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C/18/B.Sc./2nd Sem/CEMH/C3T

2018

2nd Semester

CHEMISTRY

PAPER—C3T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

Group-A

1. Answer any *five* questions : 5×2

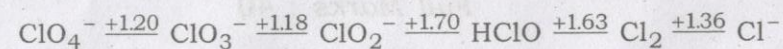
(a) SnCl_2 is reducing while PbCl_2 is neither reducing nor oxidising. — Explain.

(Turn Over)

(b) Show that de Broglie's hypothesis applied to an electron moving in a circular orbit leads to Bohr's Postulate of quantisation of angular momentum.

(c) Find out the pH of 10^{-8} M HCl solution.

(d) From the following Latimer diagram, Calculate the reduction potential of $\text{ClO}_4^- - \text{HClO}$



(e) Me_3P acts as a stronger base than Me_3N in their reaction with B_2H_6 — Explain.

(f) Calculate the screening constant (σ) for the 3d electron of iron (26).

(g) The kinetic energy of an electron is 5.76×10^{-15} J. Calculate the wavelength associated with the electron (Given mass of an electron = 9.1×10^{-31} kg ; $h = 6.626 \times 10^{-34}$ JS).

(h) State the role of H_3PO_4 in the estimation of iron by $\text{Cr}_2\text{O}_7^{2-}$ in presence of diphenyl amine indicator.

Group-B

Answer any four questions.

4×5

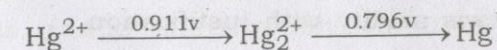
2. (a) For the hydrogen spectrum show that Lyman series occurs between 912 Å and 1216 Å and Balmer series occurs between 3647 Å and 6564 Å.

$$(R = 1.0968 \times 10^7 \text{ m}^{-1})$$

(b) Comment on the relative ionic radii of O^{2-} , F^- and Na^+ .

3+2

3. (a) Draw a Frost Diagram for Hg in acid solution from the given Latimer Diagram



comment on the tendency of any of the species to undergo disproportionation.

- (b) What is acidity function? How does it behave in dilute aqueous solution? (2+1)+2
4. (a) Calculate the electronegativity of chlorine in Mulliken's scale and hence find out the electronegativity of the same element in Pauling's Scale.
(Given electron affinity of Cl = 4.0 eV per atom ; Ionisation energy of Cl = 13.0 eV per atom)
- (b) The solubility of a sparingly soluble salt in water increases in presence of added salt without common ion — Explain. 3+2
5. (a) What are Eigen functions? What are their characteristics?
- (b) Arrange BF_3 , BCl_3 , BBr_3 and BI_3 in order of their Lewis acidity with justification. 3+2
6. (a) The equilibrium constant of the disproportionation reaction $2\text{Cu}^{+1}(\text{aq.}) \rightleftharpoons \text{Cu} + \text{Cu}^{+2}(\text{aq.})$ at 298 K is $1.66 \times 10^6 \text{ M}^{-1}$. If the standard reduction potential

- of Cu^{+2}/Cu system is 0.337 volt, Calculate the standard reduction potential of Cu^{+1}/Cu system.
- (b) Deduce ground state term symbol for atom having atomic number 22. 3+2
7. (a) How pH of an aqueous solution of KF will be affected if solid HgO is added?
- (b) How Cu^{+2} can be estimated in presence of Fe^{+3} iodometrically?
- Given that $E_{\text{Fe}^{+3}/\text{Fe}^{+2}}^0 = +0.77\text{V}$; $E_{\frac{1}{2}\text{I}_2-\text{I}^-}^0 = +0.54\text{V}$. 2+3

Group-C

Answer any one question. 1×10

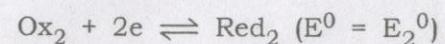
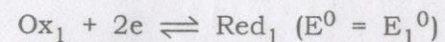
8. (a) What is radial distribution function? Show diagrammatically the variation of radial distribution function with 'r' for the 3s, 3p and 3d orbitals in a hydrogen atom.

- (b) Although In and Tl occur in the same group of the periodic table, In show +3 oxidation state in most of its compounds, however, Tl is +1. Explain.
- (c) Draw the acid-base neutralisation curve for
- Strong acid by strong base
 - Weak acid by weak base.
- (d) H_3BO_3 is a very weak acid ($\text{p}K_a = 9.2$), but in presence of any cis 1, 2 diol it behaves as strong acid. Explain.

(1+3)+2+2+2

9. (a) What is quantum mechanical interpretation of an orbital?
- (b) $\text{CaO} + \text{P}_4\text{O}_{10} \xrightarrow{\Delta} ?$ Predict the product and hence explain the reaction by Lux-Flood concept.
- (c) Calculate the first ionization energy of oxygen using Slater's rule.

- (d) Consider two redox couples as follows :



What should be the minimum difference between E_1^0 and E_2^0 in order to have 90% complete reaction between the two systems at equilibrium at 25°C ?

- (e) Ionisation energy of nitrogen is higher than that of oxygen—Explain.

1+2+3+2+2