NEW STANDARD ACADEMY

Marks: 70

Date : 03-10-25 **CLASS : 12TH CHEMISTRY** **Time: 3 hours.**

SECTION –A

1. Which ion has maximum magnetic moment?
   (a) V^{+3} (b) Mn^{+3}
   (c) Fe^{+3} (d) Cu^{+2}
2. In acidic solution, oxidising action of potassium dichromate can be represented as
   (a) $Cr_2O_7^{2-} + 3H^+ + Mn^{2+} \rightarrow 2Cr^{2+} + NH_3$
   (b) $Cr_2O_7^{2-} + 14H^+ + 6\ e^- \rightarrow 2Cr^{3+} + 7H_2O$
   (c) $Cr_2O_7^{2-} + 18H^+ + 6Fe^{2+} \rightarrow 4Cr^{3+} + Cr_2O_5$
   (d) $CrO_4^{2-} + 4H^+ + 5Cl_2 \rightarrow 2Cr^{3+} + Mn^{2+} + 7H_2O$
3. The highest oxidation state which is shown by transition metals is:
   (a) +3 (b) +8
   (c) +7 (d) +5
4. Which of the given options gives the correct magnetic properties of the given ions?
   [At no. of: La = 57 Ce = 58, Yb = 70 Lu = 71]
   (a) Both La and La^{+3} is paramagnetic in nature.
   (b) Both La^{+3} and Lu^{+3} are repelled by the applied magnetic field.
   (c) Ce^{+2} is diamagnetic in nature.
   (d) Yb^2 has a magnetic moment of 2.76 BM.
5. Which of the following is not an element of first transition series?
   (a) Fe (b) Co
   (c) Ni (d) Ag
6. Which of the following statements is not correct?
   (a) Copper liberates hydrogen from acids
   (b) In its higher oxidation states, manganese forms stable compounds with oxygen and fluorine
   (c) $M\ n^{3+}$ and Co^{3+} are oxidising agents in aqueous solution are reducing agents in aqueous solution
   (d) $T\ i^{2+}$ and Cr^{2+} are reducing agents in aqueous solution

Assertion and Reason

Direction: The following questions consist of two statements Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:
(a) Both A and R are true, and R is the correct explanation of A
(b) Both A and R are true, but R is not the correct explanation of A
(c) A is true, but R is false.
(d) A is false, but R is true.

7. Assertion (A): Transition metals have low melting points.
   Reason (R): The involvement of greater number of (n - 1)d and ns electrons in the interatomic metallic bonding.
8. Assertion (A): Copper does not form copper (II) sulphate on reaction with dil. sulphuric acid.
   Reason (R): The standard potential for Cu^{+2} | Cu electrode is negative.
9. Assertion (A): Actinoids form relatively less stable complexes as compared to lanthanoids.
   Reason (R): Actinoids can utilise their 5f orbitals along with 6d orbitals in bonding but lanthanoids do not use their 4f orbital for bonding.
10. Assertion (A): $M\ n^{2+}$ is a colourless ion
    Reason (R): Ti shows +2, +3, and +4 oxidation states due to $4s^2$ and $3d^2$ electrons.

SECTION –B

11. How would you account for the following:
    (i) Of the d^4 species, Cr^{2+} is strongly reducing while manganese(III) is strongly oxidising.
    (ii) Cobalt(II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidised.
    (iii) The d^1 configuration is very unstable in ions.

12. What are alloys? Name an important alloy which contains some of the lanthanoid metals.
13. Define transition metals. Why are Zn, Cd and Hg not called transition metals? How is the variability in oxidation states of transition metals different from that of p-block elements?
14. Following ions are given
Cr^{2+}, Cu^{2+} , Cu^{+} , Fe^{2+},Fe^{3+} , Mn^{3+}
Identify the ion which is
(i) a strong reducing agent
(ii) unstable in aqueous solution.
(iii) a strong oxidizing agent
Give suitable reason in each.
15. (a) Why Eu^{2+} acts as a strong reducing agent?
(b)Write the electronic configuration of Yb^{3+} ion and calculate its magnetic moment.
16. Actinoid contraction is greater from element to element than lanthanoid contraction. Why?
17. Describe the electronic configurations of lanthanoids and actinoids. How do these configurations contribute to the unique properties observed in these elements?
18. Attempt any two of the following:
(a) Explain the concept of lanthanide contraction. Discuss the factors responsible for the contraction and its consequences on the atomic and physical properties of the lanthanides.
(b) Determine the total number of unpaired electrons in a Gd^{3+} ion.
(c) Chemistry of actinoids is more difficult than that of lanthanoids. Give reason?
19. Which is the last element in the series of the actinoids? Write the electronic configuration of this element.
20. (a) Why do actinoids exhibit a greater range of oxidation states compared to lanthanides?
(b) Calculate the spin only magnetic moment of Np^{3+} ion.

SECTION – C

21. Account for the following:
(i) Cu^{2+} salts are coloured while Zn^{2+} salts are white.
(ii) E^{0} value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} .
(iii) Transition metals form alloys.
22. (i) How would you account for the irregular variation of ionisation enthalpies (first and second) in the first series of the transition elements?
(ii) Which of the 3d series of the transition metals exhibits the largest number of oxidation states and why?
23. Consider the given data and use the facts to answer the following questions and justify your answers:

$E^{\circ}_{(M^{2+}/M)}$	Cr	Mn	Fe	Co	Ni	Cu
	−0.91	−1.18	−0.44	−0.28	−0.25	+0.34

(a) Explain the irregularities in the given above value?
(b) Why is the value of E^{0} (Mn^{2+} / Mn) highly negative as compared to other elements?
(c) Which one from Cr^{2+} or Fe^{2+} is a stronger reducing agent and why?
24. (i) Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only?
(ii) Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why?
(iii) Calculate the 'spin only' magnetic moment of M^{2+} aq) ion (Z = 27)
25. Give reasons:
(a) E^{0} value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+} .
(b) Iron has higher enthalpy of atomization than that of copper.
(c) Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.
26. (a) Define lanthanoid contraction and explain its consequences on the properties of elements in the periodic table.
(b) Compare the chemistry of the actinoids with that of lanthanoids with reference to chemical reactivity
27. On the basis of Lanthanoid contraction, explain the following:
(i) Nature of bonding in La_2O_3 and Lu_2O_3.
(ii) Trends in the stability of oxo salts of lanthanoids from La to Lu.
(iii) Stability of the complexes of lanthanoids.
(iv) Radii of 4d and 5d block elements.

(v) Trends in acidic character of lanthanoid oxides.

28. (a)(I) Account for the following:
(i) E^0 value for M n $^{3+}$ /Mn^{2+} couple is much more positive than that for Cr^{3+} /Cr^{2+}
(ii) Sc^{3+} is colourless whereas T i $^{3+}$ is coloured in an aqueous solution.
(iii) Actinoids show wide range of oxidation states.
(II) Write the chemical equations for the preparation of $KMnO_4$, from MnO_2.

OR

(b) (I) Account for the following:
(i) Transition metals form alloys.
(ii) Ce^{4+} is a strong oxidising agent.
(II) Write one similarity and one difference between chemistry of Lanthanoids and Actinoids.
(III) Complete the following ionic equation:
$Cr_2 O_7^{2-} + 2OH^- \rightarrow$

29. (a) Give reason for the following observations related to the transition metals.
(i) Higher enthalpies of atomization
(ii) Formation of coloured compounds
(iii) Formation of complexes
(b) Complete the following reaction:
(i) $NO_2^- + MnO_4^- + H^+ \rightarrow$
(ii) $MnO_4^-(aq) + C_2O_4^{2-}(aq) + H^+(aq) \rightarrow$

30. (a) Why are all copper halides known except that copper iodide?
(b) Why is the E^0 (V^{3+} / V^{2+}) value for vanadium comparatively low?
(c) Why HCI should not be used for potassium permanganate titrations?
(d) Explain the observation, at the end of each period, there is a slight increase in the atomic radius of d block elements.
(e) What is the effect of pH on dichromate ion solution?