

g) i)  $\text{Be}_2$  may exist at very low temperature. Comment. 1

OR

ii) What is meant by lithia water ?

4. a) Predict the geometries of the following molecules explaining the causes of deviation from the regular geometry if any ; **any two** : 1×2

i)  $\text{HXeO}_4^-$  ii)  $\text{S}_2\text{O}_3^{2-}$  iii)  $\text{IF}_5$  iv)  $\text{N}_3^-$

b) Draw the structures of **any two** of the followings : 1×2

a)  $\text{CrO}_5$  b)  $\text{P}_4\text{O}_{10}$  c)  $\text{B}_3\text{N}_3\text{H}_6$  d)  $\text{S}_4\text{N}_4$

c) What are  $\pi$ -acid ligands ? Draw the M.O diagram of CO molecules and justify the affinity towards metal ions. 3

d) Explain with the help of simple M.O diagram, that  $\text{N}_2$  is diamagnetic whereas  $\text{O}_2$  is paramagnetic. 2

e) In  $(\text{CH}_3)_2\text{PF}_3$ , the angle between the methyl groups is  $124^\circ$  – Explain the fact. 1

f) Explain why 2

i)  $\text{AlF}_6^{3-}$  ion is well known but not  $\text{BF}_6^{3-}$ .

ii) Sulphur forms  $\text{SF}_6$  but not  $\text{SCl}_6$  or  $\text{SH}_6$ .

## INTER B. SC. EXAMINATION, 2017

( 1st Semester )

CHEMISTRY (HONOURS)

PAPER - VII

INORGANIC CHEMISTRY

Time : Two hours

Full Marks : 50

*The figures in the margin indicate full marks.*

Attempt **all** questions

1. a) Explain the heavy ion projectile induced reactions in the light of nucleon transfer and particle emission reactions. 1  $\frac{1}{2}$
- b) 'In the heavier nuclei the fission and spallation reactions may occur simultaneously - explain with example. 1  $\frac{1}{2}$
- c) How would you differentiate between  $\beta$ -rays and cathode rays ? 1
- d) Illustrate the experiments that lead Rutherford and Soddy to propose the theory of Radioactive disintegration. 2

OR

How would you determine the Avogadro's number from radioactive decay measurements ? 2

[ 2 ]

- e) How would you establish the existence of neutrino and antineutrino? 2
- f) The meson exchange is almost instantaneous and it cannot go beyond the nucleus - explain. 2
- g) In the orbital electron capture, both fluorescence and Auger effect may occur - explain.  $2\frac{1}{2}$
2. a) Answer **any one** of the following:  $2\frac{1}{2}$
- i) State and explain Brönsted theory of acids and bases.
- ii) Comment, with logic, on the relative basicity of  $\text{NH}_3$ ,  $\text{N}(\text{CH}_3)_3$  and  $\text{N}(\text{CF}_3)_3$ .
- b) i) State the Pearson's HSAB principle, and explain it with example.  $2\frac{1}{2}$
- ii) Give example of a reaction where this principle is not obeyed.  $1\frac{1}{2}$
- c) Answer **any two** of the following: 3+3
- i) Describe, with a suitable example, how  $\text{H}^+$  ion concentration can influence the potential of a redox reaction.
- ii) Describe, with appropriate example, the basis of choosing a suitable indicator for a redox titration.

[ 3 ]

- iii) The  $E^0$  value of the  $\text{Cu}^{2+}/\text{Cu}^0$  half-cell is 0.34 V and that of the  $\text{Cu}^{2+}/\text{Cu}^+$  half-cell is 0.15 V. Find out the  $E^0$  value of the  $\text{Cu}^+/\text{Cu}^0$  half-cell.
3. a) Draw the MO energy level diagram for  $\text{BeH}_2$ . 2
- b) Write the angular part of the wave function of  $d_z^2$  orbital of H atom. Hence draw its shape. 2
- c) Draw a Walsh diagram for linear and bent  $\text{H}_3$  systems and hence predict the shape of  $\text{H}_3^-$ . 3

OR

- Explain the ability of ethylene as a ligand with transition metals having filled  $\pi_d$  orbitals. Give example of one such complex. 3
- d) The solubility of  $\text{BeO}$  in water increases on adding aqueous  $\text{BeSO}_4$  solution. Suggest a reason. 2
- e) Calculate the exchange energy for  $p^3$  and  $f^6$  electronic configurations in ground state. 1
- f) i) Show that the stability of the bonding orbital is less than the instability of the antibonding orbital of  $\text{He}_2$ . 2

OR

- ii) Find the energy of the bonding, non-bonding and antibonding orbitals in linear  $\text{H}_3$  systems. 2

[ Turn over