QCA : 05-I

CHEMISTRY : Paper-I

2014

INSTRUCTIONS

(i) Read the question carefully.
(ii) Regrade the question according to the guidelines.
(iii) Attempt questions 1 to 5.
(iv) Attempt questions 6 to 8.Each question is divided into two parts.

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two sections and printed both in KANNADA and in ENGLISH.

Candidate has to attempt FIVE questions in all.

Question No. 1 and 5 are compulsory and out of the remaining, THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

Answer must be written in the medium authorized in the Admission Certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in a medium other than the authorized one.

Word limit in questions, wherever specified, should be adhered to.

Attempts of questions shall be counted in chronological order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.
1. (a) Discuss the Bohr’s theory of Hydrogen spectra.

(b) What is Schrödinger wave equation and discuss its usefulness in evaluating the energy of a moving particle.

2. (a) State and explain the criteria for spontaneity of a reaction in terms of entropy, enthalpy and free energy.

(b) Define Joule-Thomson coefficient. Show that Joule-Thomson coefficient is zero for an ideal gas while it has a positive value in the case of real gas.

(c) Calculate the heat of formation of $\text{CS}_2$ (l). Given that the heats of combustion of $\text{CS}_2$ (l) is $-1108 \text{ kJ/mol}$ and that of $\text{C(g)}$ and $\text{S(s)}$ are $393.5 \text{ kJ/mol}$ and $-293.7 \text{ kJ/mol}$ respectively.

3. (a) How do you account for the occurrence of defects in a crystal and how many types of crystal defects exist? Deduce expression for any one of the defects.
(b) न्यून रूप वैद्युत दक्षिणाखण्डांचे?
   (i) (2a, 3b, 2c),
   (ii) (a, 2b, 3c),
   (iii) (4a, 3b, 5c) राशी
   (iv) (−3a, −2b, 3c) वर्गात किंवा चौकोणात किंवा त्रिकोणात असलेली दक्षिणाखण्डांचे प्रदर्शन करतात?

What do you mean by Weiss and Miller Indices? Calculate the Miller Indicies of crystal planes which cut through the crystal axes at:

   (i) (2a, 3b, 2c)  
   (ii) (a, 2b, 3c)
   (iii) (4a, 3b, 5c)  
   (iv) (−3a, −2b, 3c)

4. (a) न्यून-रूप वैद्युत दक्षिणाखण्डांचे?

Deduce and verify the Debye-Hückel Limiting law and explain why it is called as limiting law.

(b) (i) 0.02 मोल क्रोमिक HCl समावे आहे.
   (ii) 0.015 मोल पॉटसियम परसुल्फेट समावे आहे.
   (iii) 0.15 मोल अल्यूमिनियम सल्फेट समावे आहे.
   (iv) 0.01 मोल K₂SO₄ समावे आहे.

Calculate the ionic strength of:
   (i) 0.02 molal HCl solution,
   (ii) 0.015 molal potassium persulphate solution and
   (iii) 0.15 molal aluminium sulphate solution and
   (iv) 0.01 molal K₂SO₄ solution.
(c) For the strong electrolytes NaOH, NaCl and BaCl₂, the molar ionic conductance at infinite dilution are $225 \times 10^{-4}$, $126 \times 10^{-4}$ and $280 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$ respectively. Calculate $\lambda_m^0$ for Ba(OH)₂ solution.

5. (a) Explain the importance of the concept of thermodynamics while evaluating the equilibrium constant.

(b) Derive Gibbs-Helmholtz equation for a process at constant pressure and temperature.

6. (a) Name the modern theories which have been developed to explain the bonding in and properties of coordination compounds.

(b) What are carbonyls? Give examples. Explain the method of synthesis of any one metal carbonyl.
7. (a) A monochromatic radiation is incident on a solution of 0.05 molar concentration of an absorbing substance. The intensity of the radiation is reduced to one-fourth of the initial value after passing through 10 cm length of the solution. Calculate the molar extinction coefficient of the solution.

(b) 10 ml of 0.05 molar urea solution was added to 0.01 molar solution of urea. What would be the concentration of urea after mixing?

2500 Å radiation was passed through a solution which was 0.05 molar in oxalic acid and 0.01 molar in uranyl oxalate. After absorption of 80 joules of radiation energy, the concentration of oxalic acid was reduced to 0.04 molar. Calculate the quantum yield of the photochemical decomposition of oxalic acid at the given wavelength.

(c) What are photoelectric cells? Explain the working principle and the applications of photoelectric cells.

8. (a) Give the important oxidation states of lanthanides. How would you account for them? Why the +3 states are more stable?
Discuss briefly the various methods used for separation of lanthanides. Which method, in your opinion is preferable.
INSTRUCTIONS

(i) All questions are compulsory.
(ii) Section A contains 2 questions.
(iii) Section B contains 1 question.
(iv) There are 6 questions in Section C.

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1. (a) Predict the products and give mechanism of the reaction

\[ 2 \text{C}_6\text{H}_5\text{CHO} \xrightarrow{\text{KOH}} ? \]

(b) Predict the product of the following reaction and propose a suitable mechanism.

\[ \text{Cl} \quad \text{H} \quad \text{CH}_3 \quad \text{Cl} \quad \text{Cl} \quad \text{CH}_3 \quad \xrightarrow{\text{OH}} ? \]

2. Describe any two methods of formation of Carbocations and Carbanions and comment on their stability.

3. What is aldol condensation? Taking suitable example give mechanism of the reaction.
4. What is Reimer-Tiemann reaction? Taking a suitable example, propose mechanism of the reaction.

5. (a) Explain auxochromes and chromophores. With suitable examples explain auxochromes and chromophores.

(b) Describe the shielding and deshielding mechanism in NMR.

6. (a) Explain the effect of conjugation and polar solvents on \( \pi \rightarrow \pi^* \) transition.

(b) Write about Fluorescence and Phosphorescence.

7. (a) The \([2 + 2]\) cycloaddition does not occur under thermal conditions but does occur under photochemical conditions. Explain.

(b) Write note on Silicones and Borazines.

8. (a) Write a short note on the study of conjugated double bonds and \( \alpha, \beta \)-unsaturated carbonyl compounds in electronic spectroscopy.
(b) Explain the effect of isotopic substitution on rotation spectra.