2019

B.Sc.

2nd Semester Examination

CHEMISTRY (Honours)

Paper - C3T

Full Marks : 40   Time : 2 Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.

Group - A

Answer any *five* questions. $5 \times 2 = 10$

1. (a) Outline the shapes of the d-orbitals indicating signs of wave functions.

   (b) Explain anomalous configuration of *Cr* and *Cu*.

   (c) Give example of one disproportionation and one comproportionation reaction.

   (d) What indicator would you use for the following titration (a) *NaOH* vs CH_3COOH (b) Na_2CO_3 vs *HCl*.

[Turn Over]

(e) Find pH of a 0.01 (M) CH_3COOH solution ($PKa = 4.74$).

(f) Oxidation of $Co(II)$ to $Co(III)$ usually happen in air — why.

(g) Why always second ionization energy is greater than first ionization energy ?

(h) Atomic volume of alkali metal is larger than other elements of a period — Explain.

(i) Give the name of two redox indicator.

(j) Electron affixity of gold in very high — Explain.

Group - B

Answer any *four* questions.   4×5

2. (a) State Pauli Exclusion Principle. Calculate the wave length of the first transition in Layman and Paschan series in the atomic spectra of hydrogen.

$$(R = 1.097373 \times 10^7 \text{ m}^{-1}) \qquad 2+3$$

(b) Explain why Cl^- is oxidised by MnO_4^- at low pH (<1.5) but not in neutral medium.

$$E^o_{MnO_4^-/Mn^{2+}} = 1.51\,V \text{ and } E^o_{Cl_2/2Cl^-} = 1.36\,V$$

What is Zimmermann-Reinhardt solution ? Where it is used and why ? $2\frac{1}{2}+1+1\frac{1}{2}$

(c) State Pauling's rule regarding strength of oxyacids and hence explain the first PKa values of H_3PO_2, H_3PO_3 and $HOCl$. $2+3$

(d) After Ca, electron enter to the $4s$ orbital before going to the $3d$ orbitals. But when a transition metal ionises, the $4s$ electrons are removed first — why ?

(e) What do you mean by ionic radius ? Calculate the radii of K^+ and Cl^- ions using Pauling's methods $[d_{KCl}(\text{Crystal}) = 3.14 \text{ Å}]$. $2+3$

(f) What is inert pair effect ? How does Tl form iodide only in $+1$ oxidation state ? The drop of ionization energy in N to O is larger than that for P to S — Explain. 5

Group - C

Answer any *one* questions. 1×10

3. (i) What is the significance of quantum numbers ?

   (ii) State Pauli Exclusion principle.

   (iii) Draw distribution curves for radial wave function of 1S, 2S and 3S orbital. $3+2+5$

[Turn Over]

4. (i) Calculate the E values at the point when

    (a) addition of 90 mL $KMnO_4$

    (b) 50 mL $KMnO_4$ and

    (c) 101 mL $KMnO_4$ solution is added in a titration of 100 mL of 0.1(N) Fe^{2+} by 0.1(N) $KMnO_4$ solution.

(ii) From the following EMF diagram, calculate the values of

$$E°_{FeO_4^{2-}/Fe^{2+}} \text{ and } E°_{Fe^{2+}/Fe^+}$$

$$FeO_4^{2-} \xrightarrow{2.20V} Fe^{3+} \xrightarrow{0.76V} Fe^{2+} \xrightarrow{?} Fe$$

with lower branch labelled $1.08\ V$ from FeO_4^{2-} to Fe^{2+}

                                                              5+5