

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

FIRST YEAR [2016-19]

B.A./B.Sc. FIRST SEMESTER (July – December) 2016

Mid-Semester Examination, September 2016

INDUSTRIAL CHEMISTRY (Honours)

Date : 10/09/2016

Time : 11 am – 1 pm

Paper : I

Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

[Answer any three questions]

- Arrange the following molecules in decreasing order of dipole moment with proper explanations. CH_3Cl , CH_2Cl_2 , CHCl_3 , CCl_4 . [3]
 - Between *ortho*- and *para*- nitrophenol which one is higher boiling and why? [2]
- Draw orbital diagram picture of 1, 3-butadiene and propyne. [2×2]
 - Define 1 Debye (unit of dipole moment). [1]
- Write the difference between inductive effect and mesomeric effect. [2]
 - Between keto and enol form of ethylacetoacetate (MeCOCO_2ET) which one is more stable in vapour phase and why? [2]
 - Oxygen atom in water is sp^3 hybridised but the bond angle is less than 109° . Explain. [1]
- Define resonance energy taking benzene molecule as an example. [2]
 - Between acetic acid and benzoic acid which one is more acidic and why? [1]
 - What is the basic difference between conjugation and hyperconjugation? [2]
- Write two conditions for a molecule to exhibit geometrical isomerism. [2]
 - What do you mean by specific rotation? [2]
 - What is the meaning of *dextrorotatory* and *levorotatory*? [1]

Group – B

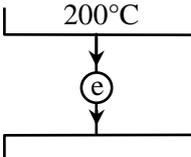
[Answer any three questions]

- “Electron affinity is an inherent property”—Explain the statement. [1]
 - The first and second electron affinity of oxygen and sulphur are as follows.
[All data's are in KJ mol^{-1}] [4]
For oxygen $\text{EA}_1 = 141$; $\text{EA}_2 = -844$
For sulphur $\text{EA}_1 = 200$; $\text{EA}_2 = -590$
Explain this phenomenon by arguments.
- CsI is ten times more soluble in water than NaF but it is much less soluble than CsF . Justify. [2]
 - Construct the Born-Haber cycle for MgBr_2 starting from solid magnesium and liquid bromine and calculate the Lattice energy of MgBr_2 . [1+2]
 ΔH_s of $\text{Mg} = 148$; E.A of $\text{Br}(\text{g}) = 331$; $(I_1 + I_2)$ of $\text{Mg} = 2187$, ΔH_v of $\text{Br}_2 (\ell) = 31$;
 ΔH_D of $\text{Br}_2(\text{g}) = 193$; ΔH_f of $\text{MgBr}_2 = 524$ [All data's are in KJ mol^{-1}]
- Write the Born-Landé equation with meaning of the different symbols and calculate the Lattice energy of NaCl from the following data given below. $A = 1.748$; Inter ionic distance = 2.79\AA , $n = 8$; electronic charge = 4.8×10^{-10} e.s.u. [1+2]
 - NaCl is known but not NaCl_2 ? Explain $\Delta H_s(\text{Na}) = 109$; $I_1 = 494$; $I_2 = 4563$, ΔH_D of $\text{Cl}_2 = 242$, EA of $\text{Cl}(\text{g}) = 347$; ΔH_L of $\text{NaCl}_2 = 2154$ [All data's are in KJ mol^{-1}] [2]

9. a) Calculate the screening constant and effective nuclear charge for the valency electron of selenium (Atomic number of selenium is 34) [1·5]
 b) Write the IUPAC name and symbol of the element with atomic number 104. [1]
 c) Write the characteristic features of the cation and anion for the formation of ionic and covalent bond or compound and passage of an ionic compound to covalent compound by Fajan's rule. [2·5]
10. a) What do you mean by intrinsic, extrinsic, n-type and p-type semiconductor with example? [3]
 b) Why is the conductivity of a metal decreases with increase of temperature? Explain. [2]

Group – C

[Answer any four questions]

11. Write down the three dimensional Maxwell velocity distribution equation and calculate most probable velocity from it. [5]
12. Define degrees of freedom. Write down the law of equipartition of energy principle and show different degrees of freedom for a linear molecule using the law. [5]
13. State first law of thermodynamics. “Lowering the temperature of sink is better for increasing the efficiency of Engine” —Explain. [2+3]
14. What is heat engine? What is refrigerator? Make a relation between their efficiency. [2+3]
15. a) State second law of thermodynamics. Make the relation between C_P and C_V . [1+2]
 b) Calculate γ for triatomic gas molecules. [2]
16. a)  Calculate the efficiency. [2]
- b) State and explain Carnot theorem. [3]

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