

5/H-23 (v) (a) (Syllabus-2015)

2022

(November)

CHEMISTRY

(Honours)

(Chem-H-501)

(Part—A : Inorganic Chemistry—I)

Marks : 38

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

1. (a) Determine the point group for each element of the following molecules and write all the symmetry elements present in it : $1\frac{1}{2} \times 2 = 3$



- (b) Write down all the symmetry elements of H_2O . 2

- (c) What are significant figures? Calculate and give the answer with the correct number of significant numbers : 2

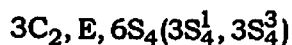
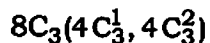
$$1.02 + 8.2 + 3.33 + 9.781$$

(2)

OR

2. (a) Distinguish between accuracy and precision with example. 3

(b) A molecule has the following symmetry elements/operations :



What point group would you assign to this molecule? Give an example of such molecule. 2

(c) In term of symmetry operation, explain the following terms : 1×2=2

(i) Equivalent configuration

(ii) Identical configuration

3. (a) Give the structural formulae of the following :

(i) Cupron

(ii) Dimethylglyoxime

Write some of the important applications of both in qualitative and quantitative analysis. 3

(b) What is co-precipitation? What are the factors responsible for co-precipitation? 1+2=3

(3)

(c) What is meant by EDTA titration? Mention the type of indicators used in this type of titration. 2

OR

4. (a) Discuss some of the advantages and disadvantages of organic reagent over inorganic reagent. 3

(b) Explain in what manner, the stability of metal-EDTA complex varies with—

(i) the change of the metal cation;

(ii) the pH of the medium. $1\frac{1}{2}\times 2=3$

(c) Give one example of adsorption indicator. Mention its uses in argentometric titration. 2

5. (a) Describe nuclear chain reaction with reference to fission of ^{235}U and discuss the concept of critical mass. 3

(b) Discuss the separation of isotopes by electrolytic method. 3

(c) Define Q-value. What is its significance? 2

OR

6. (a) Calculate the binding energy per nucleon of oxygen atom ${}_8\text{O}^{16}$, which has a mass of 15.994910 a.m.u.
Given :
Mass of neutron = 1.008665 a.m.u.
Mass of proton = 1.007277 a.m.u.
Mass of electron = 0.000548 a.m.u. 4
- (b) Write short notes on (any two): $1 \times 2 = 2$
(i) α -decay
(ii) Magic number
(iii) Positron decay
- (c) Explain stability of atomic nuclei in terms of neutron to proton ratio. 2
7. (a) Draw a diagram to show how the ionic radii of a bivalent metal ion of the first transition series element vary in presence and absence of crystal field. Explain its important features. 3
- (b) What are the factors that affect the magnitude of crystal field stabilization energy parameter (Δ_0) in complexes? 3
- (c) Arrange the following complexes in increasing order of CFSE (Δ_0) value and give explanation for your answer : 1
 $[\text{Rh}(\text{NH}_3)_6]^{3+}$, $[\text{Ir}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$

OR

8. (a) Write the salient features of crystal field theory. 3
- (b) Draw the crystal field diagram in tetrahedral field. 2
- (c) Explain why $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ ion is more paramagnetic than $[\text{Fe}(\text{CN})_6]^{3-}$ ion. 2
9. (a) Explain how the magnetic susceptibility is measured by Gouy's method. 3
- (b) Calculate the spin only magnetic moment (μ_s) of the following : $1\frac{1}{2} \times 2 = 3$
(i) $\text{K}_3[\text{FeF}_6]$
(ii) $\text{K}_3[\text{Fe}(\text{CN})_6]$
- (c) Explain and give examples of an anti-ferromagnetic substance and a ferromagnetic substance. 2

OR

10. (a) Write down the formula for calculation of spin magnetic moment and find out the spin only magnetic moment of the following complexes : 3
(i) $[\text{MnCl}_4]^{2-}$
(ii) $[\text{CoF}_6]^{4-}$

- (b) What is meant by magnetic susceptibility χ_m^{corr} ? How is it related to magnetic moment μ_{eff} ? 2
- (c) What is Curie's law? What is the significance of Curie point? 1½
- (d) Draw a diagram to show magnetic susceptibility χ_m Vs. T (temperature) for anti-ferromagnetic substance. 1½
