Student's Copy

CHEM160 (MAJOR)

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 (\checkmark) the correct answer in the brackets provided :

 $1 \times 10 = 10$

1. How many ions are produced from the complex [Co (NH₃)₆]Cl₂ 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 IF₅ is

- (a) T-shaped ()
- (b) pyramidal ()
- (c) square pyramidal ()
- (d) pentagonal bipyramidal ()

6. Complete the following reaction :

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

(a)
$$\frac{1}{0}n$$
 ()
(b) $\frac{1}{1}H$ ()
(c) $\frac{0}{0}\gamma$ ()
(d) $\frac{0}{-1}e$ ()

/374

[Contd.

- 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 ()
- 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 :

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?

3×5=15

(SECTION : C-DESCRIPTIVE)

(Marks: 50)

Answer five questions, taking at least one from each Unit :

Unit—I

- (a) Describe the postulates of Werner's theory of coordination compounds. By using this theory, write the structure of CoCl₃ · 5NH₃.
 - (b) Using valence bond theory, explain the hybridization and structure of [Fe (CN)₆]³⁻ ion.
 - (c) Name the following coordination compounds using IUPAC nomenclature : 2

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

- (ii) [Cr(H₂O)₆]Cl₃
- (a) Write the IUPAC name of [Co(en)₂Cl₂]⁺ ion. Draw the geometrical and optical isomers of this complex ion.
 - (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

10×5=50

3

- (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.

[Contd.

4. (a)	Explain the ionic or covalent characters of alkaline hydrides.	earth	metals 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
	(Ь)	Define half-life and average life of radioactive elements. How is the average life related to the half-life?	
	(c)	Write a brief note on the group displacement law with reference to emission of alpha particle.	,
		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	21		
New method	26	22	23	20	-	51	33	_
			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.
 - (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 :

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

Amount	of	oxalic	acid	(g/litre)	determined
--------	----	--------	------	-----------	------------

Show that there is no significant difference between the two methods. (The critical value of t for 5 degrees of freedom is 0.48.)

* * *

2

CHEM160 (MAJOR)

Student's Copy

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

- How many ions are produced from the complex [Co(NH₃)₆]Cl₂ 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 (

Contd.

The oxidation number of nickel in [Ni(CO)4] is ė

	^			
)	_	<u> </u>)	
0	3	e	4	
(a)	(q)	(c)	(d)	

- 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 IF₅ is
- (a) T-shaped ()
- (b) pyramidal (
- (c) square pyramidal
- (d) pentagonal bipyramidal
- 6. Complete the following reaction :

$$^{19}F$$
 + \longrightarrow ^{16}O + $^{4}H_{e}$

- (a) ¹₀n () (b) ¹₁H () (c) ⁰₀Y ()
- $(d) \frac{0}{-1}e$ (

[Contd.

- '. When a nuclide undergoes beta decay
- number mass the and unchanged remains number increases by one atomic the đ
- number atomic the and remains unchanged number decreases by one mass the **(q**)
- number atomic remains unchanged and the number increases by one the mass ত
- the mass number remains unchanged and atomic number decreases by one the (q)
- of a radioactive element is 30 days. Then the remaining amount after 90 days is The half-life ø
- (a) 1/3 () (b) 1/4 () (c) 1/6 ()

1/8

(q

- 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. called These values can be
- (a) precise ()
- (b) accurate (
- (c) infinite ()
- (d) average (

[Contd.

SECTION : B-SHORT ANSWERS)

(Marks : 15)

Answer five questions, taking at least one from each Unit :

3×5=

UNIT-I

- ۲ What are high-spin and low-spin complexes? Give examples.
- Ņ What are chelates? Give examples.

UNIT-II

- ω Why elements? Can these elements make +2 oxidation state? Give reasons. are the group-1 elements known as the electropositive
- 4 Write a short note on pseudohalogens.

UNIT--III

- ģ
- 6

- What is artificial radioactivity? Give an example.
- What is magic number? What is its importance in the stability of nuclei?

00

What are absolute and relative errors?

7

Differentiate between accuracy and precision.

UNIT-IV

/374

Contd.

(SECTION : C-DESCRIPTIVE)

(Marks : 50)

Answer five questions, taking at least one from each Unit :

 $10 \times 5 = 50$

UNIT---I

			1
		0	
	(c)	(d	E
 (i) K₃[Fe(CN)₆] (ii) [Cr(H₂O)₆]Cl₃ 	Name the for nomenclature :	Using valence be [Fe (CN) ₆] ³⁻ ion.	Describe By usin
Fe(CN) H ₂ O) ₆	the	alence	the p g this
6]]Cl3	following :	bond theo n.	ostulates o theory, wr
	 (c) Name the following coordination compounds using IUPAC nomenclature : 	(b) Using valence bond theory, explain the hybridization and structure of ${\rm [Fe(CN)_6]^{3-}}$ ion.	 (a) Describe the postulates of Werner's theory of coordination compounds. By using this theory, write the structure of CoCl₃ - 5NH₃.
	compounds	hybridization	ry of coordinat re of CoCl ₃ · 51
	using	and stru	ion com NH ₃ .
	IUPAC	cture of	pounds.
	N	ω	сл

- N Ø Write the IUPAC name of $[Co(en)_2Cl_2]^+$ ion. Draw the geometrical and optical isomers of this complex ion. 1+4=5
- J 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(NH3)4]²⁺
- (ii) [Fe(CN)6]4-

UNIT-II

		ω
(0)	6)	(a)
(c) Explain catenation giving suitable example.	(b) Write a brief note on the different types on interhalogen compounds.	3. (a) How is nitrous acid prepared? Explain its reducing property. 1+3=4
J	ω	+3=4

| Contd.

- 4 æ Explain hydrides. the ionic or covalent characters of alkaline earth metals 4
- 9 How is Caro's acid prepared? Write its properties

1+2=3

ω

<u></u> Explain inert pair effect with suitable example

UNIT-III

6			, cr
(a)	(c)	(b)	(a)
6. (a) What is the meaning of packing fraction? How is the packing fraction value related to the stability of a nucleus?	(c) Discuss the neutron-proton (n / p) ratio and nuclear stability.	(b) Write a short note on nuclear binding energy.	5. (a) Differentiate between nuclear fusion and nuclear fission reactions. Give examples.
4	ω	ω	4

ન average life related to the half-life? Define half-life and average life of radioactive elements. How is the

ω

<u>0</u> emission of alpha particle Write a brief note on the group displacement law with reference 5 ω

UNIT-IV

- 7 (a) What are the different types of determinate error? How are these errors detected and corrected? S
- G by a standard method and the other set by a new method, are given What is below : F-test? Two sets of results, in mg/litre, one set obtained

New method 26	Standard method 31
22	27
23	26
30	35
24	N
28	31
30	33
25	I

of freedom is 2.13. from that of the standard method. The critical value of F for 7 degrees Determine whether the precision of the new method differs significantly

S

- œ (a) What is meant by the term 'confidence limit? How is it calculated?
- 9 Write a note on reporting of analytical data.

Nω

0 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 :

		in for minu	cuic acia	- unit of oralle acia (g/ litre) actentified	netermin	24
Sample no.	1	N	ω	4	ы	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

Amount of oxalic acid (g/litre) determined

Show that there is no significant difference between the two methods. (The critical value of t for 5 degrees of freedom is 0.48.)

б

* * *

/374