

B. Sc. CHEMISTRY
FOURTH SEMESTER
ORGANIC, INORGANIC & PHYSICAL CHEMISTRY II
BSC – 741

(Use Separate Answer Scripts for Objective & Descriptive)

Duration: 3 hrs.

Full Marks: 70

(PART-A: Objective)

Time: 30 min.

Marks: 20

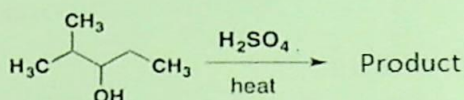
Choose the correct answer from the following:

1X20=20

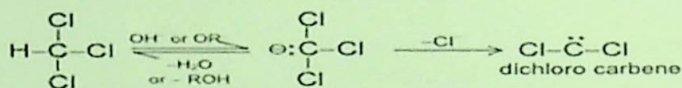
- The rate constant of 1st order reactions has the unit
 - s^{-1}
 - $\text{mol L}^{-1} \text{s}^{-1}$
 - $\text{L}^2 \text{mol}^{-2} \text{s}^{-1}$
 - None of these
- $2\text{HI} \longrightarrow \text{H}_2 + \text{I}_2$
What is the molecularity of the above reaction?
 - 1
 - 2
 - 3
 - 0
- Decomposition of ammonia is a
 - 3rd order reaction
 - 2nd order reaction
 - 1st order reaction
 - Zero (0) order reaction
- In adiabatic process, between system and surroundings
 - Heat can exchange
 - Heat cannot exchange
 - Mass and heat can exchange
 - Temperature is constant
- $H = U + PV$ in this equation, U refer to
 - Enthalpy
 - Internal Energy
 - Entropy
 - Residual heat
- The concept of entropy is related to
 - 1st law of thermodynamics
 - 2nd law of thermodynamics
 - Zeroth law
 - Steady state
- The oxidation state of Mn in KMnO_4
 - +5
 - +7
 - +6
 - +4
- The bond order of O_2^{2+} ion is
 - 1
 - 3
 - 3
 - 1.5
- Which of the following is Lewis acid
 - BCl_3
 - AlCl_3
 - GaCl_3
 - All of the these
- The oxidation state of oxygen in Na_2O_2
 - 1
 - 2
 - 3
 - None of these
- The bond order of N_2 molecule
 - 3
 - 2
 - 1
 - 4

12. Which of the following is correct statement of Lewis acid-base
- a. Acid is electron donor base is proton donor
 b. Acid is electron acceptor base electron donor
 c. Both (a) & (b)
 d. None of the above

13. Identify the major product of the following reaction:



- a. 2-Methylpent-2-ene
 b. 4-Methylpent-2-ene
 c. 2-Methylpent-3-ene
 d. 4-Methylpent-3-ene
14. In the Victor Meyer test, alcohol is treated with HI, AgNO₂ and HNO₂ respectively and finally the reaction mixture is made alkaline with KOH solution. If the colour of the resulting mixture is found to be red then the alcohol will be
- a. Primary
 b. Secondary
 c. Tertiary
 d. None of these
15. E1cB reaction is usually seen to involve the intermediate
- a. Carbocation
 b. Carbanion
 c. Carbene
 d. Free radical
16. The formation of dichlorocarbene from chloroform in the following reaction is seen to take place via



- a. β-elimination
 b. α-elimination
 c. γ-elimination
 d. δ-elimination
17. The product P in the following reaction of alkyl halide with alcoholic KOH will be
- $$\begin{array}{c} \text{H} \quad \text{X} \\ | \quad | \\ \text{R}-\text{C}-\text{C}-\text{H} \\ | \quad | \\ \text{H} \quad \text{H} \end{array} \xrightarrow{\text{Alcoholic KOH}} \text{P}$$
- Alkyl halide

- a. Alkane
 b. Aldehyde
 c. Alkene
 d. Ketone
18. When glycerol is treated with excess amount of HI the product obtained is
- a. 1,3- Diiodo propane
 b. 1,2- Diiodo propane
 c. n-Propyl iodide
 d. Isopropyl iodide
19. If glycol is heated with conc sulphuric acid the product obtained is
- a. Dioxan
 b. Glycollic acid
 c. Glycolaldehyde
 d. Glyoxal
20. The structure of carbonyl group is
- a. Tetrahedral
 b. Linear
 c. Planar
 d. Square planar

(PART-B: Descriptive)

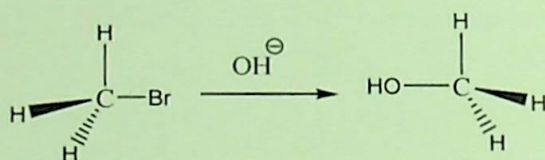
Time : 2 hrs. 40 min.

Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. a. Write down the differences between order and molecularity of a reaction. 2+3+5
=10
- b. Draw the molecular orbital energy diagram for F₂ molecule and calculate the bond order of F₂ molecule.
- c. Explain fermentation? Discuss the various steps involved in the manufacture of ethanol from molasses.
2. a. Deduce the equation for rate const k for a 1st order reaction. What change will be seen in the equation for gaseous reaction? 6+3+1
=10
- b. A reaction which is first order with respect to A has rate constant 6 min⁻¹. If we start with [A] = 0.5 mol L⁻¹, when would [A] reach the value of 0.05 ML⁻¹
- c. Give an example of pseudo 1st order reaction.
3. a. Write down the statement of 1st law of thermodynamics with mathematical expression. Define internal energy (U). 5+3+2
=10
- b. Prove that $\Delta H = \Delta U + \Delta n_g RT$
- c. For the reaction at 298 K,
- $$\frac{1}{2} \text{N}_2(\text{g}) + \frac{3}{2} \text{H}_2(\text{g}) \rightarrow \text{NH}_3(\text{g}) ; \Delta H = - 46 \text{ kJ}$$
- Calculate the value of ΔU .
4. a. Define 2nd law of thermodynamics. Describe Carnot engine in detailed. 5+5=10
- b. Write the following acid base concept with examples
- (i) Arrhenius acid -base concept
 - (ii) Bronsted Lowry acid base concept
 - (iii) Lewis acid base concept
5. a. Balance the following redox reaction 5+5=10
- (i) $\text{MnO}_4^- + \text{Fe}^{2+} \longrightarrow \text{Mn}^{2+} + \text{Fe}^{3+}$ (Acidic medium)
- (ii) $\text{Cr}_2\text{O}_7^{2-} + \text{I}^- \longrightarrow \text{Cr}^{3+} + \text{I}_2$ (Acidic medium)

- b. Write five rules for determination of oxidation state with examples.
6. a. Explain the molecular orbital energy level diagram for O_2 and N_2 molecule 5+5=10
- b. Arrange the following species on increasing order of bond length, bond order, bond strength
- (i) $O_2, O_2^+, O_2^{2-}, O_2^-$
- (ii) N_2^+, N_2, N_2^-
7. a. What are nucleophilic substitutions? Write the difference between S_N1 and S_N2 reactions. 3+4+3=10
- b. Discuss the mechanism and stereochemistry of the following reaction.



- c. What are elimination reactions? Explain Saytzeff's and Hofmann's rules.
8. a. Write the Lucas test to distinguish between $1^\circ, 2^\circ$ and 3° alcohols. 3+2+5=10
- b. Give the preparation of phenol from cumene with chemical reaction.
- c. Write notes on the following:
- (i) Aldol condensation (ii) Benzoin condensation

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