(i) Printed Pages : 7 Roll No. .....

(ii) Questions : 8 Sub. Code : 1 1 8 5 6

Exam. Code : 5 0 1 4

Bachelor of Science (FYUP) 4th Semester

(2056)

CHEMISTRY

Paper : General Chemistry–4 (Organic Chemistry)

Time Allowed : Three Hours] **[Maximum Marks : 67**

Note :— Attempt **four** questions in all, selecting **one** question from each unit I-III, and question **1** is compulsory.

Note :— (i) Question No. **1** consists of Multiple Choice Questions (MCQs) and is a compulsory question.

(ii) Question No. **2** consists of short-answer type questions and is also compulsory.

(iii) Units I-III each contain **two** questions with an internal choice. Attempt **one** question from each unit.

(iv) Attempt a total of **five** questions - **two** compulsory questions (Q.**1** and Q.**2**) and three questions from Units I-III.

Compulsory UNIT (19 Marks)

1. Attempt the following multiple-choice questions:

(a) Which compound acts as a Lewis acid?

(i) BF_3 (ii) H_3BO_3

(iii) BN (iv) All of the above

(b) The hardest naturally occurring substance is:

(i) Diamond (ii) Graphite

(iii) Silicon carbide (iv) Fullerene

(c) The polymer known as Teflon is:

(i) Polyethylene

(ii) Polytetrafluoroethylene

(iii) Polyvinyl Chloride

(iv) Polystyrene

(d) The catalyst used in Friedel-Crafts alkylation is:

(i) Sulphuric acid (ii) Aluminium chloride

(iii) Nitric acid (iv) Hydrochloric acid

(e) Which of the following groups is ortho-para directing?

(i) NO_2 (ii) COOH

(iii) CN (iv) OH

(f) Which of the following is formed as an intermediate in SN^2 mechanism?

(i) Carbacation intermediate

(ii) Carbanion intermediate

(iii) Free radical intermediate

(iv) Single transition state

(g) The temperature 0 K is known as:

(i) Freezing point

(ii) Boiling point

(iii) Absolute zero

(iv) Triple point

(h) The Nernst Heat Theorem states that:

(i) Entropy change approaches zero as temperature approaches zero

(ii) Entropy increases with temperature

(iii) Heat capacity becomes zero at 0 K

(iv) Free energy becomes zero at 0 K

(i) The equilibrium constant of reaction _____ with the increase in temperature.

(i) Always decreases

(ii) Always increases

(iii) May increase or decrease depending on the nature of reaction

(iv) Remains constant 1×9

2. Answer the following short-answer questions:

(a) Draw the structure of borax and diborane.

(b) What are fullerenes?

(c) What are benzenoid and non-benzenoid compounds?

(d) State the rate law of the SN^1 Reaction.

(e) What is Gibbs Helmholtz equation? 2×5

UNIT–I

3. (a) Explain how similarities in atomic size, electronegativity, and charge density lead to comparable chemical behavior of B and Si.

(b) Discuss the types of borates, giving suitable examples.

(c) What is borazine? Describe its molecular structure and bonding, highlighting its similarity and differences with Benzene.

(d) Explain the amphoteric nature of Aluminium Oxide with balanced chemical equations. 4,4,4,4

4. (a) Differentiate between the structure and properties of diamond and graphite.

(b) Discuss the inert pair effect in Group 14 elements and explain the stability of +2 and +4 oxidation states.

(c) Compare the structure and properties of CO_2 and SiO_2.

(d) Write a note on covalent carbides, giving examples. 4,4,4,4

UNIT–II

5. (a) Explain the resonance in benzene and discuss how resonance contributes to its stability and equal C-C bond lengths.

(b) Explain Hückel's Rule for aromaticity. Apply the rule to determine whether benzene, cyclobutadiene, and cyclopentadienyl anion are aromatic or not.

(c) Discuss the mechanism of nitration of benzene.

(d) Which factors affect the ortho-para ratio in disubstituted derivatives of benzene? 4,4,4,4

6. (a) Describe the methods of preparation of alkyl Halides from alcohols and alkenes with chemical equations.

(b) Explain the mechanism of the SN^2 Reaction and discuss the stereochemical outcome of the reaction.

(c) Explain the elimination-addition mechanism in nucleophilic substitution reactions of aryl halides.

(d) Compare the reactivity of alkyl halides and allyl halides by taking suitable examples. 4,4,4,4

UNIT–III

7. (a) State and explain the Third Law of Thermodynamics. Discuss its significance in determining the absolute entropy of substances at low temperatures.

(b) What is work function? Explain variation of work function with temperature and volume.

(c) Discuss criteria for the spontaneity of process. Discuss its limitations also.

(d) What is residual entropy? What are its causes? 4,4,4,4

8. (a) Write a note on the state of chemical equilibrium and Law of mass action.

(b) Derive relationship between Kp and Kc.

(c) Discuss Le-Chatelier's principle, giving the effect of pressure and catalyst on equilibrium.

(d) What is reaction isochore? Derive integrated form of Van't Hoff equation. 4,4,4,4