TDC (CBCS) Odd Semester Exam., 2020
held in March, 2021

CHEMISTRY

(3rd Semester)

Course No. : CHMDSC/CHMGE-301T

(Physical and Organic Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *fifteen* questions : 1×15=15

1. State Raoult's law.

2. What is critical solution temperature?

3. What is triple point?

4. Write two limitations of Nernst distribution law.

5. How many phases are there in aqueous NaCl solution?

6. Give an example of a minimum boiling azeotrope.

7. Write the SI units of equivalent conductivity and molar conductivity.

8. What is ionic mobility?

9. What do you mean by phase diagram?

10. How does conductivity vary with dilution?

11. Define standard electrode potential.

12. Write the expression relating ΔG and EMF.

13. Name one aldehyde and one ketone which do not show aldol condensation.

14. What is iodoform test?

15. $CH_3COOH \xrightarrow{NH_3,\ \Delta} ?$

(Continued)

16. How can you distinguish an aldehyde and a ketone?

17. $R-\overset{\overset{O}{\|}}{C}-Cl \xrightarrow[S,\ xylene]{H_2/Pd,\ BaSO_4} ?$

18. $H-CHO + H_2N\,NH_2 \longrightarrow ?$

19. Give an example of carbylamine test.

20. Name the amine with molecular formula C_2H_5N which produces a yellow oily liquid on reacting with HNO_2.

21. $CH_3CH_2\,CONH_2 + Br_2 + KOH \longrightarrow ?$

22. Write the IUPAC name of

$$CH_3CH_2CH_2-N\begin{matrix}CH_3\\CH_3\end{matrix}$$

23. Give an example of electrophilic substitution reaction of aniline.

24. $CH_3CH_2-NH_2 + R-\overset{\overset{O}{\|}}{C}-Cl \xrightarrow{NaOH} ?$

(Turn Over)

25. Give one example each of sugar and non-sugar.

26. Write the Haworth structure of β-D-(+) glucopyranose.

27. Sketch the zwitterion structure of alanine.

28. What is peptide linkage? Give example.

29. Give one example each of aldoketose and ketopentose.

30. What is meant by limiting molar conductivity?

SECTION—B

Answer *any* **five** questions

31. Find out the number of components in the following : 1×2=2

(i) $NaCl—KCl—H_2O$

(ii) $CaCl_2 \cdot 6H_2O—Ca^{2+}—Cl^-—H_2O$

32. Explain graphically the positive and negative deviations of liquid mixtures from ideal behaviour. 2

(Continued)

33. The molar conductances of NaOH, NaCl and $BaCl_2$ at infinite dilution are $2{\cdot}481 \times 10^{-2}$, $1{\cdot}265 \times 10^{-2}$ and $2{\cdot}8 \times 10^{-2}$ $Sm^2\ mol^{-1}$ respectively. Calculate $\Lambda^{\circ}_m\ Ba(OH)_2$. 2

34. Explain the nature of aqueous solution of $CuSO_4$. 2

35. Explain with a suitable example, the usefulness of iodoform test in distinguishing two different compounds. 2

36. Illustrate Hell-Volhard-Zelinsky with a suitable example. 2

37. Explain Hinsberg test with a suitable example. 2

38. Write the reaction for preparation of propylamine from phthalimide by Gabriel phthalimide reaction. 2

39. Convert arabinose to glucose. 2

40. Write the reaction for preparation of alanine by Gabriel synthesis. 2

(Turn Over)

SECTION—C

Answer *any* **five** questions

41. *(a)* Draw and explain the phase diagram of water system. 3

(b) Explain the effect of impurity on critical solution temperature with a suitable example. 2

42. *(a)* What is Nernst distribution law? 1

(b) Mention two conditions for the validity of Nernst distribution law. 1

(c) Deduce the Nernst distribution law thermodynamically. 3

43. *(a)* Calculate the e.m.f. from the following cell notation :

$$Mg\left|Mg^{2+}\ (0{\cdot}130)\right\|Ag^{+}\ (0{\cdot}0001)\left|Ag\right.$$

with

$$E^{\circ}_{Mg^{2+}/Mg} = -2{\cdot}37\ V \text{ and}$$

$$E^{\circ}_{Ag/Ag^{+}} = -0{\cdot}80\ V \quad 3$$

(b) Explain the term 'transference number'. 2

(Continued)

44. *(a)* The vapour pressure of a 5% aqueous solution of a non-volatile substance at 373 K is 745 mm. Calculate the molecular mass of the solute. 3

(b) Explain the term 'solubility product'. 2

45. *(a)* Write the structures and names of the products for the following : 2

(i) $CH_3—CHO + CH_3CH_2—CHO \xrightarrow[NaOH]{dil.} ?$

(ii) $CH_3CHO \xrightarrow[HCl]{Zn-Hg} ?$

(b) What are ylides? Give two examples. 3

46. *(a)* Illustrate benzoin condensation with an example along with the mechanism. 3

(b) What happens when acetaldehyde reacts with—

(i) ethyl alcohol;

(ii) ethylene glycol? 2

47. *(a)* How can you distinguish among 1°, 2° and 3° amine using benzene sulphonyl chloride? 3

(b) Explain why aniline undergoes electrophilic substitution reaction. 2

(Turn Over)

48. *(a)* Explain with a suitable example to illustrate Hofmann versus Saytzeff elimination. 3

(b) Discuss the method of preparation of amine by Hofmann's amonolysis method. 2

49. *(a)* Define the term 'mutarotation' with a suitable example. 2

(b) Define essential and non-essential amino acids with two examples for both. 3

50. *(a)* Using Strecker synthesis, how can you prepare glycine and alanine? 3

(b) How are amino acids analyzed by electrophoresis? 2

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A