SOLUTION TEST-A

1. Zinc is not a transition element due to completely filled d-subshell in the elemental as well as in stable +2 oxidation state

   The correct answer is (iii)

2. $KMnO_4$ on exposure to heat or light undergoes intramolecular redox reaction to give, MnO_2 and as a result, the bottles turns brown from the neck.

   $$2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$$

   The correct answer is (iv)

3. $Cr_2O_7^{2-} \rightarrow$ only in acidic medium

   $CrO_4^{2-} \rightarrow$ exist in basic medium

   $MnO_4^- \rightarrow$ exist in both acidic and basic medium.

   The correct answer is (ii)

4. The hydration enthalpy of Cu^{2+} is low and does not compensate for high enthalpy of sublimation and high enthalpy of ionisation.

   The correct answer is (i)

5. Zr and Hf show similarities in their physical and chemical properties due to **Lanthanoid contraction.**

   The correct answer is (iii)

6. Scandium does not show variable oxidation state.

   Its stable oxidation state is +3.

7. Misch metal is 90 – 95% lanthanoids, 4 – 5% iron and the rest is Si, C, Ca. It is used in making ignition devices like cigarette lighter, gas lighter.

8. (i) This is because 5f subshell in actinoids protects the valence electron from the nucleus less efficiently than the 4f subshell in lanthanoids. Hence, actinoid contraction is stronger than lanthanoids contraction. There is more pronounced decrease in size in actinoids than in lanthanoids.

   (ii) This is due to comparable energy 5f, 6d and 7s that all three participate in the bond formation. Hence, actinoids shows much more number of oxidation states than lanthanoids.

9. (i) Zn has a fully filled $3d^{10}$. Zinc has weak metallic bonds and interatomic forces of attraction to hold zinc atoms together are also very weak. Hence, zinc has a lowest enthalpy of atomisation.

   (ii) Cr^{2+} is reducing because by the loss of one e^-, it gains the stability of half filled t_{2g}^3 in Cr^{3+}.

   Mn^{3+} gains one e^- readily to become Mn^{2+} which has a half filled $3d^5$ configuration. Hence Mn^{3+} is strongly oxidising.

10. (i) Due to the presence of fully filled d-subshell, the interatomic forces of attractions are very weak so, Zn, Cd and Hg have low boiling points. Hence, these metals are highly volatile.

    (ii) Down the group as we move form 3d to 5d series, atomic size increases, the electron are more loosely held. Therefore, there is stronger metal-metal bonding in 5d series than in 3d or 4d series. The 5d series elements are more metallic than 3d or 4d series elements.

11. $A \rightarrow MnO_2$

$B \rightarrow K_2MnO_4$

$C \rightarrow KMnO_4$

The equations involved are:

$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$

(A) (B)

$3K_2MnO_4 + 2H_2SO_4 \rightarrow 2KMnO_4 + MnO_2 + 2K_2SO_4 + 2H_2O$

(B) (C)

12. (i) $Cr_2O_7^{2-} + 3H_2S + 8H^+ \longrightarrow 2Cr^{3+} + 3S + 7H_2O$

(ii) $2MnO_4^- + 5H_2C_2O_4 + 6H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

(iii) $Cr_2O_7^{2-} + 6I^- + 14H^+ \longrightarrow 2Cr^{3+} + 3I_2 + 7H_2O$

13. (i) Transition metals and their compounds are good catalysts due to
- Their ability to show variable oxidation states and to form complexes.
- Their ability to provide a large surface area to adsorb reactant molecules for the reaction to take place.

(ii) Co^{2+} has a configuration of $[Ar]3d^7$ but in the presence of strong complexing agent, Co^{2+} gets oxidised to Co^{3+} which attains a stable configuration of fully filled t_{2g}^6.

(iii) Ti^{3+} in $[Ti(H_2O)_6]^{3+}$ has one unpaired electron in $t_{2g}^1 e_g^0$. By the absorption of light, electron can jump from t_{2g} to e_g and gives $t_{2g}^1 e_g^0$. The wavelength of this excitation falls in the visible region of the spectrum. Hence $[Ti(H_2O)_6]^{3+}$ is pale pink in colour.

$[Sc(H_2O)_6]^{3+}$ does not have any unpaired electron so, does not show any d-d transition. Hence $[Sc(H_2O)_6]^{3+}$ is colourless.

14. (i)

	O.S. of vanadium	Electronic configuration	Number of unpaired electron
VO^{2+}	+4	$[Ar]3d^1$	1
VO_2^+	+5	$[Ar]3d^0$	0
VO^+	+3	$[Ar]3d^2$	2

More the number of unpaired electrons, higher the value of magnetic moment $\mu = \sqrt{n(n+2)}\ BM$. The correct order is

$VO_2^+ < VO^{2+} < VO^+$

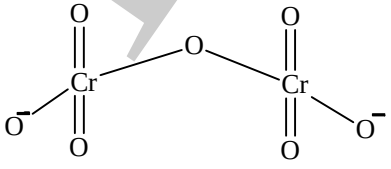
(ii) Cerium

(iii) In MnO_4^-, all Mn – O bond are equal in length due to resonance,

15. (a) (i) $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 2Fe_2O_3 + 8Na_2CrO_4 + 8CO_2$

(ii) $2Na_2CrO_4 + H_2SO_4 + 2KCl \rightarrow Na_2SO_4 + K_2Cr_2O_7 + H_2O + 2NaCl$

(b)



There are six equivalent Cr – O bond in $Cr_2O_7^{2-}$ ions.

(c) $\mu = 1.73\ BM$ means there is only one unpaired elelctron in the ion. V(Z = 23) = [Ar] $3d^3 4s^2$. In order ot have only one unpaired elecron is 3d, we have to remove four electrons (2 from 4s and 2 from 3d), hence the symbol V^{4+}.