U.G. 2nd Semester Examination - 2021

CHEMISTRY

[HONOURS]

Course Code : CHEM-H-CC-T-03

(Inorganic and Physical)

Full Marks : 20   Time : 1 Hour

The figures in the right-hand margin indicate marks.

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

Please write the answers of Group-A and Group-B in two different answer scripts.

GROUP-A

1. Answer any **three** questions: $1 \times 3 = 3$

   (a) What do you mean by formal potential?

   (b) Give the full name and composition of ZR solution.

   (c) At 80 ^{0}C, pure distilled water has $[H_3O^+]$ equals to 1×10^{-6} mol.L^{-1}. What will be the value of K_w at this temperature?

   (d) State the theory by which the reaction $6CaO + P_4O_{10} \rightarrow 2Ca_3(PO_4)_2$ may be regarded as acid-base reaction.

   (e) Write the conjugate acid and base of HS$^-$.

2. Answer any **one** questions: $2 \times 1 = 2$

   (a) Calculate the pH of 10^{-8} (N) HCl solution.

   (b) Explain the observation: Cu^{2+} ion readily liberates iodine from iodide but in presence of ethylenediamine it does not. [Given: $E^0_{Cu^{2+}/Cu^+} = 0.15$ V, $E^0_{Cu^{2+}/CuI} = 0.87$ V and $E^0_{I_2/2I^-} = 0.54$ V.

3. Answer any **one** questions: $5 \times 1 = 5$

   (a) (i) In gas phase the proton affinity of FCH_2COOH is less than $ClCH_2COOH$. Explain.

   (ii) 100 ml 0.1 (M) H_3PO_4 is being titrated with 0.1 (M) NaOH solution. Calculate the pH at second equivalence point. [Given: $K_1 = 7.5 \times 10^{-3}$, $K_2 = 6.2 \times 10^{-8}$ and $K_3 = 5.0 \times 10^{-13}$]

            $2 + 3 = 5$

(b) (i) Using the Latimer Diagram, calculate the E^0 value for the reduction of HClO to Cl⁻ in aqueous medium.

$$HClO \xrightarrow{1.67V} Cl_2 \xrightarrow{1.3\ V} Cl⁻$$
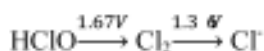
(ii) In a neutral solution $Fe(CN)_6^{3-}$ cannot liberate I_2 from KI but in presence of K_2SO_4 and $ZnSO_4$ it can do so. Explain. [Given: E^0 for $Fe(CN)_6^{3-}/Fe(CN)_6^{4-}$ = 0.36V and $I_2/2I⁻$ = 0.54 V.]   2+3 = 5

GROUP-B

4. Answer any **three** questions: 1x3 = 3

   (a) In the S-T diagram of a Carnot's cycle, the end points of a diagonal have coordinates (S2, T1) and (S1, T2). Find the work done.

   (b) If A is a state function for a system, what is the value of $\oint dA$ and why?

   (c) Will the order of a reaction be integral always?

   (d) The specific rate constant for a reaction has the unit $lit^2.mol^{-2}.sec^{-1}$?

   (e) What is meant by turn over number?

5. Answer any **one** questions: 2x1 = 2

   (a) Differentiate adiabatic cooling and Joule-Thompson cooling

   (b) The rate of a reaction of a reaction is given by $logk = A – B/T + clogT$. Find the value of activation energy.

6. Answer any **one** questions: 5x1 = 5

   (a) Starting from the definition of G, Gibbs function, obtain the corresponding Maxwell relation.

   (b) Derive Michaelis Menten equation and draw the Lineweaver-Burk plot.

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