RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, AUGUST 2021

FIRST YEAR [BATCH 2020-23]

Date : 14/08/2021 **CHEMISTRY (GENERAL)**

Time : 11.00 am - 1.00 pm **Paper : II** Full Marks : 50

Group – A

[Attempt any one from each unit]

Unit – I

[1×10]

1. a) Write short notes on the following [3×2]

   i) Cannizzaro reaction

   ii) Perkin reaction

   iii) Claisen condensation

   b) PCC is better choice of reagent for oxidation of 1^o alcohol to aldehyde – Explain. [2]

   c) Give reactions out line for the preparation of 2^o and 3^o alcohol from Grignard Reagent. [2]

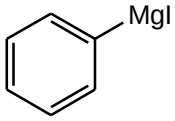
2. a) Write short notes on the following [3×2]

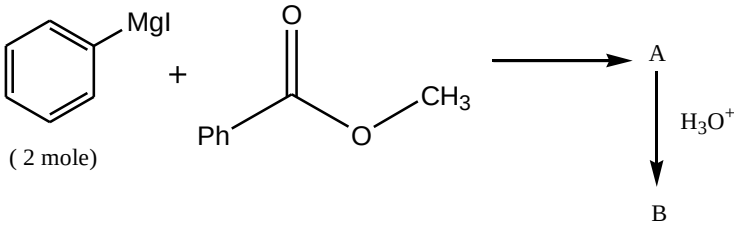
   i) Benzoin condensation

   ii) Cross aldol reaction

   iii) Jones oxidation

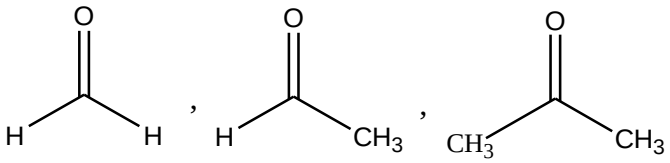
   b) Prepare the following Grignard reagent and also complete the following reaction. [1+2]

   i) 

   ii) 

(2 mole)

   c) Arrange the following molecules in increasing order of reactivity towards nucleophile. [1]



Unit – II

[1×10]

3. a) Write short notes on the following [3×2]

i) Isoelectric point

ii) Nucleotide

iii) Kiliani – Fischer method

b) D-Glucose and D-fructose should give same osazone product – Explain. [2]

c) Show synthetic out line for preparation of phenylalanine by Gatriel's phthalimide synthesis. [2]

4. a) Write short notes on the following : [3×2]

i) Zwitterion structure

ii) DNA bases.

iii) Reducing Sugars.

b) Explain the Ruff's degradation method with example. [2]

c) Write down the complementary sequence for the following single standard DNA. [2]

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{   |
A   |
G   ?
T   ?
A   |
C   |
|   |
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Group – B

[Attempt any one from each unit]

Unit – III [1×6]

5. a) Mention the factors that affect the rate of a chemical reaction. [2]

b) The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artefact containing wood had only 80% of the ^{14}C found in a living tree. Estimate the age of the sample. [2]

c) The rate of the chemical reaction doubles for an increase of 10K in absolute temperature from 298K. Calculate the activation energy (Ea). [2]

6. a) Write the Michaelis-Menten equation for an enzyme catalyzed reaction. [1]

b) The slope and intercept obtained from (1/Rate) against (1/Substrate concentration) of an enzyme catalyzed reaction are 300 and 2,00,000 respectively. Determine the Michaelis-Menten constant for the reaction. [2]

c) A first order reaction has a rate constant 1.15 × 10-3 s-1. How long will 5 g of this reactant take to reduce to 3 g ? [2]

d) Write the unit of the rate constant for a 3^{rd} order reaction. [1]

Unit – IV [1×6]

7. a) Explain the physical significance of van der Waals parameters. [2]

b) What is compressibility factor? What is its significance? [1+2]

c) Draw the curve for Compressibility factor versus pressure for CO_2 at normal temperature. [1]

8. a) What is the ratio for most probable velocity to the average velocity of a gas? [2]

b) The RMS speed of a gas molecule is 256 m/s at a given temperature. The gas has a molar mass of 32 g/mol. What would be the RMS speed of a gas with the molar mass of 131 g/mol at that same temperature? [3]

c) What do you mean by critical temperature? [1]

Unit – V

[1×6]

9. a) What are the essential criteria of being a state function for a thermodynamic quantity? By using Euler's theorem prove that pressure is a state function for an ideal gas. [2]

b) One mole of an ideal gas (C_v =1.5 R) at a temp 500K is compressed from 1.0 atm. to 2.0 atm. pressure by reversible isothermal path. Subsequently, it is expanded to 1.0 atm. by reversible adiabatic path. Calculate the volume of the final state. [3]

c) "Where there is expansion, there is work"-is it true? Justify [1]

10. a) Show that the curve for adiabatic expansion process is steeper than isothermal expansion process. [2]

b) The standard heat of formation of H_2O and H_2O_2 is 935 and 1070 kcal mol^{-1} respectively. Evaluate the bond dissociation energy of the peroxide bond (O-O) in H_2O_2 [2]

c) 2 moles of a monoatomic ideal gas (C_v = 1.5R) initially at 298K and at 10 atm. pressure expands adiabatically against a constant external pressure 1 atm. What would be the final temperature of the gas. [2]

Unit – VI

[1×6]

11. a) What is Gibb's free energy and how does it determine the thermodynamic conditions for spontaneity and equilibrium of a reaction? [2]

b) Find the molar increase in U, H, S, G in expanding one litre of an ideal gas at 25˚C to 100 litres at the same temperature. [2]

c) An ideal heat engine operating between a source having temperature 0˚C and a sink (T_2), produces 1000 calories of work per cycle rejecting 6400 calories of heat. Calculate the efficiency of the engine and temperature of the sink. [2]

12. a) What is Clausius inequality. Explain. [2]

b) 10 moles of Helium are heated from 0˚C to 100˚C at constant pressure of 1 atm. Calculate the change in entropy value. [2]

c) A Carnot engine works between 120˚C and 30˚C. If the power produced by engine is 400 W, calculate the heat absorbed from the source and rejected to sink every second. [2]

Unit – VII

[1×6]

13. a) What are lyophilic and lyophobic sols? Give one example of each type. [2]

b) Why do hydrophobic sols easily coagulate? [2]

c) What is Langmuir adsorption isotherm? Draw the isotherm at different temperature for a specific adsorbet-adsorbent pair. [2]

14. a) What is the difference between physisorption and chemisorption? [2]

b) Why is adsorption always exothermic? [2]

c) Discuss the effect of pressure and temperature on the adsorption of gases on solids. [2]

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