

Total Pages – 6

B.Sc. RNLK-/CC2T/22

2022

Chemistry

[Inorganic]

[First Semester]

Paper - CC2T

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks.

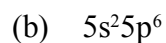
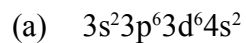
Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group - A

1. Answer any five questions : 2×5=10

(i) Give the name and symbol for each of the atoms which have the ground state electronic configurations in their outer shells :



(Turn Over)

(2)

- (ii) give the value of the four quantum numbers for each electron in the ground state for
- (a) the oxygen atom
 - (b) the scandium atom.
- (iii) Find the pH of 0.01(M) CH_3COOH solution.
($\text{p}K_a=4.74$)
- (iv) HNO_3 , HCl and H_2SO_4 appear equally strong in water but their strength differ in acetic acid medium. Explain.
- (v) Arrange the different types of radii in order of increasing size for a given element : Van der Waals radius, anion radius, cation radius, covalent radius.
- (vi) Why is the electron affinity of chlorine is greater than that the fluorine?
- (vii) SnCl_2 is reducing while PbCl_2 is neither reducing nor oxidising – explain.
- (viii) The solubility of silver chloride is 0.0015 g dm^{-3} . Calculate its solubility product.

(3)

Group - B

2. Answer any four questions : 5×4=20
- (a) Electron affinity of gold is very high – explain. 2
- (b) Arrange BF_3 , BCl_3 , BI_3 in order of their Lewis acidity with justification. $1\frac{1}{2}$
- (c) The solubility of sparingly soluble in water increases in presence of added salt without common ion – explain. $1\frac{1}{2}$
3. (a) Why does atomic radius decrease in moving from left to right along a period? 2
- (b) Explain why radii of the following ions will be different though each possesses $2s^22p^6$ configuration in the outermost shell O^{2-} , F^- , Na^+ , Al^{3+} ? What will be the order of increasing radius of these ions? 3
4. (a) $\text{CaO} + \text{P}_4\text{O}_{10} \xrightarrow{\Delta} ?$ Predict the product and hence explain the reaction by Lux-Flood concept. 2
- (b) Show that for aqueous solutions, the protonic definition of acids is practically equivalent to the Arrhenius definition, but for bases, the protonic definition covers more compounds. 3

(4)

5. (a) 'Disproportionation of Hg_2^{2+} is facilitated in presence of S^{2-} or CN^- or SCN^- – justify. 2

- (b) Calculate the solubility product of AgCl from the following data :

$\text{Ag} \mid \text{KCl} \mid 0.1\text{m, saturated with AgCl} \parallel \text{Calomel} (0.1\text{N})$

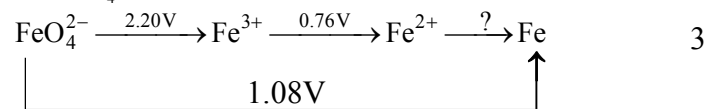
$$E_{\text{Cell}} = 0.0494\text{V}, E_{\text{Cal}}(0.1\text{N}) = 0.3338\text{V}$$

$$E^\circ_{\text{Ag}^+/\text{Ag}} = 0.8\text{V}$$

Mean activity coefficient 0.1 molal $\text{KCl} = 0.77$ 3

6. (a) In what respect, spectrum of He^+ will differ from that of H-atom? 2

- (b) From the following EMF diagram, calculate the values of $E^\circ_{\text{FeO}_4^{2-}/\text{Fe}^{2+}}$ and $E^\circ_{\text{Fe}^{2+}/\text{Fe}}$



7. (a) Discuss inert pair effect. 2

- (b) After calcium, electrons enter the 4s orbital before going to the 3d orbitals. But when a transition metal ionizes the 4s electrons are removed first. Why? 3

(5)

Group - C

8. Answer any one question. 10×1=10
- (a) Justify the Lewis acid strength runs in the sequence :
 $\text{BCl}_3 > \text{AlCl}_3 > \text{GaCl}_3$ (for O-donor lewis-base)
 $\text{GaCl}_3 > \text{AlCl}_3 > \text{BCl}_3$ (for S-donor lewis base) 2
- (b) Calculate the energy of an electron in the Bohr orbit of hydrogen atom with $n=3$. 2
- (c) The ionic radius of Cl^- is greater than the mean of the radii of F^- and Br^- whereas that of Br^- is less than the mean of the radii of Cl^- and I^- - Discuss. 3
- (d) Calculate the $[\text{H}^+]$, $[\text{OH}^-]$ and pH of a solution prepared by deluting 20 ml of 0.1 M HCl to 1 litre. 3
9. (a) What is radial distribution function? Show diagrammatically the variation of radial distribution function with 'r' for the 3s, 3p and 3d orbitals in a hydrogen atom.
- (b) Why the first ionization potential of Cu is higher than that of K, whereas the second ionisation potentials are in the reverse order?

(6)

- (c) Draw the acid-base neutralisation curve for
- (i) Strong acid by strong base.
 - (ii) Weak acid by weak base.
- (d) H_3BO_3 is very weak acid ($\text{p}K_a=9.2$), but in presence any cis-1, 2 diol, it behaves as strong acid. Explain.

(1+3)+2+2+2