

SOLUTIONS

Module - 6 / JEE-2021

In-Chapter Exercises	Chemistry	D-block Elements
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EXERCISE- A

1. Due to lanthanoid contraction, the difference between the radius of second and third period elements is negligible. As a result, they have similar lattice energies, solvation energies, ionization energies and other properties.
2. (1) Many transition metals contain partially filled electrons shell. The unpaired electrons produce spin magnetic moments which result into paramagnetism.
(2) Colour arises from the ability of a compound to absorb particular wavelengths of white light and emit the rest. This can occur when their is/are electrons/ charge can be transferred from an energy level to another which is the case with transition elements and their compounds.

EXERCISE-B

- $$\text{K}_2\text{Cr}_2\text{O}_7 + 2\text{KI} + 4\text{H}_2\text{SO}_4 \longrightarrow \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3 + 7\text{H}_2\text{O} + \text{I}_2$$
 - $$\text{K}_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta} \text{K}_2\text{CrO}_4 + \text{Cr}_2\text{O}_3 + \text{O}_2 \quad (3) \quad 2\text{KMnO}_4 \xrightarrow{\Delta} \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2 \text{ (disproportionation)}$$
 - $$2\text{MnO}_4^- + 5\text{AsO}_3^- + 6\text{H}^+ \longrightarrow 2\text{Mn}^{2+} + 3\text{H}_2\text{O} + 5\text{AsO}_4^{3-}$$
 - $$\text{K}_2\text{Cr}_2\text{O}_7 + 2\text{NH}_4\text{Cl} \longrightarrow (\text{NH}_4)_2\text{Cr}_2\text{O}_7 + 2\text{KCl}$$

$$(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta} \underset{\text{(green)}}{\text{Cr}_2\text{O}_3} + \underset{\text{(gas)}}{\text{N}_2} + 4\text{H}_2\text{O} \quad ; \quad \text{Cr}_2\text{O}_3 + 2\text{A} \xrightarrow{\Delta} \underset{\text{(metal)}}{2\text{Cr}} + \underset{\text{(oxide)}}{\text{A}_2\text{O}_3}$$
- $$2\text{CrO}_4^{2-} + 2\text{H}^+ \longrightarrow \text{Cr}_2\text{O}_7^{2-} + \text{H}_2\text{O}$$
 - $$\text{CrO}_4^{2-} + 2\text{H}_2\text{O}_2 + 2\text{H}^+ \longrightarrow \text{CrO}_5 + 3\text{H}_2\text{O}$$
- X is NH_4Cl .

$$4\text{Cl}^- + \text{K}_2\text{Cr}_2\text{O}_7 + 6\text{H}_2\text{SO}_4 \longrightarrow 2\text{CrO}_2\text{Cl}_2 + 2\text{KHSO}_4 + 4\text{HSO}_4^- + 3\text{H}_2\text{O}$$

(from NH_4Cl) (gas A)

$$\text{CrO}_2\text{Cl}_2 + 4\text{NaOH} \longrightarrow \text{Na}_2\text{CrO}_4 + 2\text{NaCl} + 2\text{H}_2\text{O}$$

(B)

$$\text{Na}_2\text{CrO}_4 + (\text{CH}_3\text{COO})_2\text{Pb} \longrightarrow \text{PbCrO}_4 \downarrow + 2\text{CH}_3\text{COONa}$$

(C)

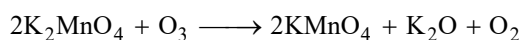
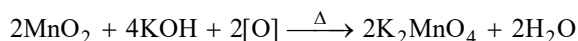
$$\text{NH}_4^+ + \text{NaOH} \xrightarrow{\Delta} \text{NH}_3 + \text{Na}^+ + \text{H}_2\text{O}$$

(From NH_4Cl) (gas)

$$\text{NH}_3 + 2\text{HgI}_4^{2-} + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{N}-\text{Hg}-\text{O}-\text{Hg}-\text{I} \downarrow + 7\text{I}^- + 3\text{H}^+$$

(D)

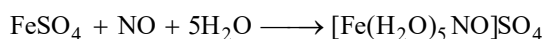
4. The process described is that of preparation of potassium permanganate from pyrolusite ore.



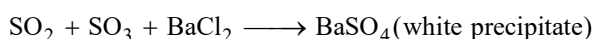
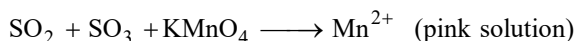
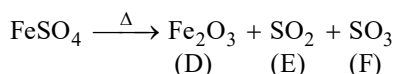
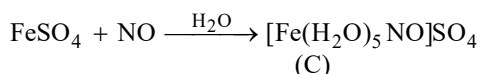
5. $\text{Cr}_2\text{O}_7^{2-} + 3\text{SO}_3^{2-} + 8\text{H}^+ \longrightarrow 2\text{Cr}^{3+} + 3\text{SO}_4^{2-} + 4\text{H}_2\text{O}$

EXERCISE-C

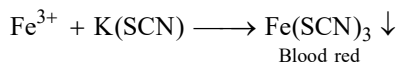
1. Nitrates produce NO which coordinates with Fe^{2+} to give a brown ring.



2. $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} \xrightarrow{\Delta} \text{FeSO}_4$ (white)
(A) (B)



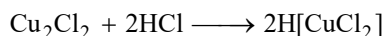
- 3.(B) $\text{Fe}^{2+} + \text{K}_3[\text{Fe}(\text{CN})_6] \longrightarrow \text{Fe}_3[\text{Fe}(\text{CN})_6]_2 \downarrow$
Turnbull's blue



- 4.(ABD) Co^{II} state is stable in simple compounds of cobalt while the +III state is more stable in complex.

EXERCISE-D

1. (1) AgNO_3 decomposes to Ag_2O and NO_2 in presence of slight heat (due to light) and is thus kept in dark bottles.
(2) This is because Cu^{2+} can form many complexes with NH_4^+ which are coloured in water.
(3) Cuprous halides form soluble complexes in presence of excess of halide ions in solution.



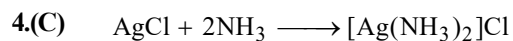
- (4) I^- ion is a stronger reducing agent than Cl^- ion. It reduces Cu^{2+} ion into Cu^+ ion. Hence, cupric iodide is converted into cuprous iodide. Thus the species $[\text{CuI}_4]^{2-}$ does not exist.

- (5) $\text{Cu}_2\text{Cl}_2 + 2\text{NaOH} \longrightarrow \text{Cu}_2\text{O} \downarrow + 2\text{NaCl} + \text{H}_2\text{O}$

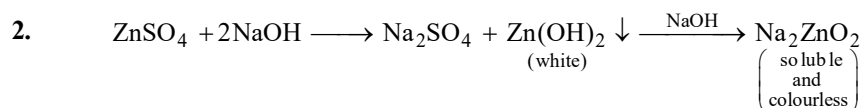
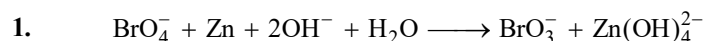
Precipitate changes colour from yellow to red due to formation of Cu_2O

- 2.(B) Fehling's Test reduces CuO to red coloured Cu_2O .

- 3.(C) $4\text{AgNO}_3 + 2\text{Cl}_2 \longrightarrow 4\text{AgCl} + 2\text{N}_2\text{O}_5 + \text{O}_2$



EXERCISE-E



3. (i) First a white precipitate of $\text{Zn}(\text{OH})_2$ is formed which on further addition of NaOH forms soluble zincate Na_2ZnO_2 .

(ii) NH_4OH is a weak hydroxide. It is ionized slightly furnishing OH^- ions which are sufficient to precipitate $\text{Zn}(\text{OH})_2$ because of its low solubility product. However, in presence of NH_4Cl , the ionization of NH_4OH is further suppressed and sufficient OH^- are not available to cause precipitation.

