

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [BATCH 2015-18]

B.A./B.Sc. SECOND SEMESTER (January – June) 2016

Mid-Semester Examination, March 2016

Date : 18/03/2016

CHEMISTRY (General)

Time : 12 noon – 1 pm

Paper : II

Full Marks : 25

[Use a separate Answer Book for each group]

Group – A

Answer any one question :

1. a) In terms of Band theory explain conductor, semiconductor and insulator with examples. [3]
b) Define with example standard electrode potential (E^0) and formal potential ($E^{o'}$). [1+1]
2. a) Draw the qualitative M.O. diagram of CO and comment on the bond order. [3]
b) Comment on the stability of N_2 , N_2^+ and N_2^{2+} . [2]

Group – B

Answer any one question :

3. Discuss S_N^1 reaction on the following points. [5]
 - a) Example
 - b) Mechanism
 - c) Rate equation
 - d) Energy profile
4. a) Predict the product(s) of the following reactions. [3]
 - i) $\text{PhCHO} + \text{HCHO} \xrightarrow{50\% \text{ NaOH}}$
 - ii) $\text{PhCHO} + \text{CH}_3\text{COOCH}_3 \xrightarrow{\text{NaOAc}}$
 - iii) $\text{PhCHO} \xrightarrow[\text{EtOH-H}_2\text{O}]{\text{KCN}}$
- b) Predict the product of the following reaction. Give mechanism. [2]

$\text{Me} \diagup \text{C}(\text{O}) \diagdown \text{Me} \xrightarrow{\text{HO}^-}$

Answer any one question :

5. a) Define metamerism with suitable example? Give one example of each keto-enol and nitroso-oxime tautomerism. [3]
b) Which one of the following pairs will have higher dipole moment? Give reason for your answer. [2]
 - i) p-dinitrobenzene and p-dihydroxybenzene
 - ii) p-nitrophenol and o-nitrophenol
6. a) Arrange the isopropyl, methyl and t-butyl carbocations in order of increasing stability and justify your answer. [2]
b) Which is more stable phenol or phenoxide ion? Give reason. [1]
c) Give one examples of each positive mesomeric effect and negative mesomeric effect. [1]
d) What is the state of hybridization for the central carbon in the compound? [1]

$\text{H}_2\text{C} = \text{C} = \text{CH}_2$

Group – C

Answer any one question :

7. a) State the law of equipartition of energy and calculate the $\bar{C}_v$ for CO. [3]
b) Show that in the graphical plot of dn_c vs C for the same collection of gas molecules, the total number of molecules remains unchanged with temperature. [2]
8. a) Explain and draw (qualitatively) the 3D gas molecular speed distribution function. [3]
b) The Dalton's law of partial pressure for ideal gas molecules can be verified from kinetic theory of gas model. Justify it. [2]

Answer any one question :

9. a) Write down the mathematical form of the first law of thermodynamics. [2]
b) From above prove that work done in a process under adiabatic condition is independent of path. [3]
10. a) i) In a P-V graph show and explain the amount of work done with a gas at initial state (P_i, V_i) is expanded isothermally to (P_f, V_f) at a single step against a constant external pressure $P_{app} = P_f$. ($V_f > V_i$; $P_f < P_i$) . [2]
ii) On the same graph show the amount of work done when the same expansion is carried out reversibly. [Consider the gas to be ideal] [2]
b) Calculate the amount of heat withdrawn by the system in both the above two cases (a(i) & a(ii)). Consider the gas to be ideal if necessary. [1]

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