) Define DVS and Nitric Ratio and show their importance in designing the optimum process control parameters in industrial Nitration. [2]
13. a) Write the Nitration products of iso-pentane. [2]
b) Describe the Schmid nitrator. [3]
14. a) Name the chemicals used for Chlorinating aromatic compounds. [2]
b) Draw a flow diagram of chloro methane manufacturing process. State use of CCl_4 . [3]
15. a) Distinguish between sulfonation and sulfation with chemical Equation. Name material of construction of sulfonator. [2]
b) Name the industrial sulfonating agents. [1]
c) Coco Lauryl Sulfate is a C_{12} alcohol sulfate derived from coconut oil. State its use in cosmetic industry. [1]
d) Give an example where SO_3 gas is used as sulfonating agent. [1]
16. Alkyl Benzene Sulfonic acid $\text{R SO}_3\text{H}$ is a widely used raw material for detergent industry under the Name "Acid slurry". Discuss in details its manufacturing process starting from $\text{C}_{12}\text{H}_{25}$ fraction or Reformer Petroleum Naphtha. [5]

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