RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

FIRST YEAR

B.A./B.SC. FIRST SEMESTER (July – December), 2012

Mid-Semester Examination, September 2012

Date : 10/09/2012 **INDUSTRIAL CHEMISTRY (Honours)**

Time : 11 am – 1 pm Paper : I Full Marks : 50

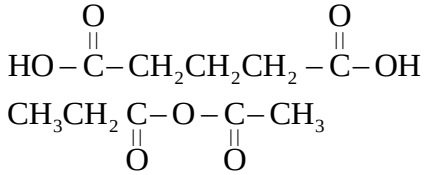
[Use Separate Answer Script for each Group]

Group – A

Unit – I

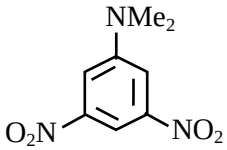
(*Attempt <u>any one</u>*)

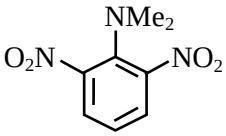
1. a) Give IUPAC name of the following compound (<u>any one</u>) :



b) Ortho-nitrophenol has a very low boiling point with respect to para-nitrophenol. Why?

c) Compare the basicity of the following compounds.





d) What will be the percentage of covalent character in HCl molecule if it has a measured dipole moment of 1·03D and 1·275Å bond distance? [1+1·5+1·5+1]

2. a) Give structure from the following IUPAC name (<u>any one</u>)
   i) 3-Hydroxypent-4-yne-1-oylchloride
   ii) 3-oxopentanamide

   b) Salicylic acid is more acidic than parahydroxy benzoic acid. —Explain.

   c) Although NH_3 and NF_3 have similar structure yet NH_3 (1·46D) has higher dipole moment than NF_3 (0·2D). —Explain.

   d) Sigma bond have higher bond strength than pi-bonds. Give reasons. [1+1·5+1·5+1]

Unit – II

(*Attempt <u>any five</u>*)

3. a) Find out the position of the spectral line in wave number for the transition corresponding to the longest wave length in Balmer Series in the hydrogen spectrum. Given, $R = 1{\cdot}097\times10^{7}cm^{-1}$.

   b) From de Broglie's concept derive the Bohr's postulate of quantisation of angular momentum for an electron. [3+2]

4. 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) Discuss the shape of $2p_z$ orbital. [2+3]

5. a) The value of m_ℓ lies between $+\ell$ and $-\ell$. —Explain.

   b) Write down the expression for ionisation energy from Bohr's energy expression.

   c) Write down the ground state term symbol for a p^3 configuration. [2+1+2]

6. a) Find out the bond order and magnetic property of B_2.

   b) Explain the structure of ClF_3 molecule using valence bond theory. [2+3]

7. a) Explain the conductivity of n-type semiconductor using band theory of metals.
   b) Ionisation energy of nitrogen molecule is greater than that of nitrogen atom. —Explain. [3+2]

8. a) Cesium iodide is nearly ten times more soluble in water than sodium fluoride. —Explain.
   b) Radius of Be^{2+} = 59 pm and radius of S^{2-} = 170 pm. Predict the coordination number of Be^{2+} in BeS. [2·5+2·5]

9. a) Aluminium Chloride sublimes on heating. —Justify.
   b) Diamond is perfectly covalent, yet it is not a low melting solid. —Justify. [2·5+2·5]

10. a) Peroxides are readily decomposed to produce oxygen. —Explain.
    b) Illustrate the structure of $POCl_3$ using valence bond theory. [2+3]

Unit – III

(*Attempt <u>any one</u>*)

11. a) Show that for ideal gas $\bar{C}_p - \bar{C}_v = R$.
    b) Derive a relation that shows how enthalpy change for a process $A \rightarrow B$ varies with temperature. [3+2]

12. a) Starting with the mathematical definition of first law of thermodynamics show that—
        i) under adiabatic condition work done is independent of path.
        ii) total energy of the Universe is constant.
    b) Compare graphically the work done in a single step versus a multiple step expansion process [Initial and final states being the same]. [(1·5×2)+2]

Group – B

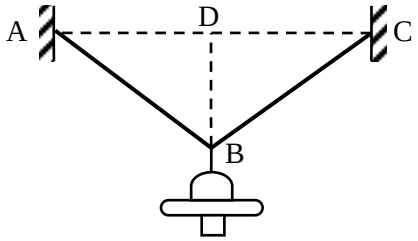
(*Answer <u>any three</u> questions*)

13. a) Name the four main circuits of a Boiler House.
    b) Describe any one of the cricuits. [2+3]

14. Draw a neat labled sketch of a water tube boiler. [5]

15. State and explain the law of superposition of a system of forces. [5]

16. Find the force in each of the wires ‘AB’ and ‘CB’ if the weight of the lamp is 15 kgs and the length of the wires = 10 m and the sag DB = 4m. [5]



17. A bam AB of length ‘l’ is supported as drawn in the figure and subjected to equal but opposite vertical forces ‘P’ at two ends. Find the reaction at the supports ‘C’ and ‘D’. [5]