

2015

(2nd Semester)

CHEMISTRY

SECOND PAPER

(Inorganic Chemistry—I)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(Marks : 35)

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

1. (a) Derive an equation correlating the wavelength of particle in motion to its momentum. Give signification of this relationship. 2+1
- (b) What do you understand by wave function ψ ? What is its significance? 2
- (c) The kinetic energy of an electron has been found to be 5.76×10^{-8} erg. Calculate the wavelength associated with the electron.
(Mass of electron = 9.1×10^{-28} gram,
 $h = 6.626 \times 10^{-27}$ erg-s) 2

G15—1000/232a

(Turn Over)

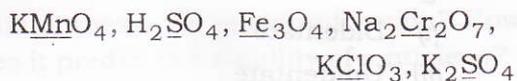
OR

2. (a) What is the difference between matter waves and light waves? 2
- (b) How does uncertainty principle introduced concept of probability? 2
- (c) Using the Slater's rule, calculate effective nuclear charge of 4s electron in the atom Zn. 3
3. (a) Explain the term 'ionization energy'. How is it measured? 2
- (b) Balance the following redox reaction by ion-electron method in acidic medium : 3
- $$\text{MnO}_4^- + \text{C}_2\text{O}_4^{2-} \rightarrow \text{Mn}^{2+} + \text{CO}_2$$
- (c) Distinguish between oxidation number and valency. 2

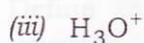
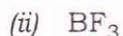
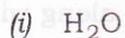
OR

4. (a) Define the equivalent weight of an oxidant (oxidizing agent). Calculate equivalent weight of KMnO_4 in acidic medium. 2
- (b) Explain why second ionization energy of sodium is very high as compared to its first ionization energy. 2

- (c) Calculate the oxidation numbers of the underlined elements in the following compounds : 3



5. (a) Predict the geometry of the following molecules on the basis of VSEPR theory : 3



- (b) Explain why H_2S is a gas and H_2O is liquid. 2

- (c) Explain, although both BH_3 and NH_3 are tetra-atomic, the dipole moment of BH_3 is zero but NH_3 is having 1.49D. 2

OR

6. (a) What do you understand by polar and non-polar molecules? Give examples. 2

- (b) Write short notes on the following : 3

(i) Intermolecular hydrogen bonding

(ii) Intramolecular hydrogen bonding

- (c) State the factors affecting the magnitude of the (i) polarizing power of a cation and (ii) polarizability of an anion. 2

7. (a) What is meant by the term 'ligand'? Give examples of each of the following ligands : 4
- (i) Bidentate
 - (ii) Unidentate
 - (iii) Hexadentate
 - (iv) Tridentate
- (b) Give one suitable example along with its IUPAC name for— 3
- (i) cationic complex;
 - (ii) anionic complex;
 - (iii) neutral complex.

OR

8. (a) Write the IUPAC names of the following complex compounds : 3
- (i) $K_4[Ni(CN)_4]$
 - (ii) $[Co(NH_3)_3(NO_2)_3]$
 - (iii) $[Co(en)_2F_2]Cl$
- (b) Illustrate with an example each of the following : 2
- (i) Linkage isomerism
 - (ii) Ionization isomerism
- (c) Write down the structure of the two ionization isomers of pentaamminebromo cobalt(III) sulphate. 2

9. (a) Explain the terms 'mass defect' and 'binding energy'. 3
- (b) What is meant by packing fraction? How does it predict the stability of a nucleus? 2
- (c) How many α and β particles are emitted in passing down from ${}_{90}^{232}\text{Th}$ to ${}_{82}^{208}\text{Pb}$? 2

OR

10. (a) Define the terms 'half-life period' and 'average-life period' of a radioactive substance. 2
- (b) Find out a relationship between half-life period and average-life period of radioactive substance. 2
- (c) Predict the bombarding projectile in each of the following cases : 3
- (i) ${}_{83}^{209}\text{Bi} + \underline{\hspace{1cm}} \rightarrow {}_{84}^{210}\text{Po} + {}_0^1n$
- (ii) ${}_{1}^2\text{H} + \underline{\hspace{1cm}} \rightarrow {}_{1}^1\text{H} + {}_0^1n$
- (iii) ${}_{13}^{27}\text{Al} + \underline{\hspace{1cm}} \rightarrow {}_{14}^{28}\text{Si} + {}_0^1n$

2 0 1 5

(2nd Semester)

CHEMISTRY

SECOND PAPER

(**Inorganic Chemistry—I**)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×5=5

1. Which of the following sets of quantum numbers is possible?

(a) $n = 4, l = 2, m = -2, s = -2$ ()

(b) $n = 4, l = 4, m = 0, s = +\frac{1}{2}$ ()

(c) $n = 4, l = 3, m = -3, s = -\frac{1}{2}$ ()

(d) $n = 4, l = 0, m = 0, s = 0$ ()

2. The neutron to proton ratio (n/p ratio) value for light stable nuclides up to ${}^{40}_{20}\text{Ca}$ is

(a) equal to 1 ()

(b) $n/p > 1$ ()

(c) $n/p < 1$ ()

(d) $n/p = 0.001$ ()

3. Which of the following has the largest ionic radius?

(a) Al^{+4} ()

(b) Al^{+} ()

(c) Al^{+2} ()

(d) Al^{+3} ()

4. The formula of the complex *tris*-ethylenediamine-cobalt(III) sulphate is

(a) $[\text{Co}(\text{en})_3]\text{SO}_4$ ()

(b) $[\text{Co}(\text{en})_3\text{SO}_4]$ ()

(c) $[\text{Co}(\text{en})_3]_2\text{SO}_4$ ()

(d) $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$ ()

5. Which of the following molecules has negligible tendency to form hydrogen bonds?

(a) HF ()

(b) H₂O ()

(c) HCl ()

(d) NH₃ ()

(4)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. A cricket ball is weighing 148.5 g. Find out the uncertainty in the velocity of the cricket ball, provided the uncertainty in its position is 5 pm. [Hint : 1 pm = 1×10^{-12} m]

2. The ionization energy of Na^+ is more than Ne although both have the same electronic configuration. Explain.

3. What are nuclear fissions? Discuss the release of energy in these reactions.

4. Define labile and inert complexes. Give examples.

CHEMISTRY

SECOND PAPER

(Inorganic Chemistry—I)

(PART - A—OBJECTIVE)

(Marks : 20)

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Section—A

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided.

1. Which of the following sets of quantum numbers is possible?

(a) $n = 4, l = 2, m = -2, s = -\frac{1}{2}$

(b) $n = 4, l = 4, m = 0, s = +\frac{1}{2}$

(c) $n = 4, l = 3, m = -3, s = -\frac{1}{2}$

(d) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

5. Define the following terms giving suitable examples :

- (a) Complex compound
- (b) Chelate effect
- (c) Coordination number

3. Which of the following has the largest ionic radius?

- (a) Al^{3+}
- (b) Al^{2+}
- (c) Al^{+}
- (d) Al^0

4. The formula of the complex tri-ethylenediamine-cobalt(II) sulphate is

- (a) $[\text{Co}(\text{en})_3]\text{SO}_4$
- (b) $[\text{Co}(\text{en})_3]\text{SO}_4 \cdot 3\text{H}_2\text{O}$
- (c) $[\text{Co}(\text{en})_3]\text{SO}_4 \cdot 6\text{H}_2\text{O}$
- (d) $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$
