

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

FIRST YEAR

B.A./B.SC. FIRST SEMESTER (July – December), 2011

Mid-Semester Examination, September, 2011

Date : 12/09/2011

INDUSTRIAL CHEMISTRY (Honours)

Time : 11 am – 1 pm

Paper : I

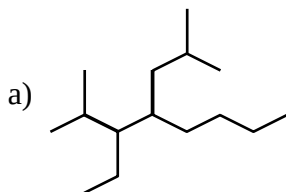
Full Marks : 50

(Use separate answer scripts for each group)

Group – A

Unit - I

1. Give IUPAC name of the following compounds. [1×5 = 5]



- b) $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_2 - \text{CHO}$
c) $\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{COOH}$
d) $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CO} - \text{NMe}_2$
e) $\text{CH}_3 - \text{CH}_2 - \text{CH}(\text{CN}) - \text{CH}_2 - \text{CO}_2\text{Et}$

Or,

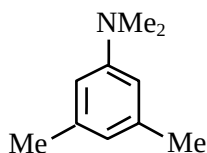
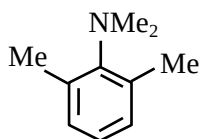
2. Write the structural formula from the following IUPAC name. [1×5 = 5]

- a) 1-Ethyl-3-propyl cyclohexene
b) 3-Chloro-3, 4-diethylhex-1-yne
c) 2,2,4-Trimethyl hexan-3-one
d) 1,1,1-Trichloro-4-methylpent-3-ene-2-one
e) Penta-1, 4-diene-3-ol

3. a) Which one is more soluble in water between orthohydroxy benzaldehyde and parahydroxy benzaldehyde and why?
b) Calculate the percentage of covalent character in HCl molecule, given the observed dipole moment is 1.03D and their internuclear distance is 1.275Å.
c) Arrange the following in order of increasing polarity of the molecule— ortho-dichlorobenzene, meta-dichlorobenzene, para-dichlorobenzene. [2+2+1 = 5]

Or,

4. a) How will you predict the shapes of CO_2 ($\mu = 0$) and H_2O ($\mu = 1.84\text{D}$) molecule from their dipole moment values?
b) Orthohydroxy benzoic acid have higher acidity than it's para isomer. Explain.
c) Which of the following compounds have higher C–N bond length? [2+2+1 = 5]



5. a) $\angle\text{HOH}$ bond angle (104.5°) in OH_2 is higher than $\angle\text{FOF}$ bond angle (103.2°) in OF_2 . Explain.
 b) Formic acid is stronger than acetic acid. Explain.
 c) Inductive effect is permanent effect but electromeric affect is temporary effect. Explain.
 d) Between paranitrophenol and metanitrophenol, which one have higher acidity and why?
 [1.5+1+1.5+1 = 5]

Or,

6. a) $\angle\text{HNH}$ bond angle in NH_3 (107.3°) is greater than $\angle\text{HPH}$ bond angle in PH_3 (93.8°) explain.
 b) What is the difference between inductive between inductive effect and field effect?
 c) Arrange the following carbocations with increasing stability and mention the stabilizing factors.
 $^+\text{CH}_3$, $\text{CH}_3\text{—CH}_2^+$, $(\text{CH}_3)_2\text{CH}^+$, $(\text{CH}_3)_3\text{C}^+$, PhCH_2^+
 d) Draw the orbital picture of the molecule allene (show only the π -bondings). [1.5+1+1.5+1 = 5]

Unit – II

Answer **any three** :

7. a) Find out the position of the spectral line in wave number for the transition corresponding to the longest wave length in Lyman Series in the hydrogen spectrum. Given, $R = 1.097 \times 10^7 \text{ m}^{-1}$.
 b) Explain how Sommerfeld overcame the difficulty of fine structure in the atomic spectrum of hydrogen. [3+2 = 5]
8. a) From de Broglie's concept derive the Bohr's postulate of quantisation of angular momentum for an electron.
 b) The value of m_ℓ lies between $+\ell$ and $-\ell$. Explain. [3+2 = 5]
9. a) Show that the maximum capacity of accommodating electrons in an orbital having principal quantum number equal to 'n' is given by $2n^2$.
 b) Calculate the pH at which precipitation of ferric hydroxide starts from a solution containing 0.01(N) ferric chloride. Given, $K_{\text{sp}}\text{Fe}(\text{OH})_3 = 3.2 \times 10^{-38}$ [2+3 = 5]
10. a) Discuss the shape of $2p_z$ orbital.
 b) From Bohr's theory show that most of the space within an atom is empty. [4+1 = 5]
11. a) Calculate the solubility of $\text{Mg}(\text{OH})_2$ in moles/lit. Given, the solubility product of $\text{Mg}(\text{OH})_2$ is 5×10^{-12} .
 b) Write down the values for the quantum numbers of the electrons present in helium atom.
 c) Write down the expression for ionisation energy from Bohr's energy expression. [2+2+1 = 5]
12. a) State Hund's rules for determination of the ground state in a polyelectronic atom.
 b) Write down the ground state term symbol for a p^6 configuration. [3+2 = 5]

Unit – III

Answer **any two** :

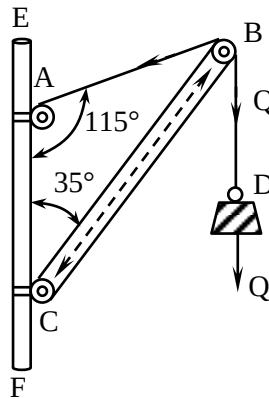
13. a) Work done during an expansion is greatest when the process is carried out reversibly. Explain with the help of P-V diagram.
 b) An expansion is carried out from a state V_1 to V_2 isothermally and reversibly at a temperature T. Derive an expression for the total amount of work. [3+2 = 5]
14. a) Reversible expansion occurs from a volume V_1 to V_2 in two different ways— i) isothermally & ii) adiabatically
 With the help of a PV diagram explain in which case the work done is greater.
 b) What do you mean by thermodynamic equilibrium? [4+1 = 5]

15. Describe Joule's experiment with stress on the following points.
- The process that is involved in the experiment along with the conditions.
 - Calculate of Joule's Coefficient (μ_{JT}) from the experiment. [3+2 = 5]
16. a) Which of the following variables are intensive and which are extensive.
- internal energy
 - density
 - temperature
 - mass
- b) Starting from the mathematical expression for first law of Thermodynamics show that the energy of the universe is constant. [2+3 = 5]

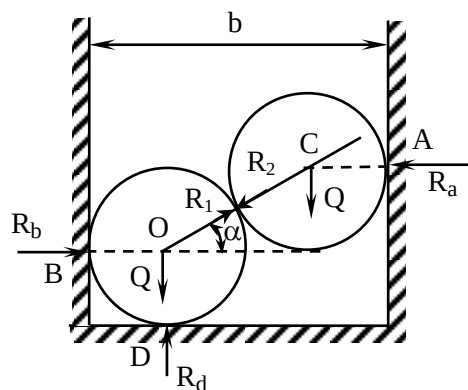
Group – B

Answer all the questions :

17. A weight $Q = 2225\text{N}$ hanging on a cable BD is supported at point B by a cable AB and a boom BC which is hinged at C. Neglecting the weights of the cable, and boom and assuming an ideal hinge at C, determine the force transmitted to the mast at points A and C. The angles of triangle ABC are indicated in the figure. [4]



18. Two smooth spheres, each of radius r and weight Q , rest in a horizontal channel having vertical walls, the distance between them is b . Find the pressure exerted on the walls and floor at the points of contact A, B and D. The following numerical data are given $r = 254\text{ mm}$, $b = 914\text{ mm}$, $Q = 445\text{ N}$. [4]



19. Explain clearly the laws Superposition and Transmissibility of forces. [2]