

B.Sc. 2nd Semester (Honours) Examination, 2023 (CBCS)**Subject : Chemistry****Course : CC-III****(Inorganic Chemistry)****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer *any five* of the following questions: $2 \times 5 = 10$

- (a) In the term symbol 3P_0 what does superscript ‘3’ and subscript ‘0’ denote for?
- (b) State Heisenberg uncertainty principle and its significance.
- (c) Write down the electronic configuration of gadolinium.
- (d) Glycine exists predominantly in the form $H_3N^+CH_2COO^-$. Work out the formulae for its conjugate acid and conjugate base.
- (e) Why is titration of weak acid with weak base not possible?
- (f) State the order of second ionisation potential of K, Ca and Ba, and explain it.
- (g) $1(M) K_2Cr_2O_7 = x(N) K_2Cr_2O_7$. What is the value of x? Show calculation.
- (h) ‘Electronegativity of oxygen in Pauling’s scale is 3.44 in all oxygen compounds.’—Comment.

2. Answer *any two* questions; $5 \times 2 = 10$

- (a) (i) State the ground state term symbol of d^5 electronic configuration.
 (ii) The energy of the second Bohr orbit of the He^+ ion is -13.62 eV. What will be the energy of the second Bohr orbit of Li^{2+} ion? $2+3$
- (b) (i) ‘All redox reactions are acid base reaction.’—Comment.
 (ii) State the relation between ΔG and any spontaneous process, any nonspontaneous process and any system at equilibrium.
 (iii) Explain the Latimer diagram with suitable example. $2+1+2$
- (c) (i) A solution of $pH=5$ is mixed with an equal volume of a solution of $pH=3$. What will be the pH of the mixture? Show calculation.
 (ii) What is levelling and differentiating solvent? Explain with proper example. $2+3$
- (d) Which elements do exhibit the inert pair effect and why? What is f contraction and how does it affect the properties of the lanthanide elements? $(1+1\frac{1}{2})+(1+1\frac{1}{2})$

3. Answer *any two* questions:

$10 \times 2 = 20$

- (a) (i) Ionization energy of hydrogen atom is 13.6 eV. What is the potential energy of the electron in hydrogen atom? Show calculation.
- (ii) State the limitations of *aufbau* principle.
- (iii) Give significance of Ψ^2 .
- (iv) State Sommerfeld's modification of Bohr's theory.
- (v) State the number of nodes of 4s and 4d orbitals. $2+2+2+3+1$
- (b) (i) 'Though standard reduction potential of $\text{Cu}^{+2}/\text{Cu}^+$ ($E^\circ = 0.15\text{V}$) is lesser than that of $\text{I}_2/2\text{I}^-$ ($E^\circ = 0.54\text{V}$), CuSO_4 can be estimated iodometrically.'—why?
- (ii) What is redox indicator? How does it work?
- (iii) For a particular redox titration how can we select an indicator suitable for it?
- (iv) Write down the Nernst equation of the couple $\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$ in acid medium. $3+(1+2)+2+2$
- (c) (i) State the order of Lewis acid strength of BF_3 , BCl_3 and BBr_3 with explanation.
- (ii) Give one example of super acid.
- (iii) Draw and explain acid-base neutralisation curve for the titration of strong acid with weak base. Name one indicator suitable for this titration.
- (iv) 'PbI₄, FeI₃ do not exist while PbCl₄, FeCl₃ exist.'—Why?
- (v) What is the conjugate base of $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$? $(1+2)+1+(2+1)+2+1$
- (d) (i) Write down the role of addition of NH_4Cl to precipitate Al^{3+} as hydroxide in presence of NH_4OH .
- (ii) What will be the solubility of AgCl in 0.1M NaCl solution ($K_s = 1 \times 10^{-10}$)? Show calculation.
- (iii) 150.0 mL of 0.1 M Na_2SO_4 , 75.0 mL 0.35 M CoCl_2 and 150.0 mL of 0.25 M SrS are mixed. Which salts will precipitate out of solution?
- (iv) 'Second electron affinity of oxygen is negative, yet a number of oxides are formed.'—Explain.
- (v) Identify the Lewis acid and base in the reaction, $\text{I}^- + \text{I}_2 \rightarrow \text{I}_3^-$. $2+2+2+2+2$
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