

2016

CHEMISTRY

( Major )

Paper : 6·4

( Inorganic Chemistry )

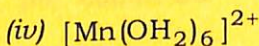
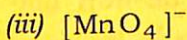
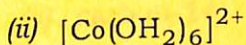
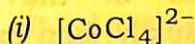
Full Marks : 60

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  $\epsilon_{\max}$  values?



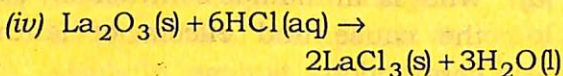
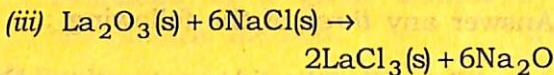
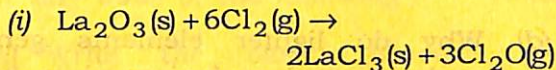
- (b) The total degeneracy of the terms  $^1G$ ,  $^3F$ ,  $^1D$ ,  $^3P$  are
- (i) 9, 21, 5, 9 respectively
  - (ii) 21, 9, 9, 5 respectively
  - (iii) 5, 9, 21, 9 respectively
  - (iv) 9, 21, 9, 5 respectively
- (c) The correct one among the following statements about ligand substitution reaction 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  $\text{Br}^-$  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

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

- (ii) What is *trans*-effect? Discuss the  $\pi$ -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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