D–BLOCK

1. What is the correct order of the following elements with respect to their density ?

(1) Cr < Zn < Co < Cu < Fe

(2) Zn < Cu < Co < Fe < Cr

(3) Zn < Cr < Fe < Co < Cu

(4) Cr < Fe < Co < Cu < Zn

2. The **incorrect** statement among the following is :

(1) $VOSO_4$ is a reducing agent

(2) Cr_2O_3 is an amphoteric oxide

(3) RuO_4 is an oxidizing agent

(4) Red colour of ruby is due to the presence of Co^{3+}

3. Dichromate ion is treated with base, the oxidation number of Cr in the product formed is _____.

4. Fex_2 and Fey_3 are known when x and y are :

(1) x = F, Cl, Br, I and y = F, Cl, Br

(2) x = F, Cl, Br and y = F, Cl, Br, I

(3) x = Cl, Br, I and y = F, Cl, Br, I

(4) x = F, Cl, Br, I and y = F, Cl, Br, I

5. Given below are two statements:

Statement I : Potassium permanganate on heating at 573 K forms potassium manganate.

Statement II : Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is true but statement II is false

(2) Both statement I and statement II are true

(3) Statement I is false but statement II is true

(4) Both statement I and statement II are false

6. The common positive oxidation states for an element with atomic number 24, are :

(1) +2 to +6 (2) +1 and +3 to +6

(3) +1 and +3 (4) +1 to +6

7. Match **List-I** with **List-II**

List-I (process)	**List-II (catalyst)**
(a) Deacron's process	(i) ZSM-5
(b) Contact process	(ii) $CuCl_2$
(c) Cracking of hydrocarbons	(iii) Particles 'Ni'
(d) Hydrogenation of vegetable oils	(iv) V_2O_5

Choose the most appropriate answer from the options given below -

(1) a-ii, b-iv, c-i, d-iii (2) a-i, b-iii, c-ii, d-iv

(3) a-iii, b-i, c-iv, d-ii (4) a-iv, b-ii, c-i, d-iii

8. Cu^{2+} salt reacts with potassium iodide to give

(1) Cu_2I_2 (2) Cu_2I_3 (3) CuI (4) $Cu(I_3)_2$

9. The set having ions which are coloured and paramagnetic both is -

(1) Cu^{2+}, Cr^{3+}, Sc^{+} (2) Cu^{2+}, Zn^{2+}, Mn^{4+}

(3) Sc^{3+}, V^{5+}, Ti^{4+} (4) Ni^{2+}, Mn^{7+}, Hg^{2+}

10. Which one of the following metals forms interstitial hydride easily ?

(1) Cr (2) Fe

(3) Mn (4) Co

11. Number of electrons present in 4f orbital of Ho^{3+} ion is _____ .

(Given Atomic No. of Ho = 67)

12. Which one of the following when dissolved in water gives coloured solution in nitrogen atmosphere?

(1) $CuCl_2$ (2) AgCl

(3) $ZnCl_2$ (4) Cu_2Cl_2

13. The nature of oxides V_2O_3 and CrO is indexed as 'X' and 'Y' type respectively. The correct set of X and Y is:

(1) X = basic Y = amphoteric

(2) X = amphoteric Y = basic

(3) X = acidic Y = acidic

(4) X = basic Y = basic

14. The addition of dilute NaOH to Cr^{3+} salt solution will give :

(1) a solution of $[Cr(OH)_4]^-$

(2) precipitate of $Cr_2O_3(H_2O)_n$

(3) precipitate of $[Cr(OH)_6]^{3-}$

(4) precipitate of $Cr(OH)_3$

15. Potassium permanganate on heating at 513 K gives a product which is :
(1) paramagnetic and colourless
(2) diamagnetic and green
(3) diamagnetic and colourless
(4) paramagnetic and green

16. In the structure of the dichromate ion, there is a
(1) linear symmetrical Cr–O–Cr bond.
(2) non-linear symmetrical Cr–O–Cr bond.
(3) linear unsymmetrical Cr–O–Cr bond.
(4) non-linear unsymmetrical Cr–O–Cr bond.

17. In which one of the following sets all species show disproportionation reaction ?
(1) ClO_2^-, F_2, MnO_4^- and $Cr_2O_7^{2-}$
(2) $Cr_2O_7^{2-}, MnO_4^-, ClO_2^-$ and Cl_2
(3) MnO_4^-, ClO_2^-, Cl_2 and Mn^{3+}
(4) $ClO_4^-, MnO_4^-, ClO_2^-$ and F_2

18. In the given chemical reaction, colors of the Fe^{2+} and Fe^{3+} ions, are respectively :
$5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$
(1) Yellow, Orange (2) Yellow, Green
(3) Green, Orange (4) Green, Yellow

19. Identify the element for which electronic configuration in +3 oxidation state is $[Ar]3d^5$:
(1) Ru (2) Mn
(3) Co (4) Fe

SOLUTION

1. Official Ans. by NTA (3)

Sol.

	Zn	< Cr	< Fe	< Co	< Cu
Density/g cm^{-3}	7.1	7.19	7.8	8.7	8.9

2. Official Ans. by NTA (4)

Sol.

(i) In $VOSO_4$, 'V' is in +4 oxidation state.

So it act as oxidising agent.

(ii) Cr_2O_3 is an amphoteric oxide.

(iii) In RuO_4, 'Ru' is in +8 oxidation state.

So it act as oxidising agent.

(iv) Red colour of ruby is due to the presence of Cr^{+3} ions in Al_2O_3.

3. Official Ans. by NTA (6)

Sol. $Cr_2O_7^{2-} + OH^- \longrightarrow CrO_4^{2-}$

Oxidation state of CrO_4^{2-} Cr in is +6

4. Official Ans. by NTA (1)

Sol. $\underset{\text{(Unstable)}}{2FeI_3} \longrightarrow \underset{\text{(Stable)}}{2FeI_2} + I_2$

Due to strong reducing nature of I^-

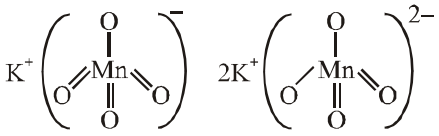
$2Fe^{3+} + 2I^- \longrightarrow 2Fe^{2+} + I_2$

remaining halides of Fe^{2+} & Fe^{3+} are stable.

5. Official Ans. by NTA (1)

Sol. $2KMnO_4 \xrightarrow{573K} K_2MnO_4 + MnO_2 + O_2$

Potassium permanganate — Potassium manganate



Tetrahedral unit diamagnetic — Tetrahedral unit paramagnetic

Statement-I is correct.

Statement-II is incorrect.

6. Official Ans. by NTA (1)

Sol. Cr(Z=24)

[Ar] $4s^1 3d^5$ Cr shows common oxidation states starting from +2 to +6.

7. Official Ans. by NTA (1)

Sol. In manufacture of H_2SO_4 (contact process), V_2O_5 is used as a catalyst.

Ni catalysts enables the hydrogenation of fats.

$CuCl_2$ is used as catalyst in Deacon's process.

ZSM-5 used as catalyst in cracking of hydrocarbons.

8. Official Ans. by NTA (1)

Sol. $2Cu^{+2} + 4I^- \longrightarrow Cu_2I_2(s) + I_2$

$2Cu^{+2} + 3I^- \longrightarrow 2CuI + I_2$

9. Official Ans. by NTA (1)

Sol. $Cu^{2+} : [Ar]3d^9 4s^0$
$Cr^{3+} : [Ar]3d^3 4s^0$
$Sc^{+} : [Ar]3d^1 4s^1$
] All are coloured and paramagnetic due to presence of unpaired electrons

10. Official Ans. by NTA (1)

Sol. Elements of group 7,8,9 do not form hydrides thus Cr will only form hydride among the given elements (Fe, Mn, Co)

11. Official Ans. by NTA (10)

Sol. Ho = $[Xe]4f^{11}6s^2$

$Ho^{3+} = [Xe]\,4f^{10}$

so number of e^- present in 4f is 10.

12. Official Ans. by NTA (1)

Sol. (1) $CuCl_2 + nH_2O \rightarrow Cu^{+2}_{(aq.)}$

blue colour

(2) $AgCl + nH_2O \rightarrow$ Insoluble

(3) $ZnCl_2 + nH_2O \rightarrow Zn^{+2}_{(aq.)}$

Colourless

(4) $Cu_2Cl_2 + nH_2O \rightarrow$ Insoluble

13. Official Ans. by NTA (4)

Sol. V_2O_3 basic

CrO basic

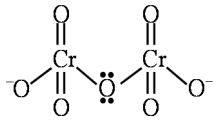
14. Official Ans. by NTA (2)

Sol. $Cr^{3+} + \underset{\text{dil.}}{NaOH} \longrightarrow \underset{\text{precipitate}}{Cr_2O_3.(H_2O)_n}$

15. Official Ans. by NTA (4)

Sol. $2KMnO_4 \xrightarrow[200°C]{\Delta} \underset{\text{Green}}{K_2MnO_4} + \underset{\text{Black}}{MnO_2} + O_2$ In K_2MnO_4, manganese oxidation state is +6 and hence it has one unpaired e^-.

16. Official Ans. by NTA (2)

Sol. 

dichromate ion contain non-linear symmetrical Cr–O–Cr Bond

17. Official Ans. by NTA (3)

Sol. No option contains all species that show disproportionation reaction.

MnO_4^-

Mn is in +7 oxidation state (highest) hence cannot be simultaneously oxidized or reduced.

18. Official Ans. by NTA (4)

Sol. Colour of Fe^{2+} is observed green and Fe^{3+} is yellow

19. Official Ans. by NTA (4)

Sol. Fe^{3+} [Ar] $3d^5$