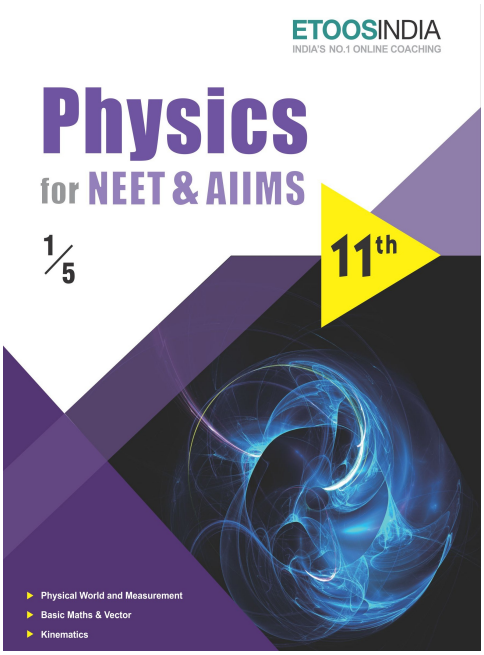
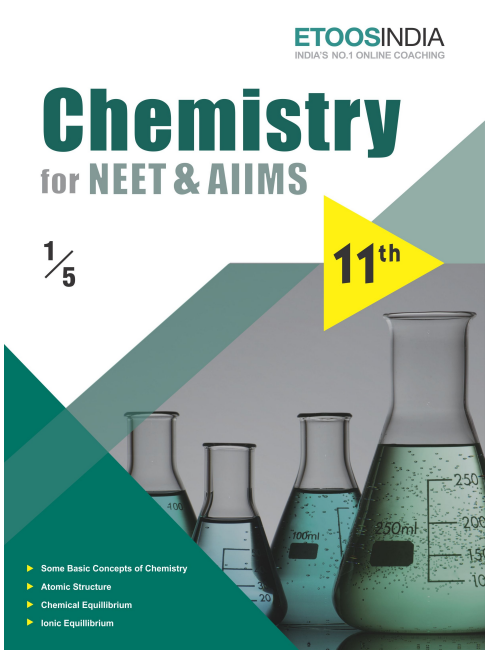
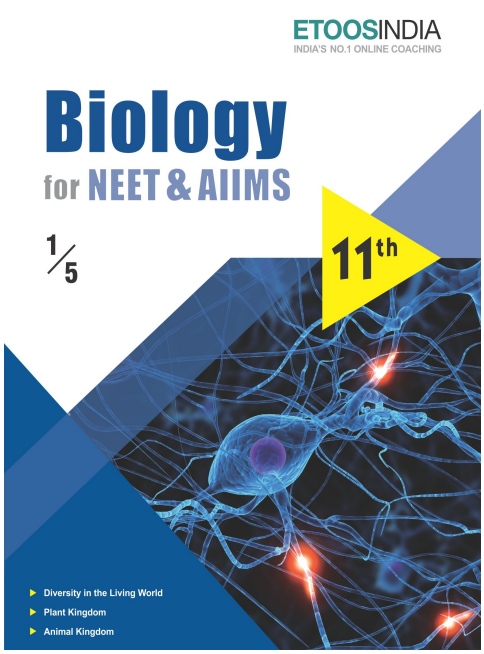
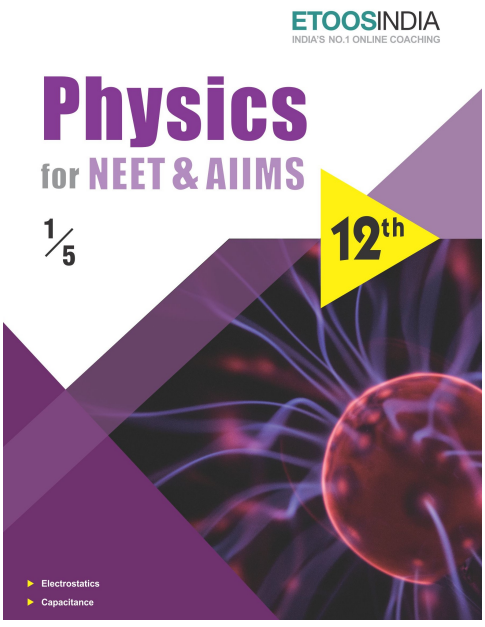
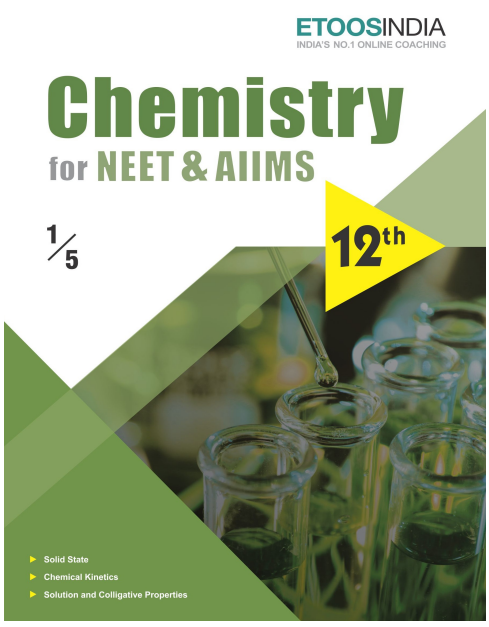
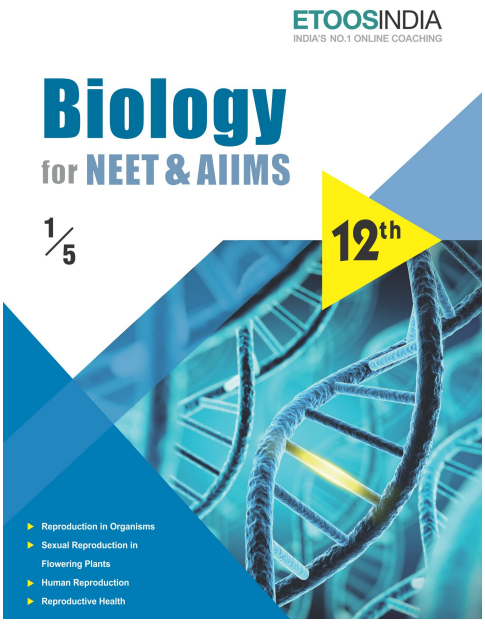












CHAPTER 07

TRANSITION ELEMENTS (D & F - BLOCK)

I've always believed there are moments in our lives which can be defined as a transition between the before and after, between the cause and the effect.

"BENJAMIN X. WRETLIND"

INTRODUCTION

The d-block of the periodic table contains the elements of the groups 3-12 in which the d orbitals are progressively filled in each of the four long periods. The elements constituting the f-block are those in which the 4 f and 5 f orbitals are progressively filled in the latter two long periods; these elements are formal members of group 3 from which they have been taken out to form a separate f-block of the periodic table. The names transition metals and inner transition metals are often used to refer to the elements of d-and f-blocks respectively.

There are mainly three series of the transition metals, 3d series (Sc to Zn), 4d series (Y to Cd) and 5d series (La to Hg, omitting Ce to Lu). The fourth 6d series which begins with Ac is still incomplete. The two series of the inner transition metals, (4f and 5f) are known as lanthanoids and actinoids respectively.

The presence of partially filled d or f orbitals in their atoms sets the study of the transition elements and their compounds apart from that of the main group elements. However, the usual theory of valence as applicable to the main group elements can also be applied successfully to the transition elements.

TRANSITION ELEMENTS (D & F BLOCK)

(a) The element lying between s- and p-block element of the periodic table are collectively known as transition or transitional elements. (T.E'.S.)

(b) Their properties are transitional between the highly electropositive s- block element to least electropositive p- block element.

(c) In d- block elements, the last differentiating electron is accommodated to the penultimate shell.

(d) The general electronic configuration of transition element is **(n-1)d1-10 ns0, 1 or 2**

(e) These elements either in their atomic state or in any of their common oxidation state have partly filled (n-1)d orbitals of $(n-1)^{th}$ main shell.

(f) The transition elements have an incompletely filled d-level. Since Zn, Cd, Hg elements have d^{10} configuration and are not considered as transition elements but they are d-block elements.

Electronic Configuration

Ist Transition Series

Symbol	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Atomic No.	21	22	23	24	25	26	27	28	29	30
3d electrons	1	2	3	5	5	6	7	8	10	10
4s electrons	2	2	2	1	2	2	2	2	1	2

Irregular electronic configuration Cr, Cu

IInd Transition Series

Symbol	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
Atomic No.	39	40	41	42	43	44	45	46	47	48
4d electrons	1	2	4	5	5	7	8	10	10	10
5s electrons	2	2	1	1	2	1	1	0	1	2

Irregular electronic configuration Nb, Mo, Ru, Rh, Pd, Ag

IIIrd Transition Series

Symbol	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg
Atomic No.	57	72	73	74	75	76	77	78	79	80
5d electrons	1	2	3	4	5	6	7	9	10	10
6s electrons	2	2	2	2	2	2	2	1	1	2

ETOOS KEY POINTS

Irregular electronic configuration W, Pt, Au

The irregularities in the observed configuration of Cr ($3d^5\ 4s^1$ instead of $3d^4\ 4s^2$), Cu ($3d^{10}\ 4s^1$), Mo ($4d^5\ 5s^1$), Pd ([Kr] $4d^{10}\ 5s^0$), Au ([Xe] $4f^{14}\ 5d^{10}\ 6s^1$), Ag ([Kr] $4d^{10}\ 5s^1$) are explained on the basis of the concept that half-filled and completely filled d-orbitals are relatively more stable than other d-orbitals.

Etoos Tips & Formulas

d-block

1. The f-blocks elements differ from those of d-blocks elements in that they have unstable electroconfiguration in the outer shells in comparison to that of d-blocks element.

   d-block elements electronic configuration

   $$(n-1)d^{1-10}\ ns^{1-2}$$

   Most common oxidation state +2

2. The colour in d-block elements is due to d-excitation while in f-block element, it is due to f-f transitions.

3. They show variable oxidation state due to less energy difference between ns and (n-1) d sub shell.

4. Most of the d-block compounds act as catalyst due to their variable oxidation state or complex formation tendency or adsorption on their surface. Example :

   contact proecess = V_2O_5

   Ostwald process = Pt/Rh

   Haber process = $Fe_2O_3 + Al_2O_3 + K_2O$

   Zeigter Natta = $TiCl_4 + (C_2H_5)_3Al$

   Phenton reagent = $FeSO_4 + H_2O_2$

   Hydrogenation of Alkene = Ni/Pd

   Decomposition of $KClO_3 = MnO_2$

   Wilkinsion catalyst = $RhCl + PPh_3$

5. Action of heat on copper sulphate

   $$CuSO_4.5H_2O \xrightarrow{\text{Exposure}} CuSO_4.3H_2O \xrightarrow{373K} CuSO_4.H_2O \xrightarrow{500K} CuSO_4$$

   Bluish green White

6. **Chemical volcano**. When crystals of red coloured ammonium dichromate are heated, a violent action takes place accompained by flashes of light and nitrogen is liberated leaving behind a dark green residue of chromium sesquioxide (Cr_2O_3)

   $$(NH_4)_2Cr_2O_7 \rightarrow N_2 + 4H_2O + Cr_2O_3$$

   Ammonium dichromate Chromium sesquioxide

SOLVED EXAMPLE

Ex. 1 Amongst $[TiF_6]^{2-}$, $[CoF_6]^{3-}$, Cu_2Cl_2 and $[NiCl_4]^{2-}$ [Atomic number ; Ti = 22, Co = 27, Cu = 29, Ni = 28] the colourless species are :

(A) $[TiF_6]^{2-}$ and $[Cu_2Cl_2]$ (B) Cu_2Cl_2 and $[NiCl_4]^{2-}$

(C) $[TiF_6]^{2-}$ and $[CoF_6]^{3-}$ (D) $[CoF_6]^{3-}$ and $[NiCl_4]^{2-}$

Ans. (A)

Sol. In $[TiF_6]^{2-}$ the titanium is in +4 oxidation state having the electronic configuration $[Ar]^{18}\ 3d^0\ 4s^0$. Similarly in Cu_2Cl_2 the copper is in +1 oxidation state having the electronic configuration $[Ar]^{18}\ 3d^{10}\ 4s^0$. As they do not have any unpaired electrons for d-d transition, they are therefore colourless.

In $[NiCl_4]^{2-}$ the nickel is in +2 oxidation state and electronic configuration is $[Ar]^{18}\ 3d^8\ 4s^0$. As it has two unpaired electrons, so the complex is coloured.

In $[CoF_6]^{3-}$, the cobalt is in +3 oxidation state having electron configuration [Ar] $3d^6\ 4s^0$. As it has four unpaired electrons, so the complex is coloured.

Ex. 2 On the basis of trends in the properties of the 3d-series elements, suggests possible M^{2+} aqua ions for use as reducing agents, and write a balanced chemical equation for the reaction of one of these ions with O_2 in acidic solution.

Sol. Because oxidation state +2 is most stable for the later elements of 3d-series elements, strong reducing agents include ions of the metals on the left of the series: such ions include V^{2+} (aq) and Cr^{2+} (aq) The Fe^{2+} (aq) ion is only weakly reducing. The Co^{2+} (aq), Ni^{2+} (aq), and Cu^{2+} (aq) ions are not oxidized in water.

$$Fe^{3+} \xrightarrow{+0.77} Fe^{2+} \xrightarrow{-0.44} Fe$$

The chemical equation for the oxidation is then

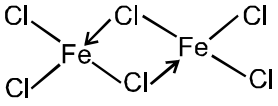
$$4\,Fe^{2+}(aq) + O_2(g) + 4H^+(aq) \longrightarrow 4Fe^{3+}(aq) + 2H_2O(\ell).$$

Ex. 3 Match the reactions given in column-I with the characteristic(s) of the reaction products given in column-II.

Column-I	Column-II
(A) $TiCl_4 \xrightarrow{Zn}$	(p) One of the products is bright orange coloured but diamagnetic.
(B) $FeCl_3 \xrightarrow{573K}$	(q) One of the products is green coloured and paramagnetic.
(C) $KMnO_4 \xrightarrow{750K}$	(r) One of the products is violet and paramagnetic.
(D) $K_2Cr_2O_7 + H_2SO_4$ (cold & conc.)	(s) One of the products exists as dimer.

Ans. [A – r] ; [B – s ; [C – q] ; [D – p].

Sol. (A) $TiCl_4 \xrightarrow{Zn} TiCl_3$, violet (one unpaired electron so d-d transition is possible).

(B) $2FeCl_3 \xrightarrow{573K}$ 

gas dimer.

(C) $2KMnO_4 \xrightarrow{750K} K_2MnO_4$ green (one unpaired electron so d-d transition is possible) + $MnO_2 + O_2$.

(D) $K_2Cr_2O_7 + 2H_2SO_4 \longrightarrow 2CrO_3$ bright orange (diamagnetic) + $2KHSO_4 + H_2O$.

Ex. 4 Among the following statements choose the true or false statement(s).

(A) $K_2Cr_2O_7$ on heating with charcoal gives metallic potassium and Cr_2O_3.

(B) On heating in current of H_2 the crystalline $KMnO_4$ is converted into KOH and Mn_3O_4.

(C) Hydrated ferric chloride on treatment with 2, 2–dimethoxypropane gives anhydrous ferric chloride.

Ans. (A) False (B) False

(C) True

Sol. (A) $K_2Cr_2O_7 + 2C$ (charcoal) $\xrightarrow{\Delta} Cr_2O_3 + K_2CO_3 + CO\uparrow$.

(B) $2KMnO_4 + 5H_2 \xrightarrow{\Delta} 2\,KOH + 2MnO + 4H_2O$.

(C) $FeCl_3 . 6H_2O + 6CH_3-C(OCH_3)_2-CH_3 \longrightarrow FeCl_3$ (anhydrous) + $12CH_3OH + 6CH_3COCH_3$.

Ex. 5 A compound (A) is used in paints instead of salts of

Exercise # 1 SINGLE OBJECTIVE NEET LEVEL

1. The number of unpaired electrons Cr^{+} in will be
(A) 3 (B) 4
(C) 5 (D) 6

2. The highest oxidation state of Cr will be
(A) 2 (B) 3
(C) 4 (D) 6

3. Which statement is true about the transitional elements
(A) They are highly reactive
(B) They show variable oxidation states
(C) They have low M.P.
(D) They are highly electropositive

4. The transitional metal which form green compound in +3 oxidation state and yellow orange compound in +6 oxidation state is
(A) Fe (B) Ni
(C) Cr (D) CO

5. Highest (+7) oxidation state is shown by
(A) Co (B) Cr
(C) V (D) Mn

6. Transitional elements are
(A) All metals
(B) Few metals and few non-metals
(C) All solids
(D) All highly reactive

7. Which of the following has highest ionic radii
(A) Cr^{+3} (B) Mn^{+3}
(C) Fe^{+3} (D) Co^{+3}

8. In a reaction the ferrous iron is oxidised to ferric ion. The equivalent weight of the ion in the above reaction is equal to
(A) Half of the atomic weight
(B) 1/5 of the atomic weight
(C) The atomic weight
(D) Twice the atomic weight

9. Which of the following element has maximum density
(A) Hg (B) Au
(C) Os (D) Pb

10. Which is heaviest among the following
(A) Iron (B) Copper
(C) Gold (D) Silver

11. Transitional elements exhibit variable valencies because they release electrons from the following orbits
(A) ns orbit (B) ns and np orbits
(C) (n - 1)d and ns orbits (D) (n - 1)d orbit

12. The tendency towards complex formation is maximum in
(A) s - block elements (B) p - block elements
(C) d - block elements (D) f - block elements

13. Which forms coloured salts
(A) Metals
(B) Non-metals
(C) p - block elements
(D) Transitional elements

14. Which element belongs to d - block
(A) Na (B) Ca
(C) Cu (D) Ar

15. Variable valency is shown by
(A) Na (B) Cu
(C) Mg (D) Al

16. The element with a atomic number 26 is
(A) A non-metal (B) Krypton
(C) Iron (D) Manganese

17. One of the following metals forms a volatile carbonyl compound and this property is taken advantage of for its extraction. This metal is
(A) Iron (B) Nickel
(C) Cobalt (D) Tungston

18. The coinage metals are
(A) Iron, Cobalt, Nickel
(B) Copper and Zinc
(C) Copper, Silver and Gold
(D) Gold and Platinum

19. Which of the following structure is that of a coinage metal
(A) 2, 8, 1 (B) 2, 8, 18, 1
(C) 2, 8, 8 (D) 2, 18, 8, 3

20. An elements in+3 oxidation state has the electronic configuration $(Ar)3d^3$. Its atomic number is
(A) 24 (B) 23
(C) 22 (D) 21

Exercise # 2 SINGLE OBJECTIVE AIIMS LEVEL

1. The atomic volumes of the transition elements are low compared with elements in neighboring group 1 and 2 because
(A) the nuclear charge is poorly screened and so attracts all the electrons more strongly.
(B) the extra electrons added occupy inner orbitals.
(C) (A) and (B) both.
(D) none.

2. The transition elements have a general electronic configuration :
(A) $ns^2\ np^6\ nd^{1-10}$
(B) $(n-1)\ d^{1-10}\ ns^{0-2}\ np^{0-6}$
(C) $(n-1)\ d^{1-10}\ ns^{1-2}$
(D) none.

3. The wrong statement regarding transition metals among the following is :
(A) 4s electrons penetrate towards the nucleus more than 3d electrons
(B) atomic radii of transition metals increase rapidly with increase in atomic number because of poor shielding of nuclear attraction by (n – 1)d electrons
(C) second and third transition series elements have nearly the same size
(D) their densities are higher and densities of the 5d series elements are higher than those of 4d series elements.

4. Which of the following statements is correct ?
(A) The lesser number of oxidation states in 3d-series in the beginning of the series is due to the presence of too few electrons to loose or share
(B) The lesser number of oxidation states in 3d-series towards the end of the series is due to the presence of too many electrons and thus fewer empty orbitals to share electrons with the ligands
(C) (A) and (B) both
(D) None is correct

5. First IE of 5d series elements are higher than those of 3d and 4d series elements. This is due to :
(A) bigger size of atoms of 5d-series elements than 3d-series elements.
(B) greater effective nuclear charge is experienced by valence electrons because of the weak shielding of the nucleus by $4f$-electrons in 5d series.
(C) (A) and (B) both.
(D) None of these.

6. Maximum oxidation sate is shown by :
(A) Os (B) Mn
(C) Cr (D) Co

7. Ionisation energies of Ni and Pt in kJ mol^{-1} are given below.

	$\underbrace{(IE)_1 + (IE)_2}$	$\underbrace{(IE)_3 + (IE)_4}$
Ni	2.49	8.80
Pt	2.60	6.70

So, (select the correct statement)
(A) nickel (II) compounds tend to be thermodynamically more stable than platinum (II)
(B) platinum (IV) compounds tend to be more stable than nickel (IV)
(C) (A) & (B) both
(D) none is correct

8. Which of the following statement is false ?
(A) Of the d^4 species, manganese (III) is strongly reducing while Cr^{2+} is strongly oxidising.
(B) Cobalt(II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidised.
(C) The d^1 configuration is very unstable in ions.
(D) None of these

9. Magnetic moment of Cr^{+2} (Z =24), Mn^{+2} (Z = 25) and Fe^{2+} (Z = 26) are x,y,z. They are in order :
(A) $x < y < z$ (B) $x > y > z$
(C) $z < x = y$ (D) $x = z < y$

10. The magnetic moment of $_{25}Mn$ in ionic state is $\sqrt{15}$ B.M, then Mn is in :
(A) +2 state (B) +3 state
(C) +4 state (D) +5 state

11. Which of the following group of ions is paramagnetic in nature :
(A) Cu^+, Zn^{2+}, Sc^{3+} (B) $Mn^{2+}, Fe^{3+}, Ni^{2+}$
(C) $Cr^{2+}, Mn^{3+}, Sc^{3+}$ (D) $Cu^{2+}, Ni^{2+}, Ti^{4+}$

12. Which of the following has the maximum number of unpaired d-electron?
(A) Zn^{2+} (B) Fe^{2+}
(C) Ni^{2+} (D) Cu^{2+}

13. The highest magnetic moment is shown by the transition metal ion with the outermost electronic configuration is :
(A) $3d^5$ (B) $3d^2$
(C) $3d^7$ (D) $3d^9$

Exercise # 3 PART - 1 MATRIX MATCH COLUMN

1. Match the reactions listed in Column (I) with the characteristic(s) of the products/type of reactions listed in Column (II).

Column - I	Column - II
(A) $MnO_4^{2-} + CO_2 \longrightarrow$	(p) Two pungent smelling gases are liberated.
(B) $CrO_4^{2-} + H^+ \longrightarrow$	(q) Show disproportionation reaction.
(C) $FeSO_4 \xrightarrow{\Delta}$	(r) Dimeric bridged tetrahedral metal ion.
(D) $CuCl_2\,2H_2O \xrightarrow{\Delta}$	(s) One of the products has central metal in its highest stable oxidation state.

2. Match the salts/mixtures listed in Column (I) with their respective name listed in Column (II).

Column - I	Column - II
(A) $ZnS + BaSO_4$ mixture	(p) Lunar caustic
(B) $FeSO_4(NH_4)_2SO_4.6H_2O$	(q) Schwitzer`s regent.
(C) $AgNO_3$	(r) Lithopone
(D) $[Cu(NH_3)_4]SO_4$	(s) Mohr's salt

3. Match the pairs of complexes/compounds listed in Column (I) with the characteristic(s) of the reaction products listed in Column (II).

Column - I	Column - II
(A) Cu(I) and Zn (II) complexes	(p) Pair of compounds having similar colour and some magnetic moment but equal.
(B) $KMnO_4$ and $K_2Cr_2O_7$	(q) Pair of compounds which are diamagnetic but coloured.
(C) Cu_2O and HgI_2	(r) Pair of compounds having metals in the highest stable oxidation states.
(D) $VOCl_2$ and $CuCl_2$	(s) Pair of compounds which show diamagnetism and are colourless.

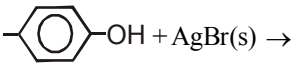
4.

Column-I (Metals)	Column-II (Ores)
(A) Zn	(p) Cyanide process
(B) Cu	(q) hydrometallurgical process
(C) Ag	(r) roasting
(D) Pt	(s) brass.

5.

Column-I (Alloys)	Column-II (Constituents)
(A) $TiCl_4$	(p) Adams catalyst in reduction
(B) $PdCl_2$	(q) In preparation of $(CH_3)_2SiCl_2$
(C) Pt/PtO	(r) Used as the Natta catalyst in polythene production
(D) Cu	(s) Wake process for converting C_2H_4 to CH_3CHO

6. Match the reactions in Column I with the types of products / the use of products in Column II.

Column - I	Column - II
(A) 	(p) Turnbull's blue pigment
(B) $BaCl_2 + K_2Cr_2O_7 + H_2SO_4 \rightarrow$	(q) Schwitzer's reagent
(C) $FeSO_4 + K_3[Fe(CN)_6] \rightarrow$	(r) Rinmann's green pigment
(D) $Cu(OH)_2 + NH_4OH + (NH_4)_2SO_4 \rightarrow$	(s) Chromyl chloride test
(E) $ZnO + Co(NO_3)_2 \xrightarrow{\Delta}$	(t) Photography

Exercise # 4

PART - 1 | PREVIOUS YEAR (NEET/AIPMT)

1. Which one of the following forms a colourless solution in aqueous medium ?
(At.No. Sc=21, Ti =22, V=23, Cr=24)
[CBSE AIPMT 2000]
(A) V^{3+} (B) Cr^{3+}
(C) Ti^{3+} (D) Sc^{3+}

2. Which of the folloiwng statements is not correct ?
[CBSE AIPMT 2001]
(A) La $(OH)_3$ is less basic than Li $(OH)^{3+}$ ion decreases
(B) In lanthanide series, ionic radius of Ln^{+3} ion decreases
(C) La is actually an element of transition series rather lanthanide
(D) Atomic radium of Zr and Hf are same because of lanthanide contraction

3. In the following transition metals, the maximum number of oxidation states are exhibited by
[CBSE AIPMT 2002]
(A) chromium (Z=24)
(B) manganese (Z=25)
(C) iron (Z=26)
(D) titanium (Z=22)

4. General electronic configuration of lanthanides are
[CBSE AIPMT 2002]
(A) $(n-2)\ f^{1-14}\ (n-1)\ s^2p^6d^{0-1}ns^2$
(B) $(n-2)\ f^{10-14}(n-1)\ d^{\ 0-1}ns^2$
(C) $(n-2)\ f^{\ 0-14}(n-1)d^{10}ns^2$
(D) $(n-2)d^{0-1}\ (n-1)f^{1-14}ns^2$

5. In the silver plating of coper, $K[Ag(CN)_2]$ is used instead of $AgNo_3$. The reason is
[CBSE AIPMT 2002]
(A) a thin layer of Ag is formed on Cu
(B) more voltage is required
(C) Ag^+ ions are completely removed from solution
(D) less availability of Ag^+ ions, as Cu cannot displace Ag from [Ag from $[Ag(CN)_2]^-$ ion

6. $CuSO_4$ when reacts with KCN forms CuCN which is insoluble in water. If is soluble in water. It is soluble in excess of KCN due to the formation of the complex
[CBSE AIPMT 2002]
(A) $K_2[Cu(CN)_4]$ (B) $K_3[Cu\,(CN)_4]$
(C) $Cu\,(CN)_2$ (D) $Cu\,[KCu(\,CN)_4]$

7. The basic character of the transition metal monoxides follows the order
(At. no. Ti=22, V=23, Cr= 24, Fe=26)
[CBSE AIPMT 2003]
(A) TiO > FeO > VO > CrO
(B) TiO > VO > CrO > FeO
(C) VO > CrO> TiO> FeO
(D) CrO > VO > FeO > TiO

8. The correct order of ionic redil of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is [CBSE AIPMT 2003]
At.No.Y=39,La=57, Eu=63,Lu=71
(A) $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$
(B) $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$
(C) $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$
(D) $Y^{3+} < LU^{3+} < Eu^{3+} < Lu^{3+}$

9. Which one of the following characteristics of the transition metals is associated with their catalytic activity? [CBSE AIPMT 2003]
(A) Colour of hydrated ions
(B) Variable oxidation states
(C) High enthalpy of atomisation
(D) Paramagnetic behaviour

10. Lanthanides are [CBSE AIPMT 2004]
(A) 14 elements in the sixth period (At. no. = 90 to 103) that are filling 4f sub-level
(B) 14 elements inthe seventh period (At. no. = 90 to 103) that are filling 5f sub-level
(C) 14 elements in the sixth period (At. no. = 58 to 71) that are filling 4f sub-level
(D) 14 elements in the seventh period (At. no. = 58 to 41) that are filling 4f sub-level

11. Among the following series of transition metal ions, the one in which all metal ions have $3d^2$ electronic configurations is [CBSE AIPMT 2004]
(At.No Ti=22, V=23,Cr=24, Mn=25
(A) Ti^{3+}, V^{2+},$Cr^{3+}Mn^{4+}$ (B) Ti^{+}, V^{4+}, Cr^{6+}, $Mn7^{+}$
(C) Ti^{4+},V^{3+},Cr^{2+},Mn^{3+} (D) Ti^{2+},V^{3+} ,Cr^{4+},Mn^{5+}

12. Four successive members of the first row transition elements are listed below with their atomic numbers. which one of them is expected to have the highest third ionisation enthalpy? [CBSE AIPMT 2005]
(A) Vanadium (Z=23) (B) Chromium (Z=24)
(C) Iron (Z=26) (D) Managanese (Z=25)

MOCK TEST

STRAIGHT OBJECTIVE TYPE

1. Zn and Hg belong to the same group, they differ in many of their properties. The property that is shared by both is
   (A) They form oxide readily **(B)** They react with steam readily
   (C) They react with hot concentrated sulphuric acid **(D)** They react with hot sodium hydroxide

2. Which of the following ionic species will impart colour to an aqueous solution
   (A) Ti^{4+} **(B)** Cu^{+} **(C)** Zn^{2+} **(D)** Cr^{3+}

3. The number of electrons in the outermost shell of the 3d-transition elements generally remains
   (A) $(n-1)d^n$ **(B)** nd^n **(C)** ns^2 **(D)** $(n-1)s^2$

4. The 3d-elements show variable oxidation states. What is the maximum oxidation state shown by the element Mn
   (A) + 4 **(B)** + 5 **(C)** + 6 **(D)** + 7

5. Which of the following ions gives coloured solution
   (A) Cu^{+} **(B)** Zn^{2+} **(C)** Ag^{+} **(D)** Fe^{2+}

6. Which metal represents more than one oxidation state
   (A) Al **(B)** Na **(C)** Mg **(D)** Fe

7. A reduction in atomic size with increase in atomic number is a characteristic of elements of
   (A) High atomic masses **(B)** d-block **(C)** f-block **(D)** Radioactive series

8. Colourless solutions of the following four salts are placed separately in four different test tubes and a strip of copper is dipped in each one of these. Which solution will turn Blue
   (A) KNO_3 **(B)** $AgNO_3$ **(C)** $Zn(NO_3)_2$ **(D)** $ZnSO_4$

9. Zinc when reacted with excess of NaOH gives
   (A) Zinc hydroxide **(B)** Zinc oxide **(C)** Di sodium zincate **(D)** Sodium zincate

10. Pair of metals which dissolves in NaOH solution
    (A) Al, Cu **(B)** Zn, Hg **(C)** Zn, Cu **(D)** Zn, Al

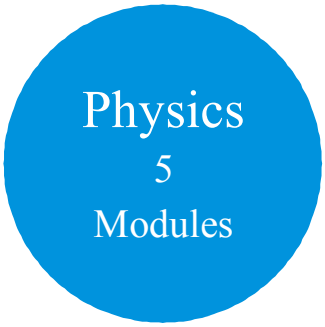
11. Lucas reagent is
    (A) Anhydrous $ZnCl_2$ + conc.HCl **(B)** Hydrous $ZnCl_2$ + dil.HCl
    (C) Conc. HNO_3 + anhydrous $ZnCl_2$ **(D)** Conc. HNO_3 + anhydrous $MgCl_2$

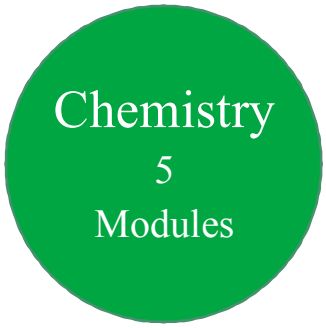
12. What is the effect of shaking dil. H_2SO_4 with small quantity of anhydrous $CuSO_4$
    (A) The white solid dissolves to form a colourless solution
    (B) The white solid dissolves to form a green solution
    (C) The white solid turns blue but does not dissolve
    (D) The white solid dissolves to form a blue solution

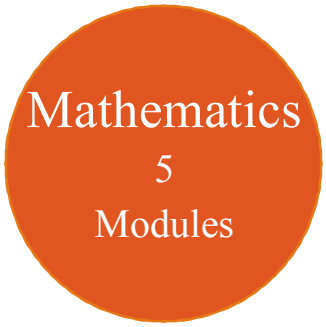
13. Which metal is electro-deposited on iron surface to prevent rusting
    (A) Cu **(B)** Zn **(C)** Mg **(D)** Pb

14. To prevent corrosion, iron pipes carrying drinking water are covered with zinc. The process involved is
    (A) Photoelectrolysis **(B)** Electroplating **(C)** Galvanization **(D)** Cathodic protection

11th Class Modules Chapter Details

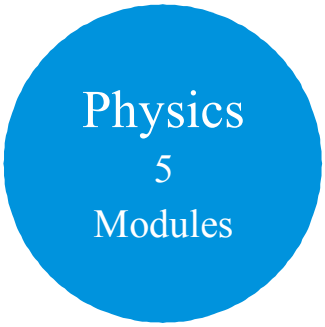


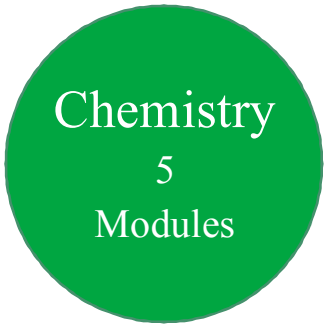


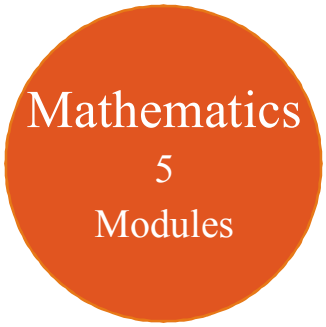


PHYSICS	CHEMISTRY	BIOLOGY
Module-1 1. Physical World & Measurements 2. Basic Maths & Vector 3. Kinematics **Module-2** 1. Law of Motion & Friction 2. Work, Energy & Power **Module-3** 1. Motion of system of particles & Rigid Body 2. Gravitation **Module-4** 1. Mechanical Properties of Matter 2. Thermal Properties of Matter **Module-5** 1. Oscillations 2. Waves	**Module-1(PC)** 1. Some Basic Conceps of Chemistry 2. Atomic Structure 3. Chemical Equilibrium 4. Ionic Equilibrium **Module-2(PC)** 1. Thermodynamics & Thermochemistry 2. Redox Reaction 3. States Of Matter (Gaseous & Liquid) **Module-3(IC)** 1. Periodic Table 2. Chemical Bonding 3. Hydrogen & Its Compounds 4. S-Block **Module-4(OC)** 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry **Module-5(OC)** 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry & Analysis Of Organic Compounds	**Module-1** 1. Diversity in the Living World 2. Plant Kingdom 3. Animal Kingdom **Module-2** 1. Morphology in Flowering Plants 2. Anatomy of Flowering Plants 3. Structural Organization in Animals **Module-3** 1. Cell: The Unit of Life 2. Biomolecules 3. Cell Cycle & Cell Division 4. Transport in Plants 5. Mineral Nutrition **Module-4** 1. Photosynthesis in Higher Plants 2. Respiration in Plants 3. Plant Growth and Development 4. Digestion & Absorption 5. Breathing & Exchange of Gases **Module-5** 1. Body Fluids & Its Circulation 2. Excretory Products & Their Elimination 3. Locomotion & Its Movement 4. Neural Control & Coordination 5. Chemical Coordination and Integration

12th Class Modules Chapter Details







PHYSICS

Module-1

1. Electrostatics
2. Capacitance

Module-2

1. Current Electricity
2. Magnetic Effect of Current and Magnetism

Module-3

1. Electromagnetic Induction
2. Alternating Current

Module-4

1. Geometrical Optics
2. Wave Optics

Module-5

1. Modern Physics
2. Nuclear Physics
3. Solids & Semiconductor Devices
4. Electromagnetic Waves

CHEMISTRY

Module-1(PC)

1. Solid State
2. Chemical Kinetics
3. Solutions and Colligative Properties

Module-2(PC)

1. Electrochemistry
2. Surface Chemistry

Module-3(IC)

1. P-Block Elements
2. Transition Elements (d & f block)
3. Co-ordination Compound
4. Metallurgy

Module-4(OC)

1. HaloAlkanes & HaloArenes
2. Alcohol, Phenol & Ether
3. Aldehyde, Ketone & Carboxylic Acid

Module-5(OC)

1. Nitrogen & Its Derivatives
2. Biomolecules & Polymers
3. Chemistry in Everyday Life

BIOLOGY

Module-1

1. Reproduction in Organisms
2. Sexual Reproduction in Flowering Plants
3. Human Reproduction
4. Reproductive Health

Module-2

1. Principles of Inheritance and Variation
2. Molecular Basis of Inheritance
3. Evolution

Module-3

1. Human Health and Disease
2. Strategies for Enhancement in Food Production
3. Microbes in Human Welfare

Module-4

1. Biotechnology: Principles and Processes
2. Biotechnology and Its Applications
3. Organisms and Populations

Module-5

1. Ecosystem
2. Biodiversity and Conservation
3. Environmental Issues