

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: 2×5=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 $\text{H}_3\text{N}^+\text{CH}_2\text{COO}^-$. 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) $1(\text{M}) \text{K}_2\text{Cr}_2\text{O}_7 = x(\text{N}) \text{K}_2\text{Cr}_2\text{O}_7$. 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; 5×2=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 $\text{pH}=5$ is mixed with an equal volume of a solution of $\text{pH}=3$. 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+1½)+(1+1½)

3. Answer any two questions:

10×2=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) ' PbI_4 , FeI_3 do not exist while PbCl_4 , FeCl_3 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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