U.G. 2nd Semester Examination - 2022

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: 1×10=10

a) What are the limitations of Bohr's theory?

b) Write down the Nernst equation.

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

d) Why atomic radii of Zirconium and hafnium are almost same?

e) What do you mean by Electron affinity?

f) What is formal potential?

g) Note down the Lux-Flood concept of acids and bases with suitable example.

h) What is van-der Waal's radius?

i) What is the equivalent weight of $K_2Cr_2O_7$ and $KMnO_4$ in acid medium.

j) Can $SiCl_4$ and $SnCl_4$ function as lewis acid?

k) The first Bohr radius of hydrogen atom is 0.529 Å, find the same for He^+ ion.

l) Why the electron affiinity value of Cl is greater than F?

m) What are super acids? Give example.

n) Arrange these oxides in order of their acidic nature:

N_2O_5, As_2O_3, Na_2O, MgO

o) First ionization potential of 'Be' is higher than its next member 'B'–Comment on this.

2. Answer any **five** questions: 2×5=10

a) What is Zimmermann-Reinhardt solution? What is the role of that solution?

b) The pH of a 10^{-3}(M) aqueous solution of weak acid was found to be 4.0 at 25°C. Find the degree of dissociation.

c) "H_2O is called Amphiprotic"–Justify your answer with proper example.

d) The fourth ionisation potential of Boron is abnormally high compared to other three – Explain.

e) What do you mean by Buffer solution? Give one example.

f) The principal quantum number, the azimuthal quantum number and the magnetic quantum number, respectively signify size, shape and orientation of orbitals in an atom–Comment.

g) A buffer solution contains 0.01mole of CH_3COOH and 0.10 mole CH_3COO^- per litre. Calculate the pH of the buffer.

h) Balance the following equation by ion electron method:

$$Mn^{2+} + BiO_3^- + H^{\oplus} \rightarrow MnO_4^- + BiO^{\oplus} + H_2O$$

3. Answer any **two** questions: 5×2=10

a) i) Explain the concept of electronegativity. State its usefulness in predicting the bond types, polarity of molecules and molecular association. $1+1\frac{1}{2}$

ii) Calculate the pauling electronegativity of chlorine from the following data: bond energies (kcal/mole) for $H_2(104)$, $Cl_2(57)$, $HCl(102)$ and pauling electronegativity of hydrogen (2.1). $2\frac{1}{2}$

b) i) Consider the following potentials:

$$Cu^{+2} + 2e \rightleftharpoons Cu,\ E^o = 0.37V$$
$$Zn^{+2} + 2e \rightleftharpoons Zn;\ E^o = -0.763V$$

and ascertain whether the following reaction will go to completion: $Zn(s) + Cu^{+2} \rightleftharpoons Zn^{+2} + Cu(s)$. $2\frac{1}{2}$

ii) The Hg^{+2}/Hg_2^{+2} couple (E^o=1.92V) is more oxidizing than the Fe^{+3}/Fe^{+2} couple (E^o=0.77V). Yet Hg_2^{+2} reduces Fe^{+3} to Fe^{+2} in presence of theocyanite ion–Comment. $2\frac{1}{2}$

c) i) For a general case of an electron moving in an orbit around a nucleus of charge Ze, show that $E = -\frac{2\pi^2 mz^2c^4}{n^2h^2}$.

ii) Explain the extraordinary difference in radii of the H atom(0.37 Å) and H^+ ion. 3+2