

**U.G. 2nd Semester Examination - 2021**

**CHEMISTRY**

**[HONOURS]**

**Course Code : BCEMCCHC 201**

**Course Title: Inorganic Chemistry-I**

Full Marks : 30 Time : 2 Hours

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

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

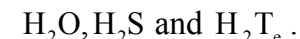
1. Answer any **ten** questions of the following:

1 × 10 = 10

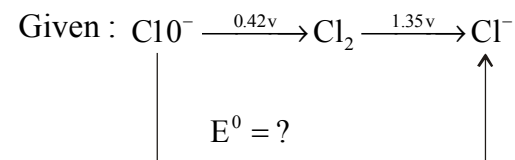
- What is the ground state term symbol of  $Ti^{2+}$  ion?
- Identify the Bronsted acid in the following reaction :  
 $PO_4^{3-}(aq) + H_2O(l) \rightarrow HPO_4^{2-}(aq) + OH^-(aq)$
- State Pauli exclusion principle.
- Write down the Schrödinger wave equation and give significance of each term.
- Compare the size and shape of 3s and 3p orbitals.

[Turn Over]

- Mention a suitable indicator for weak acid vs strong base titration.
- Why ionisation energy of Hg is comparable with Rd?
- $O^{2-}$ ,  $F^-$ ,  $N^{3+}$  and  $Mg^{2+}$  are isoelectronic, compare their ionic radii.
- Give an example of base in liquid  $NH_3$  medium.
- Is electronegativity an intensive property or not?
- Arrange the following in the order of basicity towards proton :



- Why electron affinity of  $Mn^{3+}$  is greater than that of  $Fe^{3+}$  ?
- Find out  $p^H$  of the 0.1N  $CH_3COOH$  where  $K_a$  for  $CH_3COOH$  is  $1.8 \times 10^{-5}$  mol/lit .
- Find out the value of  $E^0$  for  $ClO^- \rightarrow Cl^-$  .



- Calculate the equivalent weight of  $KMnO_4$  in basic medium.
2. Answer any **five** questions of the following :
- 2 × 5 = 10
- Explain the electronic configuration of Cr on the basis of "exchange energy".

- b) Calculate the wavelength of 2nd line in the Balmer series of the spectrum of hydrogen atom.
- c) Write down Drago-Wayland equation and signify the terms.
- d) The order of acidity of haloacids are  $\text{HI} > \text{HBr} > \text{HCl}$  but oxohaloacids are  $\text{HOCl} > \text{HOBr} > \text{HOI}$ . – Explain.
- e) "The ionisation energy of  $ns^2np^1$  and  $ns^2np^4$  configuration do not follow regular trend." – Explain.
- f) State Allred-Rochow's absolute electronegativity and show its relation with Pauling's scale.
- g) From the following Latimer diagram establish that  $\text{H}_2\text{O}_2$  is unstable toward disproportionation.
- $$\text{O}_2 \xrightarrow{0.7\text{v}} \text{H}_2\text{O}_2 \xrightarrow{1.76\text{v}} \text{H}_2\text{O}$$
- h)  $\text{CuS}$  is precipitated in acidic medium when  $\text{H}_2\text{S}$  gas is passed through  $\text{Cu}^{2+}$  solution but  $\text{ZnS}$  is precipitated in basic medium. – Justify.
- $[\text{K}_{\text{sp}}(\text{CuS}) = 8.0 \times 10^{-36}$  and  $\text{K}_{\text{sp}}(\text{ZnS}) = 3 \times 10^{-22}$  at  $25^\circ\text{C}$ ]

3. Answer any **two** questions : 5×2=10
- a) i) "Reaction between  $\text{CaO}$  and  $\text{P}_4\text{O}_{10}$  in molten state is an acid-base reaction." Work out the products and explain this acid-base reaction by a theory of your choice.
- ii) Silver perchlorate is significantly more soluble in benzene than in n-hexane. Define in terms of Lewis acid-base properties.
- 3+2=5
- b) i) Using Slater's rule determine  $z^*$  for a 4s and 3d electron of copper. Which type of electron is more likely to be lost when copper forms a positive ion?
- ii) Electronegativity varies with hybridisation of orbitals and oxidation number of element – Explain with example.
- 3+2=5
- c) i) Why Z.R. solution is added during quantitative estimation of  $\text{Fe}^{2+}$  by  $\text{KMnO}_4$  in presence of  $\text{HCl}$ ?
- ii) Explain the effect of pH on the redox potential of the system :
- $$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e} \rightleftharpoons \text{Mn}^{2+} + 4\text{H}_2\text{O}.$$
- 3+2=5