Azad Jammu and Kashmir

Public Service Commission

Date : 19-01-2015

Chemistry Exam. (B-18)

2014

Total marks: 100 Total Time: 3 Hrs.

Attempt any five question. All questions carry equal marks.

Q. No. 1 (a) What is zero-point energy? Write a detailed note on anharmonic oscillator and the selection rules governing the spectra. Explain the overtones from a diagram. (12)

(b) How many normal modes of vibration are possible for: (4)

a. HBr b. SO_2 c. OCS d. C_6H_6

(c) What are aromatic compounds? (4)

Q. No. 2 (a) Determine the formula of the following molecular/ions on the basis of MOT. Determine the bond order for each.

I. O_2^-
II. N_2
III. Be_2^{2+}
IV. Li_2 (8)

(b) Write a note on the relationship between occupancy, hybridization and geometry for the structures AB_xE_y. Using the VSEPR theory predict the structure of AB_2, ABE, AB_4, AO_4^{n-} type molecules. Give specific example for each. (12)

Q. No. 3 (a) Give a general explanation for electrophilic substitution of benzene. Give chemical equation along with the mechanism showing all steps with reaction conditions for bromination, nitration, sulphonation and acylation. (10)

(b) How are human activities in urban areas responsible for air pollution? Explain with reference to smog and its chemistry. What measures should be taken to minimize air-pollution? (10)

Q. No. 4 (a) Debye-Hueckel Theory works under limiting conditions. Elaborate the statement with examples. Also give the significance of Debye Hueckel Theory. (14)

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(b) Calculate the ionic strength for a 0.1M solution of $MgCl_2$. (6)

Q. No. 5 (a) Write a note on standard electrode potential? How the direction of chemical reaction be established by a knowledge of it. Subsequently derive a relationship between ΔG^* and K. (12)

(b) Use the following standard state cell potential to calculate the complex formation equilibrium constant K_f for the $Zn(NH_3)_4^{2+}$ complex ion.

$Zn(NH_3)_4^{2+} + 2e \leftrightarrow Zn + 4NH_3$ $\quad E^0_{red}$ = -1.04V

$Zn^{2+} + 2e \leftrightarrow Zn$ $\quad E^0_{red}$ = -0.762V (8)

Q. No. 6 (a) Assign point groups to the following molecules. Write the symmetry for the point group with each molecule.

I. POCl3
II. $[PtCl_4]^{2-}$
III. H_2O
IV. SF_6 (16)

(b) Draw a multiplication table for the C_{3v} point group. (4)

Q. No. 7 (a) Write a note on the effects of substitution groups on the rates of formation of carbocation in electrophilic aromatic substitution reactions when G releases electron and when it withdraws electron. Give specific examples of G in both cases. (8)

(b) Why a primary amine is more basic than ammonia which is more basic than a phenyl amine. Explain with respect to resonance structures and inductive effects. (6)

(c) How is Global warming related to GHG? What is the basic condition for GHG to trap and re-emit radiation? (6)

Q.No.8 (a) Synthesis of chiral compounds from achiral reactions always yield the racemic modification. Comment. Justify your answer with an example. (8)

(b) How amino acids behave as dipolar ions? Explain the Isoelectric point of amino acid. (8)

(c) What are zeolites and how can they be synthesized? (4)

Good Luck!