RAMAKRISHNA MISSION VIDYAMANDIRA

(A Residential Autonomous College)

Belur Math, Howrah

B.A./B.Sc. 1st Semester (July – December 2010)

Mid-Semester Examination, September 2010

Date: 06.09.2010 **Industrial Chemistry (Major)** Full Marks 50

Time: 11 am – 1 pm

Unit-I

Answer any **one**

1. a) The C-H bond length of cyclopropane is shorter than *n*-propane – why?

   b) Comment on the hybridisatin of (*) marked C atom $CH_2 = \overset{*}{C} = CH_2$.

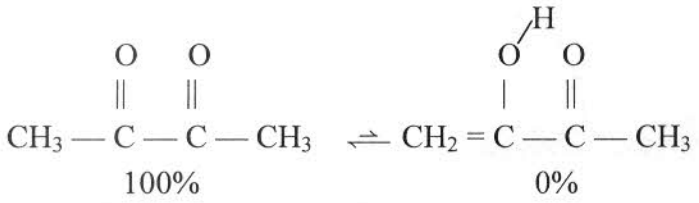
   c) Arrange the following carbocations in order of their increasing stability with proper reason – $(CH_3)_3\overset{\oplus}{C}$, $CH_2 = CH - \overset{\oplus}{C}H_2$, $CH_3\overset{\oplus}{C}H_2$ 2+1+2

2. a) Which canonical form is more stable and why?

   $CH_2 = \overset{\oplus}{N} = \underset{\cdot\cdot}{\overset{\odot}{N}} : \leftrightarrow : \overset{\odot}{C}H_2 - \overset{\oplus}{N} \equiv N :$

   b) Trichloroacetic acid is more acidic than acetic acid – why?

   c)



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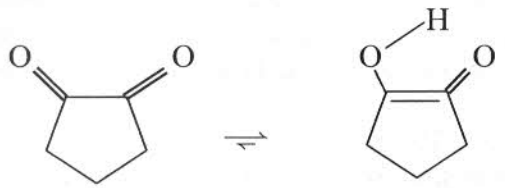

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Explain the above facts with suitable reason. 1+2+2

Unit-II

Answer any **four**

3. a) $BaSO_4$ is insoluble in water though it is an ionic compound. Explain.
   b) Peroxides are readily decomposed to produce oxygen. Explain. 3+2
4. a) Illustrate the structure of $POCl_3$ using valence bond theory.
   b) Write down the significance of azimuthal quantum number. 3+2
5. a) Explain the conducting behaviour of *n*-type semiconductor.
   b) *s*-orbitals are called to be spherically symmetrical. Explain. 3+2
6. a) Explain how two *p*-orbitals combine to form molecular orbitals.
   b) Write down the Schrodinger's equation in polar coordinates. 4+1
7. a) State Hund's rules in determining the ground state for a polyelectronic atom.
   b) Write down the values for all the quantum numbers for electrons in Li^+ ion in the ground state. 3+2

Unit-III

Answer any **one**

8. a) Classify the following properties of a system according to whether they are extensive or intensive:

Internal energy, density, volume, temperature

b) Starting from the conventional form of the first law ($dE = q + w$) arrive at the alternative definition that the energy of the universe is constant.

c) Can you derive first law starting from some more fundamental law of nature, or it is just a generalization of some experimental facts? 2+2+1

9. a) When do you call a system to be in thermodynamic equilibrium?

b) When do you call a system to be in steady state?

c) Classify the following properties according to whether they are state functions or path functions:

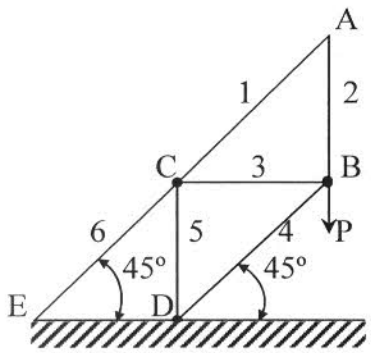
Internal energy, heat 2+2+1

Unit-IV

Answer any **four**

Each Question carries five marks

10. Determine analytically the axial forces in the bars of the plane truss supported and loaded as shown in the figure. Assume Load P to be 150 Kg.



11. Two smooth spheres, each of radius 'r' and weight 'Q', rest in a horizontal channel having vertical walls, the distance between which is 'b'. Find the pressures exerted on the walls and floor at the points of contact A, B and D. The following numerical data are given:

$r = 10$ cms, $b = 36$ cms, $Q = 100$ Kgs

12. Draw a neat sketch of a Babcock and Wilcox water tube boiler with longitudinal drum. Label all the parts.

13. a) How is force defined completely?

b) State the different laws applicable to forces.

14. Show the relative advantages and disadvantages of the various fuels used in a boiler, in a neat tabular form.

15. Using method of sections, find the axial forces in each of the bars 1,2,3 of the plane truss in the figure.