THE ASSAM
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— GUWAHATI —

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2017

End Semester B.Tech. Examination

1ˢᵗ Semester

APPLIED CHEMISTRY

Full Marks- 70   Time- 3 hours   Pass Marks-21

The figures in the margin indicate full marks.

PART – A

Q.1. Answer all questions: **16 x 1 = 16**

a) Which complex has larger crystal field splitting and why?
  i) $[Co(NH_3)]_6^{3+}$ and ii) $[Co(CN)]_6^{3-}$
b) Draw the (111) and (110) planes of a cubic crystal lattice.
c) Define a standard plane.
d) Give the Miller indices of the following Weiss indices:
  i) (a, 2b, 3c) and ii) (2a,∞b, c)
e) Calculate the emf of a concentration cell at 25°C consists of two Zn electrodes immersed in solutions of Zn^{2+} ions of 0.1M and 0.01M concentrations.
f) Why is salt bridge used in the construction of cell?
g) What is the best alloying metal for iron?
h) What properties of the corrosion product enhance the rate of corrosion?
i) Write the monomers of nylon-66.
j) What is meant by functionality in polymers?
k) Which type of liquid crystals possess chiral center?
l) What do you mean by nano materials?
m) Show that $Cv=(\frac{\partial U}{\partial T})_V$
n) Give example of a pseudo unimolecular reaction.
o) Write the differential rate equation for the reaction $PCl_5(g) \rightarrow PCl_3(g)+Cl_2(g)$
p) State the significance of Gibbs free energy in determining the spontaneity of a chemical reaction.

PART – B

Q.2. Answer all questions: **3.5 x 4 = 14**

a) Draw the M.O. diagram for HF molecule. Calculate the bond order and magnetic property.
b) Discuss the working of hydrogen-oxygen fuel cell.

c) Write brief notes on the application of liquid crystals in LCD.

d) A Carnot cycle working between 0° C and 100° C takes up 840 joules of heat energy form the high temperature reservoir. Calculate the work done, heat rejected and the efficiency of the engine.

PART – C

Q.3. 5 x 2 = 10

a) i) Show that the entropy change for an ideal gas at constant pressure is ($\Delta S = 2.303 nC_p \log(T_2/T_1)$). Calculate the entropy change accompanying the isothermal expansion of 5 moles of an ideal gas at 330 K until the volume has increased six times.

ii) Establish the relation $\Delta G = \Delta H + T[\frac{\partial(\Delta G)}{\partial T}]_P$ for Gibbs-Helmholtz equation

OR

b) i) Derive the integrated rate equation for a first order reaction. Show that time required for 75% completion of a first order reaction is two times the time required for 50% completion of the reaction.

ii) What do you mean by activation energy of a chemical reaction? The rate constant for the decomposition of nitrous oxide is 5.16×10^4 sec^{-1} at 1125 K and 3.76×10^3 sec^{-1} at 1085 K. Calculate the activation energy for the reaction.

Q.4. 5 x 2 = 10

a) i) $[Co(NH_3)]_6^{3+}$ complex is octahedral and diamagnetic; but $[CoF_6]^{3-}$ though octahedral is paramagnetic. Explain in terms of CFT with diagram.

ii) CaF_2 is a FCC lattice. The (111) reflection with X-rays of wavelength 0.1542 nm has $\theta = 14.18°$. Calculate i) the edge length of the unit cell and ii) the density of the crystal. [Given: N=6.023 x 10^{23} mol^{-1}]

OR

b) i) Predict the hybridization, geometry and magnetic property of the following molecules:
A) $[FeF_6]^{3-}$ and B) $[Ni(CO)_4]$

ii) Derive Bragg's Law. Calculate the separations of (123) planes having edge lengths a = 0.82 nm, b = 0.95 nm and c = 0.75nm.

Q.5. 5 x 2 = 10

a) i) Describe the construction of lead-acid battery with the reactions occurring during discharge.

ii) What are corrosion inhibitors? Explain with examples how anodic and cathodic inhibitors provide protection against corrosion.

OR

b) i) What are ion selective electrodes? Give the construction of glass electrode and explain the experimental method of determining pH using glass electrode.

ii) What is differential corrosion? Explain with example.

Q.6.   **5 x 2 = 10**

a) i) What is meant by the term Nanotechnology? Describe the application of nanomaterials
    in catalysis and medicine.
    ii) What are the basic constituents of cement? Discuss the role of gypsum in cement.
                                                                OR

b) i) Describe, in brief, the classification of liquid crystals.
   ii) Discuss the preparation, properties and uses of Polyvinyl chloride (PVC).

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