

2016

CHEMISTRY

(Major)

Paper : 6·4

(Inorganic Chemistry)

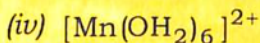
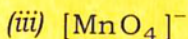
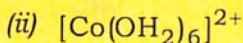
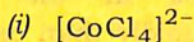
Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer : 1×7=7

(a) The visible spectra of salts of the following complexes are measured in aqueous solution. For which complex would the spectrum contain absorptions with the highest ϵ_{\max} values?

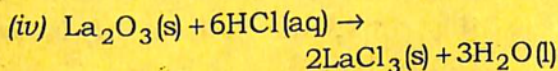
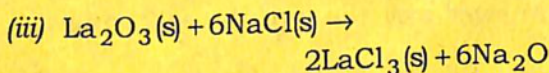
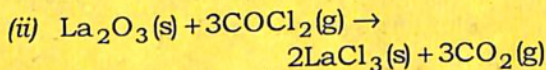
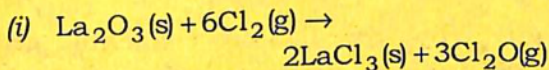


- (b) The total degeneracy of the terms 1G , 3F , 1D , 3P are
- (i) 9, 21, 5, 9 respectively
 - (ii) 21, 9, 9, 5 respectively
 - (iii) 5, 9, 21, 9 respectively
 - (iv) 9, 21, 9, 5 respectively
- (c) The correct one among the following statements about ligand substitution reaction is
- (i) complexes of the M(III) ions of f -block are inert
 - (ii) lability is common among the complexes of $4d$ and $5d$ series
 - (iii) all complexes of s -block ions except the smallest Be^{2+} and Mg^{2+} are inert
 - (iv) complexes of d^{10} ions (Zn^{2+} , Cd^{2+} , Hg^{2+}) are normally very labile
- (d) Which of the following gases on inhalation dissolves in the blood hemoglobin more rapidly than oxygen?
- (i) SO_2
 - (ii) NO
 - (iii) CO
 - (iv) NO_2

(e) The rate of radioactive decay can be increased by increasing the

- (i) temperature
- (ii) pressure
- (iii) size of the particle
- (iv) None of the above

(f) Which reaction is likely to result in successful conversion of $\text{La}_2\text{O}_3(\text{s})$ to $\text{LaCl}_3(\text{s})$?



(g) Radioisotope useful in the treatment of cancer, tumors and cells is

- (i) phosphorus-32
- (ii) carbon-14
- (iii) iron-55
- (iv) cobalt-60

2. Answer the following : 2×4=8

- (a) Explain why the absorption bands in electronic spectra of transition metal complexes are usually broad.
- (b) What is ligand-bridged mechanism in redox reactions? Illustrate with suitable examples.
- (c) What are metalloproteins? Name the two metalloproteins which comprise nitrogenase.
- (d) Why do lighter elements generally undergo nuclear fusion while heavier elements show nuclear fission?

3. Answer any *three* of the following : 5×3=15

- (a) What is lanthanide contraction? Explain the cause and effects of lanthanide contraction. 2+3=5
- (b) What is radioactive waste? Discuss the disposal of radioactive waste from nuclear reactors. 2+3=5
- (c) What are microstates in relation to an electronic configuration? Determine the possible spectroscopic term symbols for the p^2 -configuration from its microstates. 5

(d) Explain the mechanism of $\text{Na}^+ - \text{K}^+$ pump. 5

(e) What are successive and cumulative formation constants? The successive formation constants for complexes of cadmium with Br^- are $K_{11} = 36.3$, $K_{12} = 3.42$, $K_{13} = 1.15$, $K_{14} = 2.34$. Suggest an explanation of why $K_{14} > K_{13}$. 2+3=5

4. Answer any *three* of the following : 10×3=30

(a) (i) Write the basic principle of colorimetric titrations. Discuss how the amount of copper can be estimated in a given sample by colorimetric method. 2+3=5

(ii) What is cisplatin? Explain the mechanism of therapeutic action of cisplatin against cancer and also discuss the reason behind the inactivity of its *trans*-isomer. 1+2+2=5

(b) (i) Explain nuclear fission. Using laws of radioactive disintegration, show that

$$N = N_0 e^{-\lambda t} \quad \text{2+3=5}$$

(ii) What is *trans*-effect? Discuss the π -bonding theory of *trans*-effect. 2+3=5

- (c) (i) Explain the terms mass defect and binding energy of a nucleus. Calculate the mass defect and binding energy of the helium nucleus having a mass of 4.0039 a.m.u., given that masses of proton and neutron are 1.00758 a.m.u. and 1.00893 a.m.u. respectively. 2+3=5
- (ii) Write a note on importance of metal ions in diagnostic medical imaging. 5
- (d) (i) State the Laporte selection rule governing electronic transitions in transition metal complexes. Under what conditions are these rules relaxed? Explain. 2+3=5
- (ii) Discuss the paramagnetic behaviour of lanthanides and also account for the colour exhibited by them. 3+2=5
- (e) (i) What are fissile materials? How are they different from fissionable materials? Discuss with suitable examples. 1+4=5
- (ii) Write notes on the following : $2\frac{1}{2}\times 2=5$
- (1) Eigen-Wilkins mechanism
 - (2) Chelate effect

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