RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2016-19]

B.A./B.Sc. FOURTH SEMESTER (January – June) 2018

Mid-Semester Examination, March 2018

Date : 15/03/2018 **CHEMISTRY (General)**

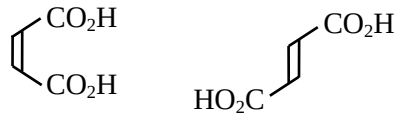
Time : 1 pm – 2 pm Paper : IV Full Marks : 25

Answer <u>any five</u> questions : [5×5]

1. a) Write the structure of $\alpha - D -$ glucopyranose in Howarth projection formula. [1]
   b) Justify or criticise : Mutarotation of D-glucose is due to spontaneous anomerisation at C – 1. [2]
   c) Convert : D – Arabinose to D – glucose. [2]

2. a) Write short note on : Osazone formation. [2]
   b) Carry out the following conversions : [1·5×2]
      i) D – glucose $\rightarrow$ D – Arabinose
      ii) Phthalimide $\rightarrow$ glycine

3. a)



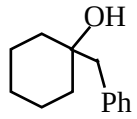
Maleic acid Fumaric acid

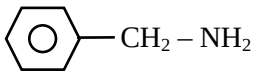
$pk_a^1 = 2 \cdot 0$ $pk_a^1 = 3 \cdot 0$

$pk_a^2 = 6 \cdot 5$ $pk_a^2 = 4 \cdot 5$

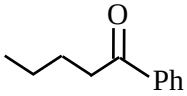
Explain the above observation in terms of pk_a values. [2]

   b) Prepare the following compound using Grignard reagent. [1]



   c) Describe Gabriel's method for synthesis of  [2]

4. a) We can't prepare primary amine selectively by substitution (S_N2) reaction on alkyl halide. — Justify. [2]
   b) Prepare the following compound using Grignard reagent. [1]



   c) Write down the mechanism for hydrolysis of ester by $B_{AC}2$ pathway. [2]

5. Draw the phase diagram for CO_2 showing explicitly the melting point line, the boiling point line, the sublimation point line, triple point, critical point. Also identify which state (solid/liquid/gas) is most stable in which regions of the plot. [1·5+2·5+1]

6. a) Plot ΔT_b (the elevation of boiling point) of the solvent of molar mass 'M' against molality (m) of the solute for an ideal solution. [2]
   b) In the same diagram as in (a) also plot the same for a solvent with molar mass 2M. [2]

c) Show how any of the above two graphs (a) or (b) would change if the solution were real. [1]

7. a) Define the 4 different paths involved in Carnot cycle. What is efficiency of a heat engine? [2+1]

   b) Consider a state (P_1, V_1, T_1), which is changed to (P_2, V_2, T_2). Give a schematic diagram of calculating ΔS for this change (reversible path) [2]

8. a) What is the criteria for the spontaneity in terms of G? Arrive it, starting from $q - Tds < 0$ as the spontaneous process. [3]

   b) A steam engine in a nuclear power plant operates between 800 and 330K. What is the maximum work that can be obtained from 1KWh of heat? [2]

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