2019/TDC/ODD/SEM/CHMDSC/ CHMGE–301T/136

TDC (CBCS) Odd Semester Exam., 2019

CHEMISTRY

(3rd Semester)

Course No. : CHMDSC/CHMGE–301 T

(Physical and Organic Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *three* questions from the following : 1×3=3

   (a) What will be the values of ΔV_{mix} and ΔH_{mix} of two liquids which on mixing form an ideal solution?

   (b) Under what conditions of pressure and temperature Henry's law is applicable?

   (c) How many phases are present in a system consisting of $CaCO_3$ (s), CaO (s) and CO_2 (g)?

   (d) What is critical solution temperature?

20J/1169 (Turn Over)

2. Answer any *one* question from the following :

(a) Calculate the degrees of freedom for a mixture of nitrogen and oxygen gases contained in a vessel.

(b) How does solubility of a gas in a liquid vary with temperature? Give reason for such variation.

3. Answer any *one* question from the following :

(a) State Raoult's law for solution of volatile liquids. Draw and explain the vapour pressure composition diagram for ideal solution.   2+3=5

(b) (i) State phase rule and explain the terms involved in it.   1+3=4

(ii) What do you mean by phase diagram?

UNIT—II

4. Answer any *three* questions from the following :   1×3=3

(a) Give the representation of Daniel cell.

(b) Which reference electrode is used in determining the standard electrode potential? How is it represented?

(c) What is meant by limiting molar conductivity?

(d) Write the expression that relates conductivity with molar conductivity of an electrolyte.
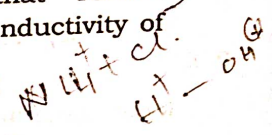
5. Answer any *one* question from the following :   2

(a) How does the molar conductivity of an weak electrolyte vary with dilution? Justify your answer.   1+1=2

(b) A solution of NH_4Cl in water is acidic. Explain.   2

6. Answer any *one* question from the following :   5

(a) (i) State Kohlrausch's law of independent migration of ions.   2

(ii) The resistance of a conductivity cell filled with 0·1 M KCl solution is 100 ohm. If the resistance of the same cell when filled with 0·02 M KCl solution is 520 ohm, calculate the conductivity and molar conductivity of 0·02 M KCl solution. Given conductivity of 0·1 M KCl solution is 1·29 ohm^{-1} m^{-1}.
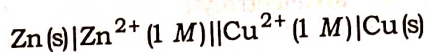
(b) *(i)* What is meant by EMF of a cell? Discuss how can EMF of a cell be measured by potentiometric method.   1+3=4

(ii) The EMF of the cell
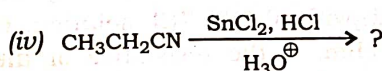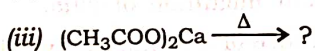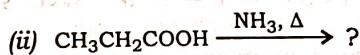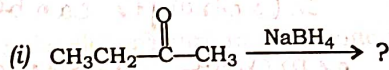
$$Zn\,(s)\,|\,Zn^{2+}\,(1\;M)\,||\,Cu^{2+}\,(1\;M)\,|\,Cu\,(s)$$

is 1·1 V. If the standard reduction potential of $Zn^{2+}\,|\,Zn$ is –0·76 V, what is the standard reduction potential of copper electrode?   1

UNIT—III

7. Write the structure and name of the products of the following reactions (any *three*) :   1×3=3

(i) $CH_3CH_2\overset{\displaystyle O}{\overset{\|}{-C}}-CH_3 \xrightarrow{NaBH_4} ?$

(ii) $CH_3CH_2COOH \xrightarrow{NH_3,\,\Delta} ?$

(iii) $(CH_3COO)_2Ca \xrightarrow{\Delta} ?$

(iv) $CH_3CH_2CN \xrightarrow[H_3O^{\oplus}]{SnCl_2,\,HCl} ?$

8. Answer any *one* question from the following :   2

(a) Give reasons for the following :   1×2=2

(i) CH_3CHO does not undergo Cannizzaro reaction.

(ii) Pentan-2-one shows haloform reaction but pentan-3-one does not.

(b) Give reasons for the following observations :   1×2=2

*(i)* Cl_3CCHO does not undergo aldol condensation.

(ii) Methanoic acid reacts with Tollen's reagent.

9. Answer any *one* question from the following :   5

(a) *(i)* Taking a suitable example, explain with reasonable mechanism the hydrolysis of an ester in acidic condition.   3

(ii) Write, with reactions involve, a chemical test to distinguish between propanal and propanone.   2

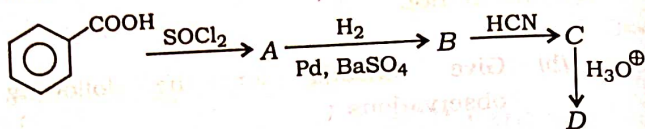*(b)* *(i)* Complete and propose a reasonable mechanism for the following reaction :   3

$$\text{C}_6\text{H}_5-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3 \xrightarrow[HCl]{Zn(Hg)} ?$$
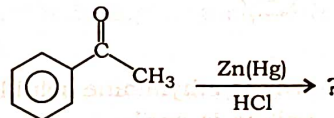
(ii) Identify *A*, *B*, *C* and *D* in the following reaction sequence :   ½×4=2

$$\text{C}_6\text{H}_5\text{COOH} \xrightarrow{\text{SOCl}_2} A \xrightarrow[\text{Pd, BaSO}_4]{\text{H}_2} B \xrightarrow{\text{HCN}} C \xrightarrow{\text{H}_3\text{O}^\oplus} D$$

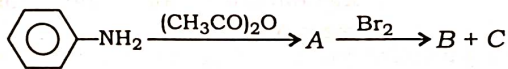### UNIT—IV

10. Answer any *three* questions from the following :   1×3=3

(a) Name the amine with molecular formula C_2H_5N which produces a yellow oily liquid by reacting with nitrous acid.

(b) Arrange the following in the increasing order of their basic strengths :

$$C_2H_5NH_2, \ C_6H_5NH_2, \ NH_3$$
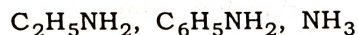
(c) Identify *A*, *B* and *C* in the following reaction :

$$C_6H_5\text{—NH}_2 \xrightarrow{(CH_3CO)_2O} A \xrightarrow{Br_2} B + C$$

(d) Why is ethylamine soluble in water but aniline is not?

11. Answer any *one* question from the following :   2

(a) Nitration of aniline with nitrating mixture of conc. HNO_3 and conc. H_2SO_4 is not very successful. Explain with reason.

(b) Aliphatic amines are more basic than comparable alcohols. Justify.

12. Answer any *one* question from the following :   5

(a) What is carbylamine reaction? Give an example. Propose a suitable mechanism for the reaction and write one of its uses.   1+1+2+1=5

(b) *(i)* What is Hoffmann bromamide reaction? Give an example. Write one of its applications in organic synthesis.   1+1+1=3

(ii) Aniline fails to give Friedel-Crafts reaction. Explain the observation with reason.   2

UNIT—V

13. Answer any *three* questions from the following :   1×3=3

(a) What are reducing sugars? Give one example.

(b) What is zwitter ion? Sketch the zwitter ion structure of glycine.

(c) Write the name and structure of one essential amino acid.

(d) What happens when D-glucose is heated with excess of HI and red phosphorus?

14. Answer any *one* question from the following : 2

(a) What is isoelectric point of amino acid? How does it help in separation of amino acids?

1+1=2

(b) Explain, how does glucose react with excess of phenyl hydrazine.

15. Answer any *one* question from the following : 5

(a) Bring out the following conversions :

2½×2=5

(i) Glucose to fructose
(ii) Arabinose to glucose

(b) (i) Give one example each of reaction of amino acid due to —COOH gr, due to —NH$_2$ gr and due to both —COOH and —NH$_2$ gr.

3

(ii) Write the Strecker synthesis of amino acid.

2

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