B.Sc. Semester-II Examination, 2022-23

CHEMISTRY [Honours]

Course ID : 21411 Course Code : SH/CHEM/201/C-3

Course Title : Inorganic Chemistry I

[NEW SYLLABUS]

Time : 1 Hour 15 Minutes Full Marks : 25

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 **five** questions: 1×5=5

   a) What values of 'm' are taken conventionally for p_x, p_y and p_z orbitals?

   b) What will be the periodic position of element having atomic number 83?

   c) Arrange halogen hydracids in an expected order of increasing acidity.

   d) Why chlorine has higher electron affinity than fluorine?

   e) Find out the equivalent weight of $K_2Cr_2O_7$ in acid medium. [M. Wt. of $K_2Cr_2O_7 \equiv M$]

   f) Give an example of an inorganic dismutation reaction.

   g) Give the expression of electronegativity in Allred-Rochow scale.

   h) Why the acidity of HSO_3F increases many times in presence of SbF_5?

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

   a) i) What is Frost diagram? What is its utility?

   ii) Balance the following equation in ion-electron method:

$$KMnO_4 + H_2S + HCl \rightarrow S + MnCl_2 + H_2O + KCl$$

(1+2)+2

   b) i) How Slater's rules explain that ns orbital is filled first than (n-l)d orbital?

   ii) State van der Waals radius. Why van der Waals radius is larger than covalent radius? 2+(1+2)

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

   ii) Enunciate de Broglie's concept on wave-particle duality. Derive Bohr's quantum restriction from de Broglie's equation.

2+3

d) i) How can you explain the following reaction as acid-base reaction?

$$CaO + SiO_2 \rightarrow CaSiO_3$$

ii) With proper reasons arrange the following acids in decreasing order of acidity:

$HClO_4$, $HClO_3$, $HClO_2$, HClO.

iii) Write down the autoionisation of liquid NO_2. 2+2+1

3. Answer any **one** question: 10×1=10

a) i) What is exchange energy? From the concept of exchange pair of electrons justify that the ground state configuration of chromium is $3d^5\ 4s^1$ and not $3d^4\ 4s^2$.

ii) What do you mean by inert pair effect? Give a suitable example.

iii) Calculate the wave number of the third line in the Balmer series of Be^{3+} ion. ($R_H = 109677 cm^{-1}$).

iv) Arrange BF_3, BCl_3 and BBr_3 in order of increasing Lewis acidity with explanation. 3+2+2+3=10

b) i) Write down the conjugate acids and bases of the following:

HSO_4^-, C_5H_5N, HS^- and HF

ii) The standard oxidation potentials of the electrodes Hg/Hg_2^{2+} and Hg/Hg^{2+} are 0.80 and –0.85 volts respectively at 25 deg C. Find the equilibrium constant of the reaction, $Hg + Hg^{2+} \rightarrow Hg_2^{2+}$.

iii) Draw the radial probability distribution curves for 2s and 3s electrons.

iv) 'Aniline is a borderline base although N is a hard centre'– Comment. 2+4+2+2

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