SH-II/CHEM/201/C-3/18

B.Sc. Semester-II (Honours) Examination, 2018
CHEMISTRY

Subject Code : 21401   **Course Code : SH/CHEM/201/C3**

Course Title : Inorganic Chemistry-I

Time: 1 Hour 15 Minutes   **Full Marks: 25**

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer *any five* questions from the following: 1×5=5

   (a) Work out the ground state term symbol of Co (III) ion.

   (b) Indicate the basic difference in the angular part of wave functions of 2s and 2p orbitals.

   (c) Give the gound state electronic configuration of ferrous ion.

   (d) Write in words the meaning of a negative value of electron affinity.

   (e) Present the autoionisation equilibrium of liquid sulphur dioxide.

   (f) Indicate the species as the acid and the base in the following reaction according to Lux-Flood concept:

   $Nb_2O_5 + Na_2S_2O_7 \rightarrow Na_2SO_4 + (NbO_2)_2SO_4$

   (g) E° values of A^{3+}/A and B^{2+}/B are +1·2V and –2·1V, respectively. Predict the reaction.

   (h) State the variables used in Frost diagram.

2. Answer *any two* questions from the following: 5×2=10

   (a) (i) State Heisenberg's uncertainty principle in words and in mathematical form. Calculate theoretical uncertainty in its positon within 1 m/s for an electron moving at 100 m/s.

        (ii) State Hund's rule.   (2+2)+1=5

   (b) (i) Distinguish between electronegativity and electron affinity. First electron attachment enthalpy of oxygen is negative while the second is positive—Justify.

        (ii) What is the slope of the curve if χ_{AR} is plotted against $\dfrac{Z^*}{r_{cov}^2}$ (2+2)+1=5

BNK21401   **Please Turn Over**

(c) (i) Arrange the oxyacids of phosphorus having formula H_3PO_n (n = 2, 3, 4) in the decreasing order of acid strength. Justify your answer.

(ii) What will be the change in pH of water when 0·01 mole of NaOH is added to 10 L of water?

3+2=5

(d) (i) What are the constituents of Zimmermann-Reinhardt solution? Specify the function of each of them.

(ii) Calculate the equilibrium constant of the cell reaction that takes place in the galvanic cell with two electrodes having following potential values: 3+2=5

$$E^o_{Fe^{3+}/Fe^{2+}} = 0·77V \; ; \; E^o_{MnO_4^-, H^+/Mn^{2+}} = 1·51V$$

3. Answer *any one* question: 10×1=10

(a) (i) What is exchange energy? From the concept of exchange pair of electrons justify that the ground state configuration of chromium is $3d^54s^1$ and not $3d^44s^2$.

(ii) What do you mean by inert pair effect? Give a suitable example.

(iii) Calculate the wave number of the third line in the Balmer series of Be^{3+} ion. (R_H = 109677cm^{-1}).

(iv) Arrange BF_3, BCl_3 and BBr_3 in order of increasing Lewis acidity with explanation.

3+2+2+3=10

(b) (i) The $E^°$ values of Cu^{2+}/Cu^+ and I_2/I^- systems are 0·15 and 0·53 volts, respectively but Cu^{2+} oxidises I^- ion in practice — explain.

(ii) The $E^°$ values of Au^+/Au and Au^{3+}/Au^+ are 1·68 and 1·41 volts, respectively. Predict whether Au^+ will disproportionate to Au and Au^{3+} or not.

(iii) Show that the direction of the following reaction is reversed on changing the pH of the medium.

$$AsO_4^{3-} + 2I^- + 2H^+ \rightleftharpoons AsO_3^{3-} + I_2 + H_2O$$
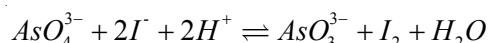
[Given : $E^o_{AsO_4^{3-}/AsO_3^{3-}} = 0·56V \; E^o_{I_2/2I^-} = 0·54V$]

(iv) Calculate the solubility of AgCl in 0·1M KCl solution. (Give $K_{SP} = 1·0×10^{-10}$).

3+2+3+2=10

_____