Chapter: d and f- block elements
Type : MLL
<u>One mark questions</u>

Explain Why ? / How would you account for the following: [1 mark each]

1. Transition metals are less reactive, high melting point and enthalpy of atomization.
2. Transition metals have high enthalpy of hydration.
3. Transition metals show several oxidation states.
4. Transition metals form coloured complexes.
5. Transition metals take part in catalytic reactions.
6. Why does vanadium pentaoxide act as a catalyst?
7. Transition metals are paramagnetic in nature.
8. Transition metals form complexes.
9. Transition metals have irregular E^0 values.
10. The E^0M^{2+}/M for copper is positive (0.34v) .Copper is the only metal in first series of transition elements showing this behavior, why?
11. Transition metals form alloys.
12. Transition metals form interstitial compounds.
13. Cu^+ is unstable in aqueous solution.
14. Cu^{2+} is stable in aqueous solution.
15. Zr and Hf exhibit almost same radii and properties.

16. The d^1 configuration is generally unstable in ions.
17. There is a in general increase in density of element from titanium(Z=22) to copper (Z=29).
18. The lowest oxides of transition metals is basic, the highest is amphoteric or acidic.
19. Anhydrous $CuSO_4$ is white while hydrated Copper sulphate is blue.
20. Co^{2+} is easily oxidized to Co^{3+} in presence of strong ligand.

Two marks questions

21. (a) Why HCl cannot be used in place of sulphuric acid to acidify KMnO4 solution in volumetric analysis ?
    (b) Potassium dichromate is a good oxidising agent in acidic medium, why?
22. Write the balanced ionic equations for reacting ions to represent the acidified potassium dichromate solution with :
    (i) Potassium iodide solution
    (ii) Acidified ferrous sulphate solution.
23. List some applications of d block elements.
24. Describe giving reasons which one of the following pairs has the properties indicated?
    (a) Fe or Cu has higher melting point.
    (b) Co^{2+}Or Ni^{2+} has lower magnetic moment.
25. Calculate the magnetic moment of a trivalent ion in aqueous solution whose atomic no. is 25.
26 Define transition elements. Explain why is Zn not considered as transition element while Cu does?
27. What happens when Cu^{2+} is added to I^-?Write the balanced chemical equation .
28 Write the electronic configuration of $_{24}$ Cr and $_{26}Fe^{2+}$.
29 Compare non transition and transition elements on the basis of their Variability of oxidation states (ii) stability of oxidation states.
30 **(a)** Name a transition element which does not exhibit variable oxidation state.
(b) Name three elements of d block which are not regarded as transition element**.**

Three Marks questions

31. Give chemical reactions for the following observations:
(i) Potassium permanganate is a good oxidising agent in basic medium.
(ii) Inter convertibility of chromate ion and dichromate ion in aqueous solution depends Upon pH of the solution.
(iii) Potassium permanganate is thermally unstable at 513K.
32. Define lanthanoid Contraction. Ce^{4+} is a good oxidizing agent whereas Eu^{2+}, Sm^{2+} is a good reducing agent, why ?
33.(a)From element to element the actinoid contraction is greater than lanthanoidcontraction,why?
(b) Name the lanthanoid element which forms tetra positive ions in the aqueous solution.
© The chemistry of actinoids is not as smooth as lanthanoids, why?
34. Balance the following equations:
(i) $MnO_4^- + S_2O_3^{2-} \longrightarrow$ (Basic medium)
(ii) $MnO_4^- + S_2O_3^{2-} + H_2O \longrightarrow$
(iii) $MnO_4^- + I^- \longrightarrow$ (in neutral or alkaline medium)

35 (a)The enthalpies of atomization of transition metals of 3d series do not follow a regular trend throughout the series.
(b) The enthalpy of atomization of zinc is lowest.
© Zn Cd Hg are soft and have low melting points.
36. Explain:
(a) The E° value for Ce^{4+}/Ce^{3+} is 1.74 Volt.
(b)$K_2Cr_2O_7$ is used as Primary Standard in volumetric analysis.
© The third ionization energy of manganese (z=25) is exceptionally high.
37.Explain:
(a)Although Cu^+ has configuration 3 d^{10} 4 s^0 (stable) and Cu^{2+} has configuration 3 d^9 (unstable configuration) still Cu^{2+} compounds are more stable than Cu^+.
(b) Titanium (IV) is more stable than Ti (III) or Ti (II).
© The greatest number of oxidation states are exhibited by the members in the middle of a transition series.
38 (a) Highest manganese flouride is MnF_4 whereas the highest oxide is Mn_2O_7, why?
(b) Copper can notlibrate H_2 from dilacids,why?
(c)Which of the 3d- series of transition metals exhibits largest number of oxidation states and why?
39.(a)O.S. of first transition series initially increase up to Mn and then decrease to Zn , why?
(b) Why is Cr^{2+} reducing and Mn^{3+} oxidizingwhile both have d^4 configuration.
© Ti achieves tetrahalides while chromium forms heaxhalide, why?
40.(a)Which form of Cu is paramagnetic and why?
(b) What is the oxidation no. of Cr in $Cr_2O_7^{2-}$?
41 Complete the following reaction equations:

(a) $MnO_2 + KOH\ (aq) + O_2 \longrightarrow$
(b) $Fe^{2+} + MnO_4^- + H^+ \longrightarrow$
(c) $MnO_4^- + C_2O_4^{2-}\ (aq) + H^+ \longrightarrow$
(d) $Cr_2O_7^{2-} + H_2S + H^+ \longrightarrow$
(e) $Cr_2O_7^{2-} + I^- + H^+ \longrightarrow$

42. Describe the preparation of potassium dichromate from iron chromite ore. What is the effect of increasing P^H on a solution of potassium dichromate or Explain how the colour of $K_2Cr_2O_7$ solution depends on P^H of the solution?
43.(a)Describe the preparation of potassium permanganate.
(b) How does the acidifiedpermanganate solution react with (i) iron(II) ions (ii) SO_2 and (iii) oxalic acid?Write the ionic equations for the reactions.
44.Describe the oxidising action of potassium dichromate and write the ionic equations for its reaction with:
iodide (ii) iron(II) solution and (iii) H_2S
45.When a chrromite ore A is fused with sodium carbonate in free excess of air and the product is dissolved in water , a yellow solution of compound B is obtained .After treatment of this yellow solution

with sulphuric acid compound C can be crystallize from the solution .When compound C is treated with KCl orange crystals of compound D is crystallizes out. Identify A to D and wtite the reaction from A to B.

Answer Key
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1	Strong metallic bonding and d-d overlapping.
2	Small size
3	Comparable energies of (n-1)d and ns electrons.
4	d-d transition.
5	Can pass from one oxidation state to another very easily.
6	Can pass from one oxidation state to another very easily.
7	Unparied electrons
8	Have vacant d orbitals to accept electrons.
9	Irregualr trend in IE, sublimation energy and hydration energy.
10	Sum of enthalpies of sublimation and ionization (enthalpy of atomization) > hydration energy.
11	Almost same size.
12	Can accommodate small atoms in void position.
13	Low hydration enthalpy and property to show disproportionation reaction.
14	High hydration enthalpy.
15	Lanthanoid contraction
16	Hydration energy > Ionization energy.
17	It is due to increase in mass per unit volume with increase in atomic no.
18	Lower oxides are ionic while higher oxides are covalent.
19	No d-d transition in the absence of ligand.
20	Crystal field stabilisation energy of Co+3 ion is higher than Co2+ ion.
21	(a) HCl can be oxidized into Cl_2. **(b)** It evolve nascent oxygen .
22	(a) $Cr_2O_7^{2-} + 6I^- + 14\ H^+ \longrightarrow 2\ Cr^{3+} + 3I_2 + 7H_2O$ (b) $Cr_2O_7^{2-} + 6Fe^{2+} + 14\ H^+ \longrightarrow 6Fe^{3+} + 2\ Cr^{3+} + 7H_2O$
23	Ni , Fe, V_2O_5 are used as catalyst in various industrial process. AgBr is used in photography. Pt compound are used in anticancer drug. MnO_2 is used as OA in dry cells.
24	Fe Ni^{2+}
25	4 unpaired electrons M.M = $[4(4+2)]^{1/2}$

26	Transition elements are those whose neutral atom or stable ion has partly filled d-orbitals. Cu^{2+} has partly filled d-orbitals which are absent in Zn or Zn^{2+}.
27	$2CU^{2+} + 4I^{-} \longrightarrow Cu_2I_2 + I_2$
28	Cr= [Ar] $3d^5\ 4s^1$ Cu[Ar]$3d^{10}4s^1$
29	Oxidation states of transition elements differ from each other by unity. In non transitionelements oxidation states normally differ by a unit of two.
30	(a) Sc (b) Zn, Cd, Hg
31	(i) $2MnO_4^- + 2H_2O + 3e^- \longrightarrow 2MnO_2 + 4OH^-$ (ii) CrO_4^{2-} ======= $Cr_2O_7^{2-}$ (if PH > 4 the CrO_4^{2-} ion will exist and if PH < 4 then $Cr_2O_7^{2-}$ will exist) ie. $2\ CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$ $Cr_2O_7^{2-} + 2OH^- \longrightarrow 2\ CrO_4^{2-} + H_2O$ (iii) $2\ KMnO_4 + 513\ K \longrightarrow K_2MnO_4 + MnO_2 + O_2$
32	(a) Decrease in atomic or ionic radii with increase in atomic number. **(b)** For lanthanoids common oxidation state is +3 . to acquire +3 oxidation state Ce^{4+} undergoes reduction and hence acts as oxidizing agent ,while Eu^{2+} undergoes oxidation and hence acts as reducing agent.
33	(a) It is due to poor shielding by 4f and 5f electrons. (b) Ce (Ce^{4+}) © Actinoids are radioactive in nature.
34	i) & (ii) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow 8MnO_2 + 2\ OH^- + 6\ SO_4^{2-}$ (iii) $2MnO_4^- + I^- + H_2O \longrightarrow 2OH^- + 2MnO_2 + IO_3^-$
35	(a) Bec. enthalpy of atomisation depends upon no. of unpaired electrons . (b) No unpaired electrons . © Absence of d-d overlapping and poor metallic bonding.
36	(a) Ce^{4+} is strong oxidant, being Lanthanoid it reverts to Ce^{3+} as + 3 is most stable. (b) $K_2Cr_2O_7$ is not much soluble in cold water. However, it is obtained in pure state and is not Hygroscopic in nature. © Mn^{3+},extra stable due to half filled d^5 configuration.
37	(a) It is due to much more negative Hydration enthalpy of Cu^{2+} (aq) than Cu^+ (b) Ti^{IV} is more stable due to d^0 configuration. (c) Maximum no. of unpaired electrons are in middle.
38	(a) The ability of oxygen to form multiple bonds to metals, explain its superiority to show higher oxidation state with metal. (b) Positive E° value (+ O . 34 Volt) accounts for its inability to liberate H_2 from acids. (c)Mn, Maximum no. of unpaired electrons.

39	(a) Number of unpaired electrons increases up to Mn and then decreases up to Zn. (b) To acquire +3 O.S. Cr^{2+} has a tendency to lose the electron while Mn^{3+} has a tendency to accept an electron . **(c)** To acquire d^0 configuration.
40	(a) Cu^{2+}, One unpaired electron. (b) +6
41	$MnO_2 + 2\ KOH\ (aq) + O_2 \longrightarrow K_2MnO_4 + H_2O$ $5\ Fe^{2+} + MnO_4^- + 8\ H^+ \longrightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$ $2MnO_4^- + 5C_2O_4^{2-}\ (aq) + 16\ H^+ \longrightarrow 2\ Mn^{2+} + 8H_2O + 10\ CO_2$ $Cr_2O_7^{2-} + H_2S + H^+ \longrightarrow$ Do yourself $Cr_2O_7^{2-} + I^- + H^+ \longrightarrow$ Do yourself
42	(a) $4FeCr_2O_4 + 8Na_2CO_3 + 7\ O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$ $2Na_2CrO_4 + 2H^+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$ $Na_2Cr_2O_7 + 2\ KCl \longrightarrow K_2Cr_2O_7 + 2\ NaCl$ (b) CrO_4^{2-} ======= $Cr_2O_7^{2-}$) (if PH > 4 the CrO_4^{2-} ion (yellow) will exist and if PH < 4 then $Cr_2O_7^{2-}$ ion(orange) will exist
43	(a) $2MnO_2 + 4KOH\ (aq) + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$ MnO_4^{2-} ----electrolysis-→ MnO_4^- $5\ Fe^{2+} + MnO_4^- + 8\ H^+ \longrightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$ $5\ SO2 + 2MnO_4^- + 2H_2O \longrightarrow 2Mn^{2+} + 4H^+ + 5SO_4^{2-}$ $2MnO_4^- + 5C_2O_4^{2-}\ (aq) + 16\ H^+ \longrightarrow 2\ Mn^{2+} + 8H_2O + 10\ CO_2$
44	(a) Ch_3CH_2OH-----$K_2Cr_2O_7/H^+$-→CH_3COOH (b) (b)$Cr_2O_7^{2-} + 6I^- + 14H^+ \longrightarrow 2Cr^{3+} + 3I_2 + 7\ H_2O$ $Cr_2O_7^{2-} + 6\ Fe^{2+} + 14\ H^+ \longrightarrow 2Cr^{3+} + 6Fe^{3+} + 7\ H_2O$ $Cr_2O_7^{2-} + 3S^{2-} + 14\ H^+ \longrightarrow 2Cr^{3+} + 3S + 7\ H_2O$
45	**A= $FeCr_2O_4$** B= Na_2CrO_4 C= $Na_2Cr_2O_7$ D = $K_2\ Cr_2O_74$ $FeCr_2O_4 + 8Na_2CO_3 + 7\ O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$