2024

(NEP–2020)

(2nd Semester)

CHEMISTRY (MAJOR)

(Inorganic Chemistry—II)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Simple calculator may be allowed

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. How many ions are produced from the complex $[Co(NH_3)_6]Cl_2$ in solution?

(a) 6 ( )

(b) 4 ( )

(c) 3 ( )

(d) 2 ( )

2. According to Werner's theory of coordination compounds

(a) primary and secondary valencies are ionisable ( )

(b) primary valency is ionisable ( )

(c) secondary valency is ionisable ( )

(d) neither primary nor secondary valency is ionisable ( )

3. The oxidation number of nickel in $[Ni(CO)_4]$ is

(a) 0 ( )

(b) 2 ( )

(c) 3 ( )

(d) 4 ( )

4. Diagonal relationship is not shown by

(a) Li and Mg ( )

(b) Be and Al ( )

(c) B and Si ( )

(d) C and Cl ( )

5. The structure of IF_5 is

(a) T-shaped ( )

(b) pyramidal ( )

(c) square pyramidal ( )

(d) pentagonal bipyramidal ( )

6. Complete the following reaction :

$$^{19}_{9}F + \_\_\_\_ \rightarrow {}^{16}_{8}O + {}^{4}_{2}He$$

(a) $^{1}_{0}n$ ( )

(b) $^{1}_{1}H$ ( )

(c) $^{0}_{0}\gamma$ ( )

(d) $^{0}_{-1}e$ ( )

7. When a nuclide undergoes beta decay

(a) the atomic number remains unchanged and the mass number increases by one ( )

(b) the mass number remains unchanged and the atomic number decreases by one ( )

(c) the mass number remains unchanged and the atomic number increases by one ( )

(d) the atomic number remains unchanged and the mass number decreases by one ( )

8. The half-life of a radioactive element is 30 days. Then the remaining amount after 90 days is

(a) 1/3 ( )

(b) 1/4 ( )

(c) 1/6 ( )

(d) 1/8 ( )

9. How many significant figures are there in the number 0·05021?

(a) 2 ( )

(b) 3 ( )

(c) 4 ( )

(d) 5 ( )

10. In a set of experiments, the values obtained are very closed to each other. These values can be called

(a) precise ( )

(b) accurate ( )

(c) infinite ( )

(d) average ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

Answer *five* questions, taking at least *one* from each Unit : 3×5=15

UNIT—I

1. What are high-spin and low-spin complexes? Give examples.

2. What are chelates? Give examples.

UNIT—II

3. Why are the group–1 elements known as the most electropositive elements? Can these elements make +2 oxidation state? Give reasons.

4. Write a short note on pseudohalogens.

UNIT—III

5. What is magic number? What is its importance in the stability of nuclei?

6. What is artificial radioactivity? Give an example.

UNIT—IV

7. Differentiate between accuracy and precision.

8. What are absolute and relative errors?

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer *five* questions, taking at least *one* from each Unit : 10×5=50

UNIT—I

1. *(a)* Describe the postulates of Werner's theory of coordination compounds. By using this theory, write the structure of $CoCl_3 \cdot 5NH_3$. 5

(b) Using valence bond theory, explain the hybridization and structure of $[Fe(CN)_6]^{3-}$ ion. 3

(c) Name the following coordination compounds using IUPAC nomenclature : 2

(i) $K_3[Fe(CN)_6]$

(ii) $[Cr(H_2O)_6]Cl_3$

2. *(a)* Write the IUPAC name of $[Co(en)_2Cl_2]^+$ ion. Draw the geometrical and optical isomers of this complex ion. 1+4=5

(b) State the effective atomic number (EAN) rule. Calculate the effective atomic number (EAN) of the central atom in the following complexes : 1+2+2=5

(i) $[Cu(NH_3)_4]^{2+}$

(ii) $[Fe(CN)_6]^{4-}$

UNIT—II

3. *(a)* How is nitrous acid prepared? Explain its reducing property. 1+3=4

(b) Write a brief note on the different types on interhalogen compounds. 3

(c) Explain catenation giving suitable example. 3

4. (a) Explain the ionic or covalent characters of alkaline earth metals hydrides. 4

(b) How is Caro's acid prepared? Write its properties. 1+2=3

(c) Explain inert pair effect with suitable example. 3

UNIT—III

5. (a) Differentiate between nuclear fusion and nuclear fission reactions. Give examples. 4

(b) Write a short note on nuclear binding energy. 3

(c) Discuss the neutron-proton (n / p) ratio and nuclear stability. 3

6. (a) What is the meaning of packing fraction? How is the packing fraction value related to the stability of a nucleus? 4

(b) Define half-life and average life of radioactive elements. How is the average life related to the half-life? 3

(c) Write a brief note on the group displacement law with reference to emission of alpha particle. 3

UNIT—IV

7. (a) What are the different types of determinate error? How are these errors detected and corrected?

(b) What is F-test? Two sets of results, in mg/litre, one set obtained by a standard method and the other set by a new method, are given below :

Standard method	31	27	26	35	2	31	33	—
New method	26	22	23	30	24	28	30	25

Determine whether the precision of the new method differs significantly from that of the standard method. The critical value of F for 7 degrees of freedom is 2·13.

8. *(a)* What is meant by the term 'confidence limit'? How is it calculated? 3

(b) Write a note on reporting of analytical data. 2

(c) What do you mean by the test of significance? The amount of oxalic acid present in each solution was determined by two methods, one standard and the other new, and the following results were obtained :

Amount of oxalic acid (g/litre) determined

Sample no.	1	2	3	4	5	6
Standard method	8·6	11·7	7·4	13·9	17·3	12·8
New method	9·4	11·1	8·9	12·9	18·9	11·7

Show that there is no significant difference between the two methods. (The critical value of t for 5 degrees of freedom is 0·48.) 5

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Student's Copy

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