

CHAPTER 6

TRANSITION ELEMENTS

MULTIPLE CHOICE QUESTIONS

- What is formula of haematite:
 - FeS_2
 - FeO_3
 - Fe_2O_3
 - Fe_3O_4
- Which is non-typical transition elements:
 - Cr
 - Mn
 - Zn
 - Fe
- Highest oxidation state of Mn in which compound:
 - K_2MnO_4
 - KMnO_4
 - MnO
 - MnO_2
- The trace metal present in insulin is:
 - Mn
 - Co
 - Fe
 - Zn
- The hybridization of Ni in $[\text{Ni}(\text{CN})_4]^{-2}$ ion is:
 - sp^3
 - dsp^3
 - d^2sp^3
 - dsp^2
- Which of the following cation has maximum unpaired electron:
 - Ni^{+2}
 - Co^{+2}
 - Mn^{+2}
 - Fe^{2+}
- Which is the configuration of Cr:
 - $3\text{d}^4 4\text{s}^2$
 - $3\text{d}^5 4\text{s}^1$
 - $3\text{d}^6 4\text{s}^1$
 - $2\text{d}^1 4\text{s}^2$
- The black image on an exposed and developed photographic film is composed of:
 - Ag
 - Ag_2O
 - AgBr
 - $\text{Ag}[(\text{SrO}_3)_2]^-$

9. The strength of binding energy of transition elements depend upon:
- (a) No. of $\bar{e}$ -pair (b) No. of unpaired $\bar{e}$
 (c) No. of neutron (d) No. of proton
10. Mild steel contain carbon:
- (a) 0.1 – 0.2% (b) 0.2 – 0.7%
 (c) 0.1 – 1.0% (d) 17
11. To prevent corrosion, iron pipes carrying drinking water are covered with Zn by process called:
- (a) Alloy formation (b) Electroplating
 (c) Galvanizing (d) Soldering
12. No. of $\bar{e}$ -pairs accepted by the central atom in a transition metal complex is called:
- (a) Co-ordination sphere (b) Co-ordination complex
 (c) Co-ordination number (d) Chelate
13. Group VIB of transition elements contains:
- (a) Zn, Cd, Hg (b) Fe, Ru, Os
 (c) Cr, Mo, W (d) Mn, Te, Re
14. Which of the following is a typical transition metal:
- (a) Sc (b) Y
 (c) Ra (d) Co
15. Co-ordination number of Pt in $[\text{Pt Cl}(\text{NO}_2)(\text{NH}_3)_4]^{2-}$ is:
- (a) 2 (b) 4
 (c) 1 (d) 6

answers

1.	(c)	2.	(c)	3.	(b)	4.	(d)	5.	(d)
6.	(c)	7.	(b)	8.	(a)	9.	(b)	10.	(a)
11.	(c)	12.	(c)	13.	(c)	14.	(d)	15.	(d)

solved EXERCISE

Q.1 Fill in the blanks:

- (i) The property of paramagnetism is due to the presence of _____ electrons.
- (ii) MnO_4^{-1} ion has _____ colour and $\text{Cr}_2\text{O}_7^{-2}$ has _____ colour.
- (iii) When potassium chromate is treated with an acid _____ is produced.
- (iv) The d-block elements are located between _____ and _____ block elements.
- (v) Oxidation number of Fe in $\text{K}_4[\text{Fe}(\text{CN})_6]$ is _____ while in $\text{K}_3[\text{Fe}(\text{CN})_6]$ it is _____.
- (vi) The presence of _____ in a metal promotes corrosion.
- (vii) If copper is in contact with aluminium _____ gets corroded.
- (viii) Complexes having sp^3d^2 hybridization have _____ shape.
- (ix) In naming the complexes, all the ligands are named in _____.
- (x) In an aqueous solution, CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$ exist in the form of _____.

answers

(i)	unpaired	(ii)	violet, orange red	(iii)	potassium dichromate
(iv)	s, p	(v)	+2, +3	(vi)	impurities
(vii)	aluminium	(viii)	octahedral	(ix)	alphabetic order
(x)	equilibrium				

Q.2 Indicate True or False:

- (i) A substance which is attracted into a magnetic field is said to be diamagnetic.
- (ii) Compounds of the transition elements are mostly coloured.
- (iii) Fe^{3+} ions are blue when hydrated.
- (iv) An extreme case of paramagnetism is called diamagnetism.
- (v) Tin plating is used to protect iron sheets from corrosion.

- (vi) In galvanizing, zinc prevents corrosion of iron.
- (vii) Tin plated iron gets rusted more rapidly when the protective coating is damaged than the unplated iron.
- (viii) The name of anionic ligands in a complex ends in suffix 'O'.
- (ix) Pig iron contains greater percentage of carbon than steel.
- (x) Complex compounds having dsp^2 hybridization have tetrahedral geometry.

answers

(i)	False	(ii)	True	(iii)	False	(iv)	False	(v)	True
(vi)	True	(vii)	True	(viii)	True	(ix)	True	(x)	False

Q.3 Multiple choice questions. Encircle the correct answer:

- (i) Which of the following is a non-typical transition element:
 - (a) Cr
 - (b) Mn
 - (c) Zn
 - (d) Fe
- (ii) Which of the following is a typical transition metal:
 - (a) Sc
 - (b) Y
 - (c) Ra
 - (d) Co
- (iii) f-Block elements are also called:
 - (a) Non-typical transition elements
 - (b) Outer transition elements
 - (c) Normal transition elements
 - (d) None is true
- (iv) The strength of binding energy of transition elements depends upon:
 - (a) Number of electron pairs
 - (b) Number of unpaired electrons
 - (c) Number of neutrons
 - (d) Number of protons
- (v) Group VIB of transition elements contains:
 - (a) Zn, Cd, Hg
 - (b) Fe, Ru, Os
 - (c) Cr, Mo, W
 - (d) Mn, Te, Re
- (vi) Which is the formula of tetraammine chloro-nitro-platinum (IV) sulphate:
 - (a) $[Pt(NH_3)_4(NO_2)]SO_4$
 - (b) $[PtNO_2Cl(NH_3)_4]SO_4$

- (c) $[\text{PtCl}(\text{NO}_2)(\text{NH}_3)_4]\text{SO}_4$ (d) $[\text{Pt}(\text{NH}_3)_4(\text{NO}_2)\text{Cl}]\text{SO}_4$
- (vii) The percentage of carbon in different types of iron products is in the order of:
- (a) $\text{Wrought iron} > \text{Steel} > \text{Cast iron}$ (b) $\text{Cast iron} > \text{Steel} > \text{Wrought iron}$
- (c) $\text{Cast iron} > \text{Wrought iron} > \text{Steel}$ (d) $\text{Cast iron} > \text{Steel} > \text{Wrought iron}$
- (viii) The colour of transition metal complexes is due to:
- (a) d-d transition of electrons (b) Paramagnetic nature of transition elements
- (c) Ionization (d) Loss of s-electrons
- (ix) Coordination number of Pt in $[\text{PtCl}(\text{NO}_2)(\text{NH}_3)_4]^2$ is:
- (a) 2 (b) 4
- (c) 1 (d) 6
- (x) The total number of transition element is:
- (a) 10 (b) 14
- (c) 40 (d) 58

answers

(i)	(c)	(ii)	(d)	(iii)	(d)	(iv)	(b)	(v)	(c)
(vi)	(c)	(vii)	(b)	(viii)	(a)	(ix)	(d)	(x)	(d)

Q.4 How does the electronic configuration of valence shell affect the following properties of the transition elements?

- (a) Binding energy (b) Paramagnetism
- (c) Melting points (d) Oxidation states

Ans. Detailed question. See text book (Q.5 and Q.6 are on next page).

Q.5 Explain the following terms giving examples:

- (a) Ligands (b) Coordination sphere
- (c) Substitutional alloy (d) Central metal atom

Ans. Detailed question. See text book.

Q.6 Describe the rules for naming the coordination complexes and give examples.

Ans. Descriptive question. See text book.

Q.7 What is the difference between wrought iron and steel? Explain the Bessemer's process for the manufacture of steel.

Ans. Wrought Iron and Steel: Wrought iron is the purest form of commercial iron and contains 0.12% to 0.25% carbon which is lowest percentage of carbon while steel is an alloy of iron containing 0.25% to 2.5% of carbon.

Process for manufacture of steel see in text book.

Q.8 Explain the following giving reasons:

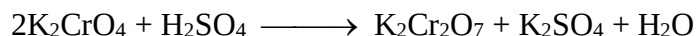
- (a) Why does damaged tin plated iron get rusted quickly.
- (b) Under what conditions does aluminium corrode?
- (c) How does the process of galvanizing protect iron from rusting?

Ans.

- (a) When iron is alone galvanic cell cannot be established and rusting is slow but when tin plating gets damaged on the surface of iron then iron comes in contact with moisture of air and a galvanic cell is established due to which rusting proceeds more rapidly.
- (b) The conditions necessary for aluminum corrosion are:
 - (i) Aluminum is in contact with less reactive metal like Cu.
 - (ii) Aluminum is provided with moisture by atmosphere or salt solution.
- (c) When iron is coated with more reactive metal (like Zn) to prevent corrosion then iron is protected. When coating is damaged galvanic cell established but iron remains intact because Zn will be rusted. So in this way galvanizing or Zn coating protect iron from rusting. It is called "sacrificial corrosion".

Q.9 How chromate ions are converted into dichromate ions?

Ans. Chromate (K_2CrO_4) is converted into dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) in the presence of conc. H_2SO_4 .



The above reaction is a reversible reaction and equilibrium shift towards right according to Le-Chatelier's Principle changing chromate ions into dichromate ions.

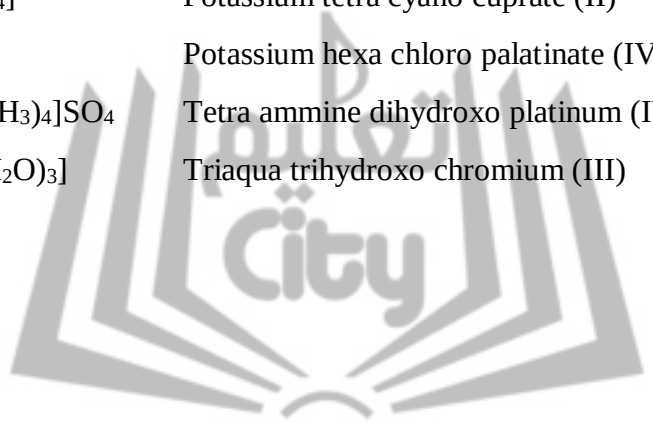
Q.10 Describe the preparation of KMnO_4 and K_2CrO_4 .

Ans. Descriptive question. Consult text book for details.

Q.11 Give systematic names to following complexes:

- | | |
|--|--|
| (a) $[\text{Fe}(\text{CO})_5]$ | (b) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ |
| (c) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ | (d) $\text{Na}_3[\text{CoF}_6]$ |
| (e) $\text{K}_2[\text{Cu}(\text{CN})_4]$ | (f) $\text{K}_2[\text{PtCl}_6]$ |
| (g) $[\text{Pt}(\text{OH})_2(\text{NH}_3)_4]\text{SO}_4$ | (h) $[\text{Cr}(\text{OH})_3(\text{H}_2\text{O})_3]$ |

Ans.

- | | |
|--|---|
| (a) $[\text{Fe}(\text{CO})_5]$ | Penta carbonyl iron (0) |
| (b) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ | Hexa ammine cobalt (III) chloride |
| (c) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ | Hexa aqua iron (II) ion |
| (d) $\text{Na}_3[\text{CoF}_6]$ | Sodium hexa fluoro cobaltate (III) |
| (e) $\text{K}_2[\text{Cu}(\text{CN})_4]$ | Potassium tetra cyano cuprate (II) |
| (f) $\text{K}_2[\text{PtCl}_6]$ | Potassium hexa chloro platinate (IV) |
| (g) $[\text{Pt}(\text{OH})_2(\text{NH}_3)_4]\text{SO}_4$ | Tetra ammine dihydroxo platinum (IV) sulphate |
| (h) $[\text{Cr}(\text{OH})_3(\text{H}_2\text{O})_3]$ | Triaqua trihydroxo chromium (III) |
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DO YOU KNOW?

1. Formula of pyrolusite is MnO_2 .
2. Paramagnetic behaviour is due to the presence of unpaired electrons.
3. The electrons in the low energy d-orbital absorb a part of visible light and jump to high energy d-orbital. This is called d-d transition.
4. The ions or neutral molecules which donate electron pairs to the central metal atom or ion is called ligand. In $\text{K}_4[\text{Fe}(\text{CN})_6]$, CN^- is ligand.
5. The central metal atom or ion along with ligand is called coordination sphere.
6. The number of electron pairs provided by the ligand to the central atom or ion is called coordination number. In $\text{K}_4[\text{Fe}(\text{CN})_6]$, coordination number of Fe is 6.
7. Wrought iron is the purest form of iron.
8. KMnO_4 is called pinky.
9. $\text{K}_2\text{Cr}_2\text{O}_7$ is called “Surkh Kahi”.
10. Complexes having d^2sp^3 hybridization have octahedral shape.

