ACU

2007

CHEMISTRY - I (Optional) 100058

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

(i) *Answers must be written in **English** only.*

(ii) *Question **No. 1** is **Compulsory.** Of the remaining questions, attempt **any four** selecting one question from **each section.***

(iii) *Figures to the **RIGHT** indicate marks of the respective question.*

(iv) *Use of log table, Non-Programmable calculator is permitted, but any other Table / Code / Reference book are not permitted.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vii) *Credit will be given for orderly, concise and effective writing.*

(viii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

(ix) *For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.*

1. Answer ***any four*** of the following :

(a) What are postulates of Werner's theory of coordination compounds ? Give experimental evidences to support it. **10**

(b) What are olefin complexes ? Discuss bonding in such complexes. **10**

(c) What are colloids ? Give classification of colloids (with examples) on the basis of physical state of dispersed phase and dispersion medium. **10**

(d) Draw labelled phase diagram of water system and discuss the importance of various points, lines and areas in it. **10**

(e) What is green house effect ? Which gases are responsible for it ? What are its consequences ? **10**

P.T.O.

Marks

SECTION - A

2. Answer the following sub-questions :

(a) (i) Calculate the wave length associated with an electron ($m = 9.1 \times 10^{-31} kg$) travelling with one third speed of light ($h = 6.624 \times 10^{-34}$ Js and $C = 2.998 \times 10^{8} ms^{-1}$) **5**

(ii) Describe the mechanism of colours imparted to the flame by alkali metals and some alkaline earth metals. **5**

(b) What is VSEPR theory ? Explain hybridisation and shapes of ClF_3 and $IC1_2^-$ on the basis of it. **10**

(c) What are interhalogen compounds ? How do they differ from halogens ? Give preparation of each type of interhalogen compound. **10**

(d) What are transition elements ? Explain the trends in atomic and ionic radii of these elements. **10**

3. Answer the following sub-questions :

(a) (i) Draw radial Probability distribution curves for 1s, 2s, 3s and 4s orbitals. **5**

(ii) Explain the mobilities of alkali metal ions in aqueous solution. **5**

(b) What is lattice energy ? Explain Born-Haber cycle to calculate the lattice energy of NaCl crystal. **10**

(c) Explain structure and bonding in diborane and tetrasulphur tetranitride. **10**

(d) Discuss magnetic properties of transition elements. **10**

SECTION - B

4. Answer the following sub-questions :

(a) Explain diagramatically how d orbitals lose their degeneracy in octahedral and square planar field. **10**

(b) For a tetrahedral Co (II) Complex, $\mu_{eff} = 4.87$ B.M. The crystal field splitting parameter, D_2 for the Complex is 294 cm^{-1}. Calculate spin-orbit coupling constant, λ, of Co (II) in this complex. **10**

Marks

(c) (i) Give the spectroscopic symbol for ground state term in the following complexes. **5**

(1) $[C_r (H_2O)_6]^{3+}$ (Cr = 24) (2) $[C_o(NH_3)_6]^{2+}$ (Co = 27)

(ii) Give electronic configuration of lanthanide elements. **5**

(d) What are actinides ? Give a method of separation of Np, Pu and Am from U. **10**

5. Answer the following sub-questions :

(a) Explain with suitable examples, different factors affecting crystal field splitting parameter. **10**

(b) Which of the following complexes show orbital contribution to their magnetic moments ? Justify your answer. **10**

(i) $Na_4 [C_o(NO_2)_6]$ (ii) $K_3 [F_e (CN)_6]$, (Fe = 26)

(c) (i) Explain Laporte Selection rule in d-d transitions. State under which conditions it is relaxed ? **5**

(ii) What is lanthanide contraction ? What are its consequences ? **5**

(d) Give points of similarities between lanthanides and later actinides. **10**

SECTION - C

6. Answer the following sub-questions :

(a) (i) Explain Lewis concept of acids and bases with suitable examples. What are drawbacks of the concept. **5**

(ii) What are nonaqueous solvents ? Explain in short acid-base reactions in liquid NH_3 as a solvent. **5**

(b) Derive the reduced equation of state and state the law of corresponding state. **10**

(c) What are liquid crystals ? Describe in short classification of thermotropic liquid crystals. **10**

(d) Derive Bragg's equation $n\lambda = 2d \sin\theta$. **10**

P.T.O.

Marks

7. Answer the following sub-questions :

(a) (i) What are limitations of Arrhenius theory of acids and bases. **5**

(ii) What is dipole moment of a solvent ? Explain it with respect to different solvents. **5**

(b) Derive van der Waal's Equation for real gases. **10**

(c) What is isotropy and anisotropy ? Describe following properties of liquid crystals. Viscosity, optical properties, electrical properties and magnetic properties. **10**

(d) What is Tyndall effect in colloids ? Explain it in short. **10**

SECTION - D

8. Answer the following sub-questions :

(a) What is first order reaction ? Derive an expression for the rate constant of first order reaction. **15**

(b) Derive an expression for work done in isothermal reversible expansion of a gas. **15**

(c) State and explain law of mass action. Deduce the law of Chemical equilibrium. What is meant by equilibrium constant ? **10**

9. Answer the following sub-questions :

(a) How will you determine order of a reaction using differential rate equation ? The half-life period of a substance is 50 min. at a certain concentration. When the concentration is reduced to one half of the initial concentration the half life period is 25 min. Calculate the order of the reaction. **15**

(b) State and explain Carnot theorem. What is Carnot cycle ? Calculate the efficiency of a Carnot engine. **15**

(c) Discuss the equilibrium of the reaction **10**

$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$.

Show that for above reaction $K_p = K_e$.

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