Q.P. Code – 42234

Second Semester B.Sc. Degree Examination, September 2020

(CBCS Scheme)

CHEMISTRY

Paper II

Time : 3 Hours] *[Max. Marks : 90*

Instructions to Candidates :

1) *The question paper has two Parts A and B. Both the parts should be answered.*

2) *Write the equations/reactions wherever necessary.*

PART – A

Answer any **TEN** of the following questions. Each question carries **2** marks : **(10 × 2 = 20)**

1. What is the criteria for reversible and irreversible processes in terms of entropy?

2. 10 moles of an ideal gas expand reversibly from a volume of 5 dm^3 to 15 dm^3 at a temperature of 25°C. Calculate the change of entropy of the gas.

3. What is an adsorption? Give an example of an adsorption process.

4. Write any two general characteristics of a catalyst.

5. Write any two catalysed chemical processes? Mention the catalysts used in them.

6. What is the effect of temperature on ionic product of water? What is its value at 298 K?

7. A monobasic acid of concentration 0.20 M has a dissociation constant equal to 1.8×10^{-5} at 25°C. Calculate its degree of dissociation assuming it very small.

8. What is tautomerism? Write keto and enol forms of ethyl acetoacetate.

9. How is chlorobenzene synthesized from aniline? Name the reaction.

10. What is the action of PCl_5 and $SOCl_2$ on alcohols?

11. How is phenolphthalein prepared from phenol?

12. Complete the following reactions :

(a) $R-\overset{\overset{O}{\|}}{C}-H \xrightarrow{LiAlH_4}$

(b) $\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix} \xrightarrow{HIO_4}$

PART – B

Answer any **SEVEN** questions. Each question carries **10** marks : **(7 × 10 = 70)**

13. (a) Using $G = H - TS$, deduce the expression $dG = Vdp - SdT$.

(b) A Carnot engine has the same efficiency

(i) between 100 K and 500 K and

(ii) between T K and 900 K. Calculate the temperature T of the sink.

(c) Derive an expression for the entropy change accompanying the isothermal reversible expansion of an ideal gas. **(4 + 3 + 3)**

14. (a) Derive an expression for Van't Hoff isochore.

(b) Show that Gibbs free energy measures the network (non mechanical work) done by the system.

(c) State

(i) Nernst heat theorem

(ii) Third law of thermodynamics

(iii) A spontaneous process **(4 + 3 + 3)**

15. (a) Derive Langmuir's adsorption isotherm.

(b) What is heterogeneous catalysis? Explain intermediate compound formation theory of catalysis.

(c) What is an enzyme catalysis? Give the composition of Zeigler-Natta catalyst and one of its applications. **(4 + 3 + 3)**

16. (a) Derive an expression for pH of the hydrolysed salt solution of a weak acid and a strong base.

(b) What is degree of ionisation? What is the effect of temperature and concentration on it?

(c) What would be the pH of a solution containing 0.1 M of NH_4OH and 0.15 M of NH_4Cl $\left(K_b = 1.8 \times 10^{-5}\right)$? **(4 + 3 + 3)**

17. (a) Illustrate the application of solubility product principle to the following :

(i) Determination of solubility of sparingly soluble salt $Mg(OH)_2$.

(ii) Purification of common salt

(b) What are buffer solutions? Explain the terms buffer capacity and buffer index.

(c) Explain why a solution of a weak acid and its salt behaves as a buffer. **(4 + 3 + 3)**

18. (a) How are the following compounds prepared?

(i) Benzene from Benzoic acid

(ii) Naphthalene from α- tetralone

(b) Discuss the mechanism of nitration of benzene.

(c) What are carcinogens? Write the structure of benzo(a)pyrene. **(4 + 3 + 3)**

19. (a) What are elimination reactions? Explain the mechanism of SN^2 reaction by taking an example.

(b) How are the following prepared from alkylhalides?

(i) di ethyl ether and

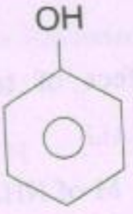
(ii) alkyl isonitrile

(c) Discuss the effect of NO_2 group an aromatic nucleophilic substitution of chlorobenzene. **(4 + 3 + 3)**

20. (a) What is the action of PCC, carboxylic acids, Na and conc. HNO_3 on primary alcohols?

(b) Write a note on chemistry of methanol poisoning.

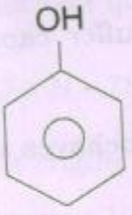
(c) Complete the following reactions :

(i) 

$+ CHCl_3 \xrightarrow{\text{aq NaOH}} ? \xrightarrow{HCl}$

(ii) 

$+ Br_2 / H_2O \longrightarrow ?$

(iii) 

$+ C_6H_5COCl \xrightarrow{\text{aq NaOH}} ?$

(4 + 3 + 3)

21. (a) How are Grignard reagents prepared in the laboratory? Discuss the synthesis of primary alcohols and carboxylic acids from organolithium.

(b) How are the following synthesised from diethyl malonate (DME) :

(i) Butanoic acid

(ii) 2-butanone

(iii) Succinic acid

(c) What are active methylene compounds? How is ethyl aceto acetate prepared? **(4 + 3 + 3)**

22. (a) What are epoxides? How is ethylene oxide prepared from alkenes? How does it react with H_2O?

(b) How does diethyl ether reacts with

(i) hot conc. HBr

(ii) Acetyl chloride

(c) How are primary, secondary and tertiary alcohols distinguished using Lucas test? **(4 + 3 + 3)**