

B.Sc. 2nd Semester (Honours) Examination, 2021

CHEMISTRY

(Inorganic Chemistry-I)

Paper : SH/CHE/201/C3

Course ID: 21411

Time: 1 Hour 15 Minutes

Full Marks: 25

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* questions:

1×5=5

- (a) Why Niobium and Tantalum have almost same atomic radii?
- (b) Give the ground state electronic configuration of Ti and Ti^{+3} ion.
- (c) Why $(H_3Si)_3N$ is weaker base than $(H_3C)_3N$?
- (d) Find out the conjugate acid base pair(s) of HCO_3^- ion.
- (e) Work out ground state term symbol of Fe^{3+} ion.
- (f) Point out the criterion of a Bronsted base.
- (g) Express one inorganic disproportionation reaction.
- (h) Which one has higher electron affinity? O or F. - Explain.

2. Answer *any two* questions:

5×2=10

- (a) (i) From Bohr's theory compare the frequencies of the radiation emitted from n^{th} orbit of H-atom with those emitted by He^+ , and Be^{3+} ions.

(ii) What would be the wavelength of emission spectrum when the electron jumps from the level with $n = 2$ to ground state of He^+ ? ($h = 6.6 \times 10^{-27}$ erg-sec, $m_e = 9.1 \times 10^{-28}$ g, $1 \text{ erg} = 6.24 \times 10^{11} \text{ eV}$).
2+3=5
- (b) (i) Calculate Pauling's electronegativity of hydrogen atom from the following data: Bond energies (KJ/mole): H_2 (458), F_2 (155), HF (565) and Pauling's electronegativity of F = 4.0

(ii) Find the smallest and largest sized ions from the following: H^- , F^- , Cl^- , Br^- . Give reason in support of your answer.
3+2=5

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(c) (i) List the bases in order of their increasing proton affinities: HS^- , F^- , I^- , NH_2^- .

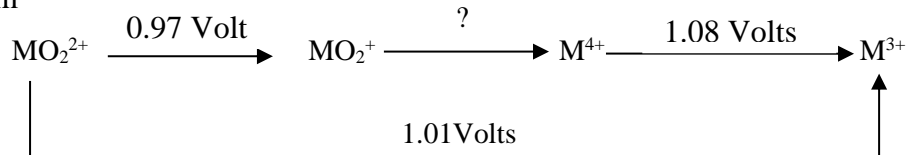
(ii) Identify the Lewis acid and base in the reaction, $\text{I}^- + \text{I}_2 \rightarrow \text{I}_3^-$. Justify your answer.

2+3=5

(d) (i) Write down the composition of Zimmermann Reinhardt solution. Explain why this solution is used during redox titration of Fe(II) ion by KMnO_4 solution in HCl medium.

(ii) Calculate the E_0 value of $\text{MO}_2^+/\text{M}^{4+}$ couple in 1M acid medium from the following

diagram



4+1=5

3. Answer *any one* question:

10×1=10

(a) (i) Explain with example the exchange energy of electrons. Estimate the exchange energy of 2p electrons of fluorine atom.

(ii) What is the shortest Wave length in the absorption spectrum of deuterium? ($R=109737\text{cm}^{-1}$)

(iii) "Addition of phosphoric acid is essential in the titration of ferrous ion with dichromate". -Comment. [Given, E^0 for $\text{Cr}_2\text{O}_7^{2-}/\text{Cr(III)} = 1.33 \text{ V}$; $\text{Fe}^{3+}/\text{Fe}^{2+} = 0.77 \text{ V}$; $\text{In(ox)}/\text{In(red)} = 0.76 \text{ V}$]

(iv) Classify the following species into acids and bases and write their conjugate bases and conjugate acids: HSO_4^- , CH_3OH . 3+2+3+2=10

(b) (i) During ionization of Vanadium, the 4s electron comes out first. – Establish it using Slater's rules.

(ii) Explain why BH_3F^- and BF_3H^- react to form BF_4^- and BH_4^- ?

(iii) Using electronic theory classify the following into acids, bases or neutral species: $\text{CH}_2=\text{CH}_2$, H_3O^+ , HCl , and Me_2SO .

(iv) Define comproportionation reaction with example.

4+2+2+2=10