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?

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

(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 : 5

(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? 1

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?

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(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}. 3

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

(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.

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(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.

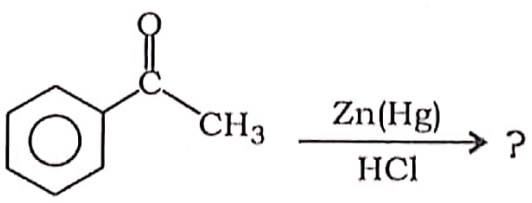
(ii) Methanoic acid reacts with Tollen's reagent.

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



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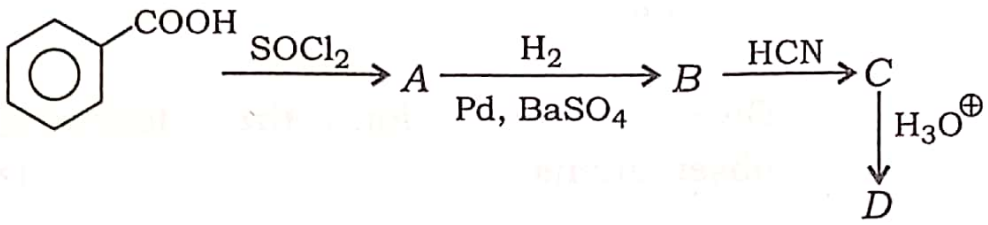
(ii) Identify *A*, *B*, *C* and *D* in the following reaction sequence : ½×4=2



UNIT—IV

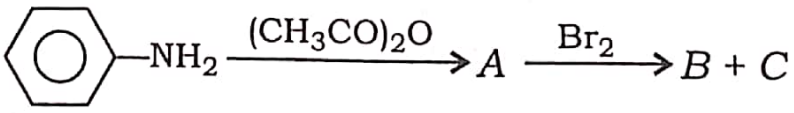
10. Answer any *three* questions from the following : 1×3=3

(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 :



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

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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.

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(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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