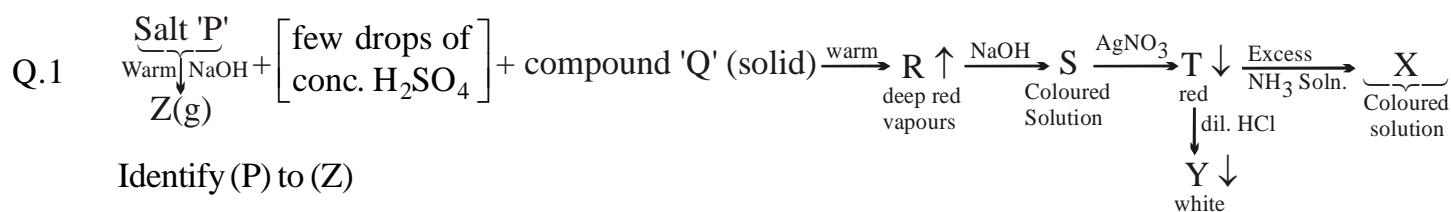


9

CHAPTER

D & F-BLOCK ELEMENTS

EXERCISE-1

d-BLOCK COMPOUNDS**[SINGLE CORRECT CHOICE TYPE]**

Identify (P) to (Z)

- (A) P = HCl, Q = KMnO₄, R = Cl₂, Y = AgCl
- (B) P = NH₄Cl, Q = K₂Cr₂O₇, R = CrO₂Cl₂, X = [Ag(NH₃)₂]⁺, Y = AgCl, Z = NH₃
- (C) P = KCl, Q = K₂CrO₄, R = CrO₂Cl₂, X = Na₂CrO₄, Z = HCl
- (D) P = NaCl, Q = K₂MnO₄, R = MnO₂, Y = AgCl
- Q.2 The number of moles of acidified KMnO₄ required to convert one mole of sulphite ion into sulphate ion is
 (A) 2/5 (B) 3/5 (C) 4/5 (D) 1
- Q.3 In Haber's process of manufacture of ammonia, Mo is used as
 (A) a catalyst (B) a catalytic promoter
 (C) an oxidising agent (D) as a catalytic poison
- Q.4
$$\text{Cr}_2\text{O}_7^{2-} \xrightleftharpoons[\text{Y}]{\text{X}} 2\text{CrO}_4^{2-}$$
, X and Y are respectively
 (A) X = NaOH, Y = H₂SO₄ (B) X = H⁺, Y = OH⁻
 (C) X = NaOH, Y = HI (C) X = H₃BO₃, Y = NaOH
- Q.5 CrO₃ dissolves in aqueous NaOH to give
 (A) Cr₂O₇²⁻ (B) CrO₄²⁻ (C) Cr(OH)₃ (D) Cr(OH)₂
- Q.6 Potassium sulphite solution was mixed with potassium hydroxide and the potassium permanganate solution was added into it, then final colour of the solution is
 (A) Blue (B) colourless (C) light pink (D) Green

- Q.7 An ornamental of gold having 75% of gold, it is of carat.
(A) 18 (B) 16 (C) 24 (D) 20
- Q.8 Purple-coloured of KMnO_4 is due to
(A) d-d-transition
(B) charge transfer from O to Mn
(C) due to both d-d-transition and charge transfer
(D) none of these
- Q.9 During estimation of oxalic acid by KMnO_4 , self indicator is
(A) KMnO_4 (B) oxalic acid (C) K_2SO_4 (D) MnSO_4
- Q.10 Mercurous ion is represented as
(A) Hg_2^{2+} (B) Hg^{2+} (C) $\text{Hg} + \text{Hg}^{2+}$ (D) Hg_2^+
- Q.11 A compound of mercury used in cosmetics, in Ayurvedic and Yunani medicines and known as Vermilion is
(A) HgCl_2 (B) HgS (C) Hg_2Cl_2 (D) HgI
- Q.12 Acidified chromic acid + $\text{H}_2\text{O}_2 \xrightarrow{\text{Org. solvent}} \text{X} + \text{Y}$, X and Y are
(blue colour)
(A) CrO_5 and H_2O (B) Cr_2O_3 and H_2O (C) CrO_2 and H_2O (D) CrO and H_2O
- Q.13 $\uparrow \text{Y}(\text{g}) \xleftarrow{\text{KI}} \text{CuSO}_4 \xrightarrow{\text{dilH}_2\text{SO}_4} \text{X}(\text{Blue colour})$, X and Y are
(A) $\text{X} = \text{I}_2$, $\text{Y} = [\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ (B) $\text{X} = [\text{Cu}(\text{H}_2\text{O})_4]^{2+}$, $\text{Y} = \text{I}_2$
(C) $\text{X} = [\text{Cu}(\text{H}_2\text{O})_4]^+$, $\text{Y} = \text{I}_2$ (D) $\text{X} = [\text{Cu}(\text{H}_2\text{O})_5]^{2+}$, $\text{Y} = \text{I}_2$
- Q.14 Transition elements are usually characterised by variable oxidation states but Zn does not show this property because of
(A) completion of np-orbitals (B) completion of (n-1)d orbitals
(C) completion of ns-orbitals (D) inert pair effect
- Q.15 $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (Ammonium dichromate) is used in fire works. The green coloured powder blown in air is
(A) Cr_2O_3 (B) CrO_2 (C) Cr_2O_2 (D) CrO_3
- Q.16 The d-block metal which is liquid at room temperature and its iodide changes colour on sublimation.
(A) Cu (B) Hg (C) Zn (D) Au

- Q.17 Coinage metals show the properties of
(A) typical elements (B) normal elements
(C) inner-transition elements (D) transition element
- Q.18 Iron becomes passive by due to formation of
(A) dil. HCl, Fe₂O₃ (B) 80% conc. HNO₃, Fe₃O₄
(C) conc. H₂SO₄, Fe₃O₄ (D) conc. HCl, Fe₃O₄
- Q.19 Bayer's reagent used to detect aliphatic double bond is
(A) acidified KMnO₄ (B) aqueous KMnO₄
(C) 1% alkaline KMnO₄ solution (D) KMnO₄ in benzene
- Q.20 The transition metal used in X-rays tube is
(A) Mo (B) Ta (C) Tc (D) Pm
- Q.21 $\text{Cu} + \text{conc. HNO}_3 \xrightarrow{\text{(hot)}} \text{Cu(NO}_3)_2 + \text{X}$ (oxide of nitrogen); then X is
(A) N₂O (B) NO₂ (C) NO (D) N₂O₃
- Q.22 When KMnO₄ solution is added to hot oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time. This is because
(A) Mn²⁺ acts as auto catalyst (B) CO₂ is formed
(C) Reaction is exothermic (D) MnO₄⁻ catalyses the reaction.
- Q.23 CuSO₄ solution reacts with excess KCN to give
(A) Cu(CN)₂ (B) CuCN (C) K₂[Cu(CN)₂] (D) K₃[Cu(CN)₄]
- Q.24 The higher oxidation states of transition elements are found to be in the combination with A and B, which are
(A) F, O (B) O, N (C) O, Cl (D) F, Cl
- Q.25 Pick out the **incorrect** statement:
(A) MnO₂ dissolves in conc. HCl, but does not form Mn⁴⁺ ions
(B) MnO₂ oxidizes hot concentrated H₂SO₄ liberating oxygen
(C) K₂MnO₄ is formed when MnO₂ in fused KOH is oxidised by air, KNO₃, PbO₂ or NaBiO₃
(D) Decomposition of acidic KMnO₄ is not catalysed by sunlight.

- Q.26 1 mole of Fe^{2+} ions are oxidised to Fe^{3+} ions with the help of (in acidic medium)
- (A) $1/5$ moles of KMnO_4 (B) $5/3$ moles of KMnO_4
(C) $2/5$ moles of KMnO_4 (D) $5/2$ moles of KMnO_4
- Q.27 The metals present in insulin and haemoglobin are respectively
- (A) Zn, Hg (B) Zn, Fe (C) Co, Fe (D) Mg, Fe
- Q.28 Metre scales are made-up of alloy
- (A) invar (B) stainless steel (C) electron (D) magnalium
- Q.29 Which of the following metal does not react with conc. HNO_3
- (A) Ag (B) Pb (C) Au (D) Hg
- Q.30 A metal M which is not affected by strong acids like conc. HNO_3 , conc. H_2SO_4 and conc. solution of alkalies like NaOH, KOH forms MCl_3 which finds use for toning in photography. The metal M is
- (A) Ag (B) Hg (C) Au (D) Cu
- Q.31 Solid $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ having covalent, ionic as well as co-ordinate bonds. Copper atom/ion forms co-ordinate bonds with water.
- (A) 1 (B) 2 (C) 3 (D) 4
- Q.32 $\text{KMnO}_4 + \text{HCl} \longrightarrow \text{H}_2\text{O} + \text{X}(\text{g})$, X is a (acidified)
- (A) red liquid (B) violet gas
(C) greenish yellow gas (D) yellow-brown gas
- Q.33 Purple of cassius is:
- (A) Pure gold (B) Colloidal solution of gold
(C) Gold (I) hydroxide (D) Gold (III) chloride
- Q.34 Amongst the following species, maximum covalent character is exhibited by
- (A) FeCl_2 (B) ZnCl_2 (C) HgCl_2 (D) CdCl_2
- Q.35 Number of moles of SnCl_2 required for the reduction of 1 mole of $\text{K}_2\text{Cr}_2\text{O}_7$ into Cr_2O_3 is (in acidic medium)
- (A) 3 (B) 2 (C) 1 (D) $1/3$

Q.36 Pick out the **incorrect** statement:

- (A) MnO_4^{2-} is quite strongly oxidizing and stable only in very strong alkalies. In dilute alkali, neutral solutions, it disproportionates.
- (B) In acidic solutions, MnO_4^- is reduced to Mn^{2+} and thus, KMnO_4 is widely used as oxidising agent
- (C) KMnO_4 does not acts as oxidising agent in alkaline medium.
- (D) KMnO_4 is manufactured by the fusion of pyrolusite ore with KOH in presence of air or KNO_3 , followed by electrolytic oxidation in alkaline solution.

Q.37 The aqueous solution of CuCrO_4 is green because it contains

- (A) green Cu^{2+} ions (B) green CrO_4^{2-} ions
(C) blue Cu^{2+} ions and green CrO_4^{2-} ions (D) blue Cu^{2+} ions and yellow CrO_4^{2-} ions

Q.38 Concentrated acid obtained from reaction between solid NaNO_3 and conc. H_2SO_4 does not react with

- (A) P_4 (B) H_2S (C) Au (D) Hg

Q.39 In nitroprusside ion, the iron exists as Fe^{2+} and NO as NO^+ rather than Fe^{3+} and NO respectively. These forms of ions are established with the help of

- (A) magnetic moment in solid state (B) thermal decomposition method
(C) by reaction with KCN (D) by action with K_2SO_4

Q.40 Transition elements in lower oxidation states act as Lewis acid because

- (A) they form complexes (B) they are oxidising agents
(C) they donate electrons (D) they do not show catalytic properties

Q.41 The Ziegler-Natta catalyst used for polymerisation of ethene and styrene is $\text{TiCl}_4 + (\text{C}_2\text{H}_5)_3\text{Al}$, the catalysing species (active species) involved in the polymerisation is

- (A) TiCl_4 (B) TiCl_3 (C) TiCl_2 (D) TiCl

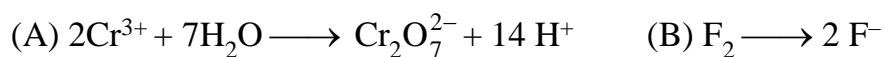
Q.42 The electrons which take part in order to exhibit variable oxidation states by transition metals are

- (A) ns only (B) $(n-1)d$ only
(C) ns and $(n-1)d$ only but not np (D) $(n-1)d$ and np only but not ns

Q.43 'Bordeaux mixture' is used as a fungicide. It is a mixture of

- (A) $\text{CaSO}_4 + \text{Cu}(\text{OH})_2$ (B) $\text{CuSO}_4 + \text{Ca}(\text{OH})_2$
(C) $\text{CuSO}_4 + \text{CaO}$ (D) $\text{CuO} + \text{CaO}$

Q.44 Which of the following reaction is possible at anode?



Q.45 “925 fine silver” means an alloy of:

- (A) 7.5 % Ag and 92.5% Cu (B) 92.5 % Ag and 7.5 % Cu
(C) 80% Ag and 20 % Cu (D) 90 % Ag and 10% Cu

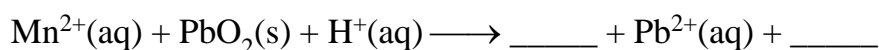
Q.46 Iron salt used in blue prints is:

- (A) FeC_2O_4 (B) $\text{Fe}_2(\text{C}_2\text{O}_4)_3$ (C) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (D) $\text{K}_3[\text{Fe}(\text{CN})_6]$

Q.47 Product obtained on strong heating $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ is

- (A) FeCl_3 (B) FeO (C) Fe_2O_3 (D) FeCl_2

Q.48 What is the **correct** set of co-efficients for the reactants in following reaction:



- (A) 1 : 2 : 0 (B) 3 : 1 : 9 (C) 2 : 5 : 4 (D) 4 : 6 : 3

Q.49 In the elements of 3d-series, the element with highest melting point is

- (A) Mn (B) Fe (C) Cr (D) Cu

Q.50 Heating of a blue coloured salt produces a black residue. Which of the following cations will be present in the salt?

- (A) Fe^{2+} (B) Fe^{3+} (C) Cu^{2+} (D) Zn^{2+}

Q.51 Which one of the following is least covalent and least acidic?

- (A) VCl_2 (B) VCl_3 (C) VCl_4 (D) VOCl_3

Q.52 Select correct order of acidic strength of their aq. solution

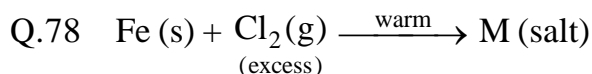
- (A) $\text{FeCl}_3 > \text{AlCl}_3 > \text{MgCl}_2$ (B) $\text{FeCl}_3 > \text{MgCl}_2 > \text{AlCl}_3$
(C) $\text{AlCl}_3 > \text{FeCl}_3 > \text{MgCl}_2$ (D) $\text{MgCl}_2 > \text{AlCl}_3 > \text{FeCl}_3$

Q.53 When KMnO_4 separately reacts with H_2O_2 in weakly alkaline medium and acidic medium, then products of KMnO_4 are respectively.

- (A) K_2MnO_4 and $\text{Mn}^{2+}(\text{aq})$ (B) MnO_2 and MnO_2
(C) MnO_2 and $\text{Mn}^{2+}(\text{aq})$ (D) $\text{Mn}^{2+}(\text{aq})$ and MnO_2

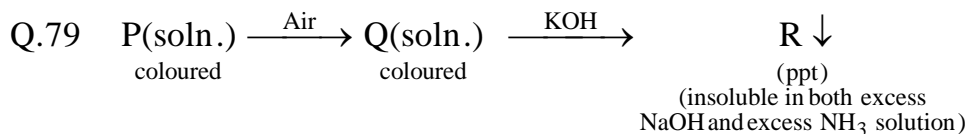
- Q.54 Which oxide exhibits strongest oxidizing character among given oxides.
 (A) CrO_3 (B) MoO_3 (C) WO_3 (D) Mn_2O_7
- Q.55 Which of the following ionic/molecular species does not disproportionate in water at room temperature.
 (A) NO_2 (B) Cu^+ (C) MnO_4^{2-} (D) $\text{Ca}(\text{OCl})\text{Cl}$
- Q.56 Fe (Finely powdered) + $\text{HCl}(\text{dil}) \rightarrow \text{P} + \text{Q}$
 compound 'P' does not precipitate with
 (A) AgNO_3 (B) $\text{K}_3[\text{Fe}(\text{CN})_6]$ (C) $(\text{NH}_4)_2\text{S}$ (D) $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$
- Q.57 Colour of acidified $\text{K}_2\text{Cr}_2\text{O}_7$ is not changed by
 (A) H_2O_2 (B) $\text{Sn}^{++}(\text{aq})$ (C) HF (D) HBr
- Q.58 Select the salt whose aqueous solution is not green
 (A) FeSO_4 (C) CrCl_3 (C) NiCl_2 (D) MnCl_2
- Q.59 Which of the following compound undergoes disproportionation in presence of SO_3 gas
 (A) K_2MnO_4 (B) K_2CrO_4 (C) I_2 (D) $\text{Hg}(\text{NO}_3)_2$
- Q.60 Colour of $\text{CrO}_4^{2-}(\text{aq})$ is not changed by
 (A) dil. HCl (B) NH_3 solution (C) CH_3COOH (D) NO_2 gas
- Q.61 Which does not undergo comproportionation reaction
 (A) $\text{H}_2\text{S} + \text{SO}_2 \longrightarrow$ (B) $\text{I}^-(\text{aq}) + \text{IO}_3^-(\text{aq}) + \text{H}^+(\text{aq}) \longrightarrow$
 (C) $\text{K}_2\text{MnO}_4 + \text{H}^+(\text{aq}) \longrightarrow$ (D) $\text{MnO}_4^- + \text{Mn}^{2+}(\text{aq}) \longrightarrow$
- Q.62 $\text{I}^-(\text{aq.}) + \text{MnO}_4^-(\text{aq}) \xrightarrow{\text{H}^+} \text{X} + \text{Mn}^{++}(\text{aq})$
 $\text{I}^-(\text{aq.}) + \text{MnO}_4^-(\text{aq}) \xrightarrow[\text{weakly OH}^-]{\text{neutral or}} \text{Y} + \text{MnO}_2$
 $\text{MnO}_4^-(\text{aq}) + \text{Mn}^{++}(\text{aq}) \xrightarrow{\text{ZnSO}_4} \text{Z} + 4\text{H}^+$
 Products X, Y and Z are respectively
 (A) $\text{I}_2, \text{IO}_3^-, \text{MnO}_2$ (B) $\text{IO}_3^-, \text{I}_2, \text{MnO}_2$
 (C) $\text{I}_2, \text{IO}_3^-, \text{MnO}_4^{2-}$ (D) $\text{IO}_3^-, \text{I}_2, \text{MnO}_4^{2-}$
- Q.63 Which property remains same in metal and in its interstitial compound?
 (A) Hardness (B) Ductility
 (C) Electrical conductivity (D) Density

- Q.64 The oxidation number is changed in which of following cases
(A) SO_2 gas is passed into $\text{Cr}_2\text{O}_7^{2-} / \text{H}^+$ soln.
(B) Aqueous solution of CrO_4^{2-} is acidified
(C) CrO_2Cl_2 is dissolved in NaOH soln.
(D) $\text{Cr}_2\text{O}_7^{2-}$ solution is made alkaline
- Q.65 In a transition series, as atomic number increases, paramagnetism
(A) Increases gradually
(B) Decreases gradually
(C) First increases to a maximum and then decreases
(D) First decreases to a maximum and then increases
- Q.66 In the reaction. $2\text{CuCl}_2 + 2\text{H}_2\text{O} + \text{SO}_2 \longrightarrow \text{A} + \text{H}_2\text{SO}_4 + 2\text{HCl}$; A is
(A) CuSO_4 (B) CuS (C) Cu_2Cl_2 (D) Cu
- Q.67 Many transition metals form interstitial compounds. The characteristics of these interstitial compounds are:
(I) They have high melting points as compared to pure metals.
(II) They are very hard.
(III) They retain metallic conductivity.
(IV) They are chemically more reactive than pure metals.
Then correct option(s) is/are
(A) I, II, III (B) I, III (C) II, IV (D) IV only
- Q.68 Incorrect statement is
(A) $\text{Cr}^{2+}(\text{aq})$ has strong reducing character
(B) $\text{Mn}^{3+}(\text{aq})$ has strong oxidizing character
(C) $\text{CO}^{2+}(\text{aq})$ is stable but it is easily oxidized in presence of complexing reagent.
(D) CuCl undergoes disproportionation in excess of water
- Q.69 Each of the following ion contains vanadium in + 5 oxidation state except
(A) VO_2^+ (B) $\text{V}(\text{OH})_4^+$ (C) VO^{2+} (D) $[\text{VO}_3 \cdot \text{OH}]^{2-}$
- Q.70 The oxoanion in which the oxidation state of central atom is same as its group number in the periodic table is
(A) SO_4^{2-} (B) VO_2^- (C) MnO_4^{2-} (D) $\text{Cr}_2\text{O}_7^{2-}$



Salt M **does not** react with solution of

- (A) CH_3COONa (B) AgNO_3 (C) $\text{Na}_2\text{S}_2\text{O}_3$ (D) SrCl_2

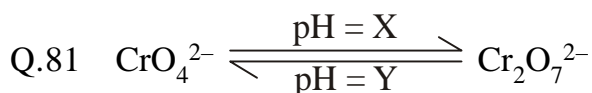


Then P contains

- (A) Cu^{2+} (aq) (B) Fe^{2+} (aq) (C) Cr^{2+} (aq) (D) Ni^{2+} (aq)

Q.80 K_2MnO_4 is unstable in aqueous solution and the green solution obtained is changed into purple colouration **INCORRECT** statement regarding the above change is.

- (A) It is a disproportionation reaction
 (B) It produces KMnO_4
 (C) It produces brown precipitate of hydrated MnO_2
 (D) K_2MnO_4 stable in acidic medium



The pH values of (X) and (Y) are respectively :

- (A) 4 and 5 (B) 4 and 8 (C) 8 and 4 (D) 8 and 9

Q.82 **CORRECT** stability order of oxidation state of given metal cation is :

- (A) $\text{Mn}^{+2}(\text{aq}) < \text{Mn}^{+3}(\text{aq})$ (B) $\text{Fe}^{+2}(\text{aq}) < \text{Fe}^{+3}(\text{aq})$
 (C) $\text{Cr}^{+2}(\text{aq}) < \text{Cr}^{+3}(\text{aq})$ (D) $\text{Co}^{+2}(\text{aq}) < \text{Co}^{+3}(\text{aq})$

Q.83 When CuSO_4 reacts with KI and KCN separately which of the following statement is **incorrect** for both reaction

- (A) Both are redox reactions
 (B) Both reactions produce diatomic gas
 (C) Cu (II) cation is reduced in both reaction
 (D) Both reactions produce white colour compound

- Q.84 Which of the two set of reactions represent amphoteric nature of Zn(OH)_2
(I) $\text{Zn(OH)}_2 + \text{NaOH}$ (II) $\text{Zn(OH)}_2 + \text{H}_2\text{O}$ (III) $\text{Zn(OH)}_2 + \text{HCl}$ (IV) $\text{Zn(OH)}_2 + \text{NH}_3$
(A) I, II (B) I, III (C) II and IV (D) III and IV
- Q.85 FeCr_2O_4 (chromite ore) is converted to Cr by following steps.
Chromite $\xrightarrow{\text{I}}$ Na_2CrO_4 $\xrightarrow{\text{II}}$ Cr_2O_3 $\xrightarrow{\text{III}}$ Cr
In above chain of reactions, steps I, II and III are:
- | | I | II | III |
|-----|---|--------------------------------|--------------|
| (A) | $\text{Na}_2\text{CO}_3/\text{air}, \Delta$ | C | C |
| (B) | $\text{NaOH}/\text{air}, \Delta$ | C, Δ | Al, Δ |
| (C) | $\text{NaOH}/\text{air}, \Delta$ | C, Δ | Mg, Δ |
| (D) | Conc. $\text{H}_2\text{SO}_4, \Delta$ | $\text{NH}_4\text{Cl}, \Delta$ | C, Δ |
- Q.86 Which substance **does not** react with dilute HCl ?
(A) ZnCO_3 (B) Zn(OH)_2 (C) Zn Metal (D) $\text{Zn(NO}_3)_2$
- Q.87 Which metal cation absorbs violet colour in aqueous medium ?
(A) Fe^{2+} (aq.) (B) Fe^{3+} (aq.) (C) Cr^{3+} (aq.) (D) Cu^{2+} (aq.)
- Q.88 Which is **not** oxidized by acidified $\text{K}_2\text{Cr}_2\text{O}_7$?
(A) KF (aq.) (B) KCl (aq.) (C) KBr (aq.) (D) KI (aq.)

[REASONING TYPE]

Questions given below consist of two statements each printed as **Statement-1** and **Statement-2**; while answering these questions you are required to choose any one of the following four responses:

- (A) if both **Statement-1** and **Statement-2** are true and **Statement-2** is the correct explanation of **statement-1**
(B) if both **Statement-1** and **Statement-2** are true but **Statement-2** is not correct explanation of **statement-1**
(C) if **Statement-1** is true but **Statement-2** is false
(D) if **Statement-1** is false and **Statement-2** is true

- Q.89 **Statement-1** : KMnO_4 is purple in colour due to charge transfer.
Statement-2 : In MnO_4^- , there is no unpaired electron present in d-orbitals of manganese.
- Q.90 **Statement-1** : K_2CrO_4 has yellow colour due to charge transfer.
Statement-2 : CrO_4^{2-} ion is tetrahedral in shape.
- Q.91 **Statement-1** : The highest oxidation state of chromium in its compounds is +6.
Statement-2 : Chromium atom has only six electrons in ns and (n-1) d orbitals.
- Q.92 **Statement-1** : CrO_3 reacts with HCl to form chromyl chloride gas.
Statement-2 : Chromyl chloride (CrO_2Cl_2) has tetrahedral shape.
- Q.93 **Statement-1** : Zinc does not show characteristic properties of transition metals.
Statement-2 : In zinc outermost shell is completely filled.
- Q.94 **Statement-1** : Tungsten has a very high melting point.
Statement-2 : Tungsten is a covalent compound.
- Q.95 **Statement-1** : Equivalent mass of KMnO_4 is equal to one-third of its molecular mass when it acts as an oxidising agent in an alkaline medium.
Statement-2 : Oxidation number of Mn is +7 in KMnO_4 .
- Q.96 **Statement-1** : Cu^+ ion is coloured in aqueous solution.
Statement-2 : Four water molecules are coordinated to Cu^+ ion

f-BLOCK COMPOUNDS

- Q.97 In general, actinides exhibit more number of oxidation states than lanthanoids. This is because
- (A) there is a similarity between 4f and 5f orbitals in their angular part of wave function
 - (B) The actinoids are more reactive than lanthanoids
 - (C) The 5f orbitals extend farther from nucleus than 4f-orbitals
 - (D) The 5f orbitals are more buried than the 4f-orbitals
- Q.98 Which of the following statement is **not correct**?
- (A) $\text{La}(\text{OH})_3$ is less basic than $\text{Lu}(\text{OH})_3$
 - (B) In Lanthanide series, ionic radius of Ln^{3+} ions decreases
 - (C) La metal is actually an element of transition series rather than lanthanide series
 - (D) Atomic radii of Zr and Hf are almost same because of lanthanide contraction
- Q.99 Which of the following statements is **NOT CORRECT** regarding lanthanoids and actinoids?
- (A) Oxidation state of +3 is predominant in both the series
 - (B) Both the series show contraction in ionic radii as lanthanoid contraction and actinoid contraction with increase in atomic number .
 - (C) Actinoids show larger number of oxidation states than lanthanoids due to lesser energy difference between 5f and 6d orbitals than between 4f and 5d orbitals of lanthanoids.
 - (D) Elements of both the series are radioactive
- Q.100 Incorrect statement for lanthanides is
- (A) They liberate hydrogen gas with dilute acids
 - (B) They form carbides with carbon on heating
 - (C) Their hydroxides are basic
 - (D) $\text{Ce}^{4+}(\text{aq})$ is stable towards reducing agents.
- Q.101 Which of the properties has higher value for lanthanoids in comparison of actinoids
- (A) Variety of oxidation state
 - (B) Element to element size contraction
 - (C) Both of them
 - (D) None of these
- Q.102 The lanthanide contraction is responsible for the fact that:
- (A) Zr and Nb have same oxidation state
 - (B) Zr and Hf have about the same radius
 - (C) Y and La have about the same radius
 - (D) Zr and Zn have the same oxidation state

Q.103 **Incorrect** statement for lanthanides is

- (A) They all liberate hydrogen gas with dil HCl.
- (B) All paramagnetic hydrated lanthanoid cations $[\text{Ln}^{3+}(\text{aq})]$ are coloured
- (C) Separation of Hf^{4+} from Zr^{4+} is difficult due to their comparable size
- (D) Misch metal is an alloy of a lanthanide metal.

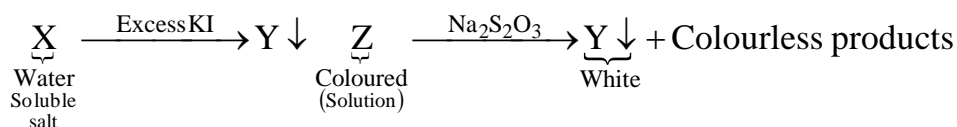
Q.104 **Incorrect** statement about Lanthanoids is:

- (A) They liberate H_2 gas with non oxidizing acids
- (B) Their hydroxides are basic
- (C) $\text{Ce}^{4+}(\text{aq})$ acts strong oxidant
- (D) All tripositive lanthanoid ions are coloured

EXERCISE-2

[PARAGRAPH TYPE]

Paragraph for question nos. 1 & 2

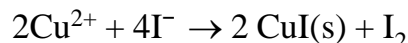


- Q.1 Salt 'X' is
 (A) $\text{Fe}_2(\text{SO}_4)_3$ (B) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (C) KNO_2 (D) $\text{Hg}(\text{NO}_3)_2$
- Q.2 Salt 'X' does not produce precipitate with solution of
 (A) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (B) BaCl_2 (C) NaOH (D) excess NH_4OH

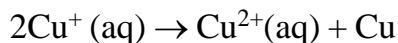
Paragraph for question nos. 3 & 4

The unique behaviour of Cu, having a positive E° (Reduction potential) accounts for its inability to liberate H_2 from acids. Only oxidising acids (nitric acid and hot concentrated sulphuric acid) react with Cu. The high energy to transform $\text{Cu}(\text{s})$ to $\text{Cu}^{2+}(\text{aq})$ is not balanced by its hydration enthalpy.

On the other hand, all Cu (II) halides are known except iodide. In this case, Cu^{2+} oxidises I^- to I_2 :



However, copper (I) compounds are unstable in aqueous solution and undergo disproportionation.



The stability of $\text{Cu}^{2+}(\text{aq})$ rather than $\text{Cu}^+(\text{aq})$ is due to the much more negative ΔH_{Hyd} of $\text{Cu}^{2+}(\text{aq})$ than $\text{Cu}^+(\text{aq})$.

- Q.3 Consider the following transformation :
 $\text{CuSO}_4(\text{aq}) + \text{KI}(\text{Excess}) \longrightarrow \text{Product}$

Select the **correct** statement

- (A) Product contains $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ ion.
 (B) Presence of brown colouration in product is due to I_3^- ion
 (C) Oxidation state of sulphur in reactant and product is different
 (D) White ppt. of CuI_2 is observed in product
- Q.4 Select the **correct** chemical change
 (A) $\text{Cu} + \text{dil. H}_2\text{SO}_2 \rightarrow \text{CuSO}_4 + \text{H}_2(\text{g})$
 (B) $\text{Cu} + \text{dil. HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{N}_2\text{O}(\text{g})$
 (C) $\text{CuSO}_4(\text{aq}) + \text{KCN}(\text{excess}) \rightarrow \text{K}_2[\text{Cu}(\text{CN})_4]$
 (D) $\text{CuSO}_4(\text{aq}) + \text{NH}_4\text{OH} \rightarrow \text{Cu}(\text{OH})_2 \downarrow$

Paragraph for question nos. 5 & 6

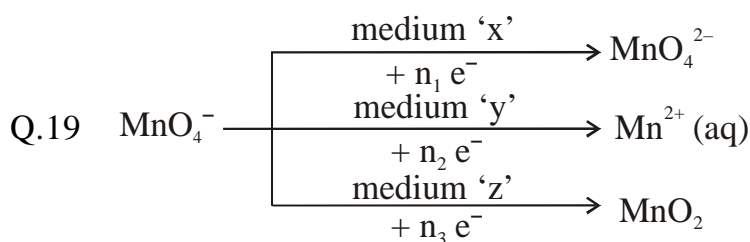
When hydrogen peroxide is added to an acidified solution of a dichromate gives a deep blue coloured compound 'A' in presence of organic solvent, which decomposes rapidly in aqueous solution into 'B' and dioxygen. Compound 'A' can be extracted by dimethyl ether forming the adduct 'C'.

- Q.5 The oxidation state of the metal ion in compound 'A' are
(A) 3+ (B) 10+ (C) 6+ (D) 4+
- Q.6 The magnetic moment of compound 'B' is:
(A) 2.8 B.M (B) 4.9 B.M (C) 0 (D) 3.8 B.M

[MULTIPLE CORRECT CHOICE TYPE]

- Q.7 **Correct** characteristics of aqueous solution of chrome alum is/are
(A) green colour
(B) acidic character
(C) gives precipitates with BaCl_2
(D) Produces precipitates with excess of NaCN
- Q.8 Addition of non-metals like boron, carbon and nitrogen to the interstitial voids of a transition metal, makes the metal
(A) more ductile (B) less ductile (C) less malleable (D) more hard
- Q.9 Mercury is a liquid at 0°C because of
(A) very high ionisation energy (B) weak metallic bonds
(C) high heat of hydration (D) high heat of sublimation
- Q.10 The ionisation energies of transition elements are
(A) less than p-block elements (B) more than s-block elements
(C) less than s-block elements (D) more than p-block elements
- Q.11 Transition metal cations have more tendency to form complex than metal cations of s- and p-block elements. It is due to
(A) availability of d-orbitals for bonding
(B) variable oxidation states are not shown by transition elements
(C) all electrons are paired in d-orbitals
(D) Higher nuclear force of attraction at their peripheral shell in transition metal cations
- Q.12 The metal(s) which does/do **not** form amalgam
(A) Fe (B) Pt (C) Zn (D) Ag

- Q.13 Which of the following statements concern with transition metals?
 (A) Hydrated paramagnetic transition metal salts are coloured
 (B) common oxidation state is +3
 (C) they show variable oxidation states, which differ by two units only
 (D) they can form acidic oxides
- Q.14 **Correct** statement(s) is/are
 (A) Acidified solution of $K_2Cr_2O_7$ liberates iodine from KI
 (B) Acidified $K_2Cr_2O_7$ is used as a standard solution for estimation of Fe^{2+} ions
 (C) In acidic medium, $M = N/6$ for $K_2Cr_2O_7$
 (D) On heating $(NH_4)_2Cr_2O_7$ decomposes to yield Cr_2O_3 through an endothermic reaction
- Q.15 The highest oxidation state among transition elements is
 (A) + 7 by Mn (B) + 8 by Os (C) + 8 by Ru (D) + 7 by Fe
- Q.16 Amphoteric oxide(s) is/are
 (A) Al_2O_3 (B) SnO (C) ZnO (D) Fe_2O_3
- Q.17 Interstitial compounds are formed by
 (A) Co (B) Ni (C) Fe (D) Ca
- Q.18 The catalytic activity of transition elements is related to their
 (A) variable oxidation states (B) surface area
 (C) complex formation ability (D) magnetic moment

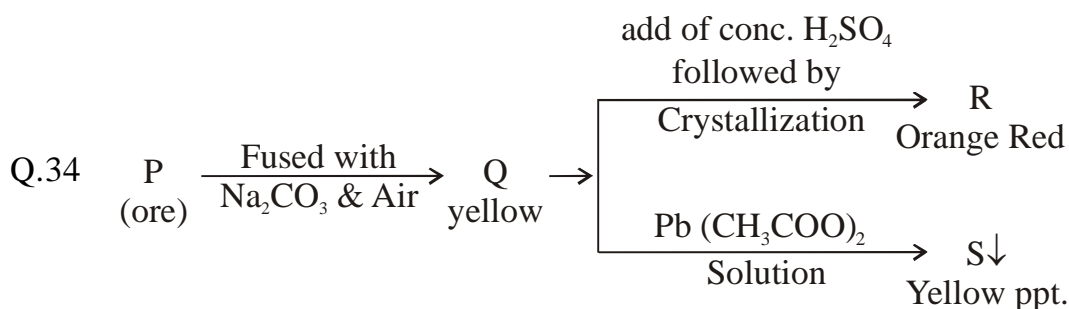


Select **correct** match:

- (A) $n_1 = 1$; x = strongly alkaline medium
 (B) $n_2 = 5$, acidic medium
 (C) $n_3 = 3$, Neutral or weakly alkaline medium
 (D) $n_1 = 1$, weakly alkaline medium

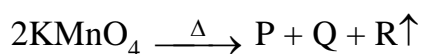
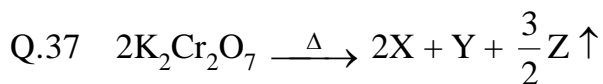
- Q.20 In the equation : $M + 8CN^- + 2H_2O + O_2 \rightarrow 4[M(CN)_2]^- + 4OH^-$, the metal M is
(A) Ag (B) Au (C) Pb (D) Hg
- Q.21 An element of 3d-transition series shows two oxidation states x and y, differ by two units then
(A) If $x > y$ then compound in oxidation state x will be ionic
(B) If $x < y$ then compound in oxidation state x will be ionic
(C) If $x < y$ then compound in oxidation state y will be covalent
(D) If $y < x$ then compound in oxidation state y will be covalent
- Q.22 A pinch of Na_2O_2 was added to an acidified dichromate solution, then observations noted are
(A) Blue colour appears in transient phase
(B) Orange colour directly changing to green
(C) Copious evolution of oxygen
(D) Bluish -green precipitate
- Q.23 The rusting of iron is formulated as $Fe_2O_3 \cdot xH_2O$ which involves the formation of
(A) Fe_2O_3 (B) $Fe(OH)_3$ (C) $Fe(OH)_2$ (D) $Fe_2O_3 + Fe(OH)_3$
- Q.24 $CuSO_4(aq) + 4NH_3 \rightarrow X$, then X is
(A) $[Cu(NH_3)_4]^{2+}$ (B) paramagnetic
(C) coloured (D) of a magnetic moment of 1.73 BM
- Q.25 Amphoteric oxide(s) of Mn is/are
(A) MnO_2 (B) Mn_3O_4 (C) Mn_2O_7 (D) MnO
- Q.26 Acidified $KMnO_4$ can be decolourised by
(A) SO_2 (B) H_2O_2 (C) $FeSO_4$ (D) $Fe_2(SO_4)_3$
- Q.27 The lanthanide contraction is responsible for the fact that
(A) Zr and Hf have same atomic sizes (B) Zr and Hf have same properties
(C) Zr and Hf have different atomic sizes (D) Zr and Hf have different properties
- Q.28 Ion(s) having non zero spin only magnetic moment:
(A) Sc^{3+} (B) Ti^{3+} (C) Cu^{2+} (D) Zn^{2+}
- Q.29 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) $Hg(NO_3)_2$

- Q.30 Which of the following option is **correctly** match ?
- (A) FeSO_4 . White (B) $\text{FeCl}_2 \cdot 6\text{H}_2\text{O}$: Pale green
 (C) $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ Green (D) $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$: Blue
- Q.31 Which of the following compound(s) produce green coloured product on thermal decomposition.
- (A) $\text{K}_2\text{Cr}_2\text{O}_7$ (B) KMnO_4 (C) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (D) NH_4NO_3
- Q.32 Quantitative conversion of K_2MnO_4 into KMnO_4 can be carried out by
- (A) Electrolytic oxidation of K_2MnO_4 in acidic medium
 (B) Electrolytic oxidation of K_2MnO_4 in alkaline medium
 (C) Oxidation of K_2MnO_4 by chlorine in alkaline medium
 (D) Oxidation of K_2MnO_4 by Ozone in alkaline medium
- Q.33 The element with maximum and minimum melting points in the respective transition series respectively are-
- (A) Cr and Zn (B) Mo and Ag (C) Mn and Zn (D) Mo and Cd



Which of the following option(s) is/are **correctly** match.

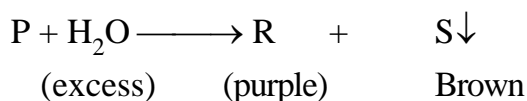
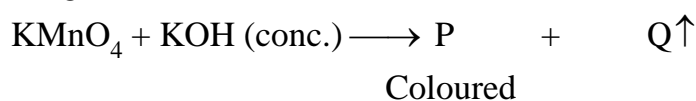
- (A) P : FeCr_2O_4 (B) R : $\text{K}_2\text{Cr}_2\text{O}_7$ (C) PbCrO_4 (D) Q : $\text{Fe}(\text{OH})_3$
- Q.35 Select the **CORRECT** chemical changes
- (A) $\text{Cu} + \text{dil. H}_2\text{SO}_4 + 1/2 \text{O}_2(\text{g}) \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$
 (B) $\text{Cu} + \text{dil. HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{N}_2\text{O}(\text{g})$
 (C) $\text{CuSO}_4(\text{aq}) + \text{KCN}(\text{excess}) \rightarrow \text{K}_2[\text{Cu}(\text{CN})_4]$
 (D) $\text{CuSO}_4(\text{aq}) + \text{NH}_4\text{OH} \rightarrow \text{Cu}(\text{OH})_2^-$
- Q.36 Which of the following compound(s) undergo does /do not disproportionation in presence of SO_3 gas.
- (A) K_2MnO_4 (B) K_2CrO_4 (C) I_2 (D) $\text{Hg}(\text{NO}_3)_2$



If order of molecular weight is $\text{X} > \text{Y} > \text{Z}$ and $\text{P} > \text{Q} > \text{R}$, then which of the following statement is **CORRECT** regarding above information

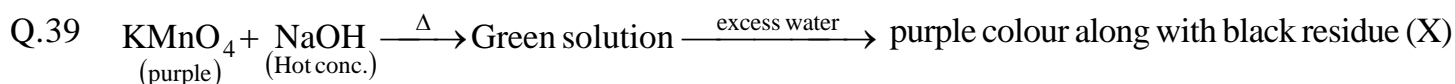
- (A) Oxidation state of central metal atoms are same in X and P.
- (B) Molecular weight of Z and R is same
- (C) Molecular weight of Q is greater than Y.
- (D) The colour of Y and P almost same

Q.38 For given reactions :



Correct statement(s) is/are :

- (A) Both are redox reactions
- (B) Substance 'S' on heating with solid KOH in presence of KNO_3 produces 'R'
- (C) 'S' is converted into mixed oxide on heating
- (D) Atomic form of Q can convert I^- (aq) into I_2 in acidic medium



Which of the following statement is/are **correct** regarding above information

- (A) The oxidation state of Mn in green solution is +6
- (B) Both steps take place through redox reaction
- (C) MnO_2 is obtained in the form of black residue (X)
- (D) Black residue (X) can oxidize NaCl into Cl_2 gas in acidic medium

Q.40 **Correct** statement is/are :

- (A) Cr^{2+} (aq) has strong reducing character.
- (B) Mn^{3+} (aq) has oxidizing character.
- (C) Co^{2+} (aq) is stable but it is easily oxidized in presence of strong field ligand (SFL).
- (D) CuCl undergoes disproportionation in excess of water.

- Q.41 When acidified CrO_4^{2-} ion reacts with H_2O_2 in the presence of ether solvent then **correct** statement(s) is/are?
- (A) Orange colour of solution turns blue
 (B) Deep blue colour is due to formation of $\text{CrO}_5 \cdot \text{OEt}_2$
 (C) Oxidation state of Cr-atom remains same in the reaction
 (D) Orange colour of solution turns green
- Q.42 Which of the following metal sulphide (s) undergo hydrolysis ?
- (A) Cr_2S_3 (B) Al_2S_3 (C) MgS (D) FeS
- Q.43 Which of the general properties are common among group 2nd elements and 4f series elements ?
- (A) Abundance in earth crust
 (B) Evolution of H_2 gas on reaction with dil HCl
 (C) Formation of oxide and nitride when reacts with air
 (D) Aqueous solution reacts with HCl
- Q.44 K_2CrO_4 reacts with which of the following reagents
- (A) dil. $\text{H}_2\text{SO}_4 + \text{H}_2\text{O}_2$ (B) KOH solution + I^- (aq.)
 (C) AgNO_3 (D) SO_2 gas
- Q.45 Reduction of the metal centre in aqueous permanganate ion involves
- (A) 3 electrons in neutral medium (B) 1 electron in strongly basic medium ($\text{pH} \geq 11$)
 (C) 3 electrons in alkaline medium (D) 5 electrons in acidic medium
- Q.46 Which one of the following ionic species will impart colour to an aqueous solution?
- (A) Ti^{4+} (aq) (B) Cu^+ (aq) (C) Zn^{2+} (aq) (D) Cr^{3+} (aq)

[MATCH THE COLUMN]

- Q.47
- | Column-I | Column-II |
|--|---------------------------|
| (A) $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ | (P) Paramagnetic complex |
| (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ | (Q) Diamagnetic complex |
| (C) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ | (R) Coloured complex |
| (D) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ | (S) Colourless complex |
| | (T) Inner orbital complex |

- Q.48
- | Column-I | | Column-II | |
|----------|--------------------------|-----------|----|
| (A) | Highest density | (P) | Os |
| (B) | Colourless salts | (Q) | Cr |
| (C) | Maximum magnetic moment | (R) | Zn |
| (D) | Variable oxidation state | (S) | Mn |
- Q.49
- | Column-I | | Column-II | |
|----------|--------------------------------|-----------|------------------|
| (A) | Coloured ion | (P) | Cu^+ |
| (B) | $\mu = 1.73$ B.M. | (Q) | Cu^{2+} |
| (C) | d^{10} configuration | (R) | Fe^{2+} |
| (D) | More than 3 unpaired electrons | (S) | Mn^{2+} |
- Q.50
- | Column-I | | Column-II | |
|----------|----|-----------|--------------------|
| (A) | Zn | (P) | d-block metal |
| (B) | Cu | (Q) | Coinage metal |
| (C) | Ag | (R) | Native metal |
| (D) | Fe | (S) | Transitional metal |

[INTEGER TYPE]

- Q.51 Calculate difference between oxidation state of chromium (Cr) in blue and green coloured chromium species formed during the following given transformation.
- $$\text{CrO}_4^{2-}(\text{aq}) \xrightarrow{\text{H}_2\text{O}_2/\text{H}^+} \text{Blue solution} \xrightarrow{\text{on standing}} \text{Green solution}$$
- Q.52 Total number of species that can be oxidized by acidic permanganate ion ($\text{MnO}_4^- / \text{H}^+$) I^- , Fe^{2+} , CO_2 , $\text{C}_2\text{O}_4^{2-}$, S^{2-} , SO_3^{2-} , NO_2^- , PO_4^{3-} , SO_4^{2-} .
- Q.53 Find total number of bond angles in $\text{Cr}_2\text{O}_7^{2-}$ ion which are greater than $109^\circ 28'$
- Q.54 Find total number of process which has positive value of standard electrode potential $\text{Cr}^{2+}/\text{Cr}^{3+}$, $\text{Mn}^{2+}/\text{Mn}^{3+}$, Fe/Fe^{2+} , Cu/Cu^{2+} , Fe/Fe^{3+} , Sn/Sn^{2+} , Cr/Cr^{3+} , Ag/Ag^+ , $\text{Fe}^{3+}/\text{Fe}^{2+}$
- Q.55 The oxidation state of Cr in K_3CrO_8 .
- Q.56 Find total no. of oxides which act as an acid on reacting with NaOH. ZnO , MnO , Mn_2O_7 , CrO_3 , MnO_2 , Cr_2O_3 , TiO

- Q.57 Find total no. of mole of I^- required to reduce 1 mole $K_2Cr_2O_7$ in acidic medium
- Q.58 Find total no. of ions/molecules which are tetrahedral in shape.
 MnO_4^{-1} , MnO_4^{-2} , CrO_4^{-2} , CrO_2Cl_2 , $Zn(OH)_4^{-2}$, $NiCl_4^{-2}$, $Ni(CO)_4$
- Q.59 Select total no. of ions which are disproportionate in aqueous medium.
 Cu^+ , Au^+ , Zn^{+2} , Hg_2^{+2}
- Q.60 Find total no. of ions which are paramagnetic in nature.
 Sc^{3+} , Ti^{3+} , V^{+3} , Cr^{+3} , Mn^{+2} , Fe^{+2} , Co^{+2} , Ni^{+2} , Cu^+ , Zn^{+2}
- Q.61 Find total no. of ions whose aqueous solution is coloured.
 Sc^{3+} , Ti^{3+} , V^{+3} , Cr^{+3} , Mn^{+2} , Fe^{+2} , Co^{+2} , Ni^{+2} , Cu^{+2} , Zn^{+2}
- Q.62 Find total number of metals which shows variably valency. Na, Zn, Fe, Cu, Hg, Cd, Au, Cr, Mn

[ANSWER KEY]**EXERCISE-1**

Q.1	B	Q.2	A	Q.3	B	Q.4	A	Q.5	B
Q.6	D	Q.7	A	Q.8	B	Q.9	A	Q.10	A
Q.11	B	Q.12	A	Q.13	B	Q.14	B	Q.15	A
Q.16	B	Q.17	D	Q.18	B	Q.19	C	Q.20	A
Q.21	B	Q.22	A	Q.23	D	Q.24	A	Q.25	D
Q.26	A	Q.27	B	Q.28	A	Q.29	C	Q.30	C
Q.31	D	Q.32	C	Q.33	B	Q.34	C	Q.35	A
Q.36	C	Q.37	D	Q.38	C	Q.39	A	Q.40	A
Q.41	B	Q.42	C	Q.43	B	Q.44	A	Q.45	B
Q.46	B	Q.47	C	Q.48	C	Q.49	C	Q.50	C
Q.51	A	Q.52	A	Q.53	C	Q.54	D	Q.55	D
Q.56	D	Q.57	C	Q.58	D	Q.59	A	Q.60	B
Q.61	C	Q.62	A	Q.63	C	Q.64	A	Q.65	C
Q.66	C	Q.67	A	Q.68	D	Q.69	C	Q.70	D
Q.71	A	Q.72	C	Q.73	C	Q.74	A	Q.75	D
Q.76	C	Q.77	A	Q.78	D	Q.79	B	Q.80	D
Q.81	B	Q.82	C	Q.83	B	Q.84	B	Q.85	B
Q.86	D	Q.87	B	Q.88	A	Q.89	B	Q.90	B
Q.91	A	Q.92	B	Q.93	C	Q.94	C	Q.95	B
Q.96	C	Q.97	C	Q.98	A	Q.99	D	Q.100	D
Q.101	D	Q.102	B	Q.103	B	Q.104	D		