

- In periodic table, ten groups, group number 3 to 12 are called d-block elements.
- The position of these elements are between s-block and p-block elements.
- The properties of d-block elements show transition between the properties of representative elements of periodic table i.e. most electropositive s-block elements and least electropositive p-block elements.
- Hence they are known as **Transition elements**.
- The two horizontal rows at the bottom of the periodic table are called f-block elements.
- The ($Z = 90$) has electronic structure $[\text{Rn}] 5f^0 6d^2 7s^2$
- In Th the last electron is not filled in f-orbital although the experimental results support the element as f-block element.
- Thus it is included in f-block elements.
- f block elements being part of the transition series of transition elements of periods 6 and 7 are called **Innertransition elements**.

- What are called the elements of group 3 to 12 in modern periodic table ?
(A) s-block elements (B) p-block elements (C) d-block elements (D) f-block elements
- Which properties of d-block elements show transition between the properties of representative elements of periodic table ?
(A) more electropositive and less electropositive
(B) more electropositive and more electronegative
(C) less electropositive and more electronegative
(D) less electropositive and less electronegative
- Which elements are included in less electropositive p-block elements in periodic table ?
(A) Metal elements (B) Non-metal elements (C) Semi metals (D) All mentioned
- Which block elements are known as transition elements in modern periodic table ?
(A) s (B) p (C) d (D) f
- What is the electronic configuration of Th ?
(A) $[\text{Rn}] 5f^2 7s^2$ (B) $[\text{Rn}] 5f^1 6d^1 7s^2$ (C) $[\text{Rn}] 5f^2 6d^1 7s^1$ (D) $[\text{Rn}] 5f^0 6d^2 7s^2$
- Due to which reason Th is included in f-block elements ?
(A) based on physical properties (B) based on chemical properties
(C) based on experimental results (D) based on electronic configuration

Answers : 1. (C), 2. (A), 3. (B), 4. (C), 5. (D), 6. (C)

• **Transition Elements d-block elements :**

- The elements which in their ground state or any one of its oxidation state, have incompletely filled d-orbitals with electrons are called transition elements.
- If 3d orbital is incompletely filled with electrons known as first transition series, same as 4d and 5d orbital is incompletely filled with electrons known as second and third transition series.
- Actinium ($Z = 89$) and Rutherfordium ($Z = 104$) and onwards elements are included in fourth transition series.
- The general electronic configuration of transition elements is $(n-1)d^{1-10} ns^{1-2}$.

- Electronic configuration of Cr ($Z = 24$) is $[\text{Ar}]3d^54s^1$ instead of $[\text{Ar}]3d^44s^2$.
- Electronic configuration of Cu ($Z = 29$) is $[\text{Ar}]3d^{10}4s^1$ instead of $[\text{Ar}]3d^94s^2$.
- When ions are formed from first transition series elements, the electron entering last in 3d-orbital is not removed first, but both the electrons of 4s orbital are removed first and then remaining electrons removed from 3d-orbital because the electrons in outermost orbital have relatively less attraction towards the nucleus in comparison to the inner 3d orbital.
- Cu is considered as transition elements but Zn is not considered as transition element in first transition series.
- Cd is not considered as transition element in second series.
- Hg is not considered as transition element in third series.

7. When d-block elements are considered as transition elements ?
 (A) d-orbital is incompletely filled with electrons in ground state.
 (B) d-orbital is completely filled with electrons in any oxidation state.
 (C) d-orbital is incompletely filled with electrons in any oxidation state.
 (D) Both A and C
8. What is the general electronic configuration of transition elements ?
 (A) $(n-1)d^{1-10}ns^2$ (B) $(n-1)d^{1-10}ns^{1-2}$ (C) $(n-1)d^{1-9}ns^{1-2}$ (D) $(n-1)d^{1-10}ns^1$
9. When ions are formed from first transition series, the electron first remove from 4s-orbital because...
 (A) the electrons in 4s-orbital have relatively less attraction towards the nucleus compared to the electrons in 3d-orbital.
 (B) the electrons in 4s orbital have relatively more attraction towards the nucleus compared to the electrons in 3d-orbital.
 (C) principal quantum number is less in 4s-orbital.
 (D) principal quantum number is more in 3d-orbital.
10. Cu is considered as transition element because,
 (A) 3d-orbital is completely filled in ground state of Cu.
 (B) 3d-orbital is incompletely filled in ground state of Cu.
 (C) 3d-orbital is completely filled in any oxidation state of Cu.
 (D) 3d-orbital is incompletely filled in any oxidation state of Cu.
11. **Two statements are given. Among them one is statement A and other is reason (R). Select correct option by reading instructions carefully.**
Statement (A) : When ions are formed from first transition series, both electrons from 4s-orbital are removed first.
Reason (R) : The electrons in 4s-orbital have relatively more attraction towards the nucleus compared to the electrons in 3d-orbital.
 (A) statement (A) and Reason (R) are true, Reason (R) is correct explanation of statement (A).
 (B) statement (A) and Reason (R) are true. Reason (R) is not correct explanation of statement (A).
 (C) statement (A) is false but Reason (R) is true.
 (D) statement (A) is true but Reason (R) is false.
12. Which of the following element is not considered as element of second transition series ?
 (A) Cd (B) Pd (C) Ag (D) Y
13. Which of the following element is not considered as elements of third transition series ?
 (A) Au (B) Hg (C) La (D) Hf

14. Which of the following statement is not suitable for general characteristics of transition elements ?
 (A) They possess variable valencies.
 (B) They form alloy by mixing with each other.
 (C) They have low melting points.
 (D) Most of the elements dissolve in acid.
15. Which of the following pair of transition ions show $3d^2$ electronic configuration ?
 (Atomic number of : Ti = 22, V = 23, Cr = 24, Mn = 25)
 (A) Ti^{3+} , V^{2+} , Cr^{3+} , Mn^{4+} (B) Ti^{+} , V^{4+} , Cr^{6+} , Mn^{7+}
 (C) Ti^{4+} , V^{3+} , Cr^{3+} , Mn^{3+} (D) Ti^{2+} , V^{3+} , Cr^{4+} , Mn^{5+}
16. Which of the following statement is incorrect according to transition element ?
 (A) After d^5 electronic configuration is completed tendency of participating in bonding decreases for 3d-orbital's electrons.
 (B) In common oxidation state as well as in some complexes the elements in this series show zero oxidation state.
 (C) Transition element show basic character at maximum oxidation state and form positively charged complex.
 (D) All the electrons of 4s and 3d orbital participate in bonding in maximum oxidation state of first five transition elements. (Sc to Mn)
17. Which of the following electronic configuration show maximum number of oxidation state ?
 (A) $3d^5 4s^2$ (B) $3d^2 4s^2$ (C) $3d^3 4s^2$ (D) $3d^5 4s^1$
18. Which of the following statement is correct for transition elements ?
 (A) They are very reactive.
 (B) They show variable valencies.
 (C) They have low melting points.
 (D) They are strongly electropositive elements.
19. Which of the following series contain an element having 56 atomic number ?
 (A) Lanthanides (B) Actinides
 (C) Alkaline Earth Elements (D) None of these
20. Which of the following electronic configuration of atom get highest oxidation state ?
 (A) $(n-1)d^5 ns^2$ (B) $(n-1)d^8 4s^2$ (C) $(n-1)d^5 ns^1$ (D) $(n-1)d^3 ns^2$
21. What is the atomic number of element having electronic configuration $[Ar]3d^8$ like M^{2+} ion ?
 (A) 26 (B) 27 (C) 28 (D) 25

Answers : 7. (D), 8. (B), 9. (A), 10. (D), 11. (D), 12. (A), 13. (B), 14. (C), 15. (D), 16. (C), 17. (A), 18. (B), 19. (C), 20. (A), 21. (C).

• **Periodic trends in properties of elements of first transition series :**

- All the elements of first transition series possess metallic property.
- As we move from left to right in period atomic radii and ionic radii decreases.
- Atomic radius decreases from Sc to V, while from Cr to Cu it is almost similar.
- Atomic radius of Zn is found to be increasing.
- As the nuclear charge increases, the value of ionization enthalpy increases, but is not equal to increase in enthalpy in the elements of the main group.
- There is difference in the first ionization enthalpies of two neighbouring transition elements.

- The values of second ionization enthalpy of Cr and Cu are more than those of their neighbouring elements.
- Thermodynamic stability of transition metal depends on the magnitude of their ionization enthalpy.
- The value of electrode potential is determined on the basis of the sum of the enthalpy changes (ΔH_T) of different reactions.
- The stabilities of different oxidation states of transition metal ions are determined on the basis of the electrode potentials.

22. Select correct order of atomic radius.
 (A) $V > Mn > Cu > Zn$ (B) $V > Mn = Cu > Zn$
 (C) $V < Mn < Cu < Zn$ (D) $V > Mn = Cu < Zn$
23. "Atomic radius of Cr to Cu is almost similar." Which of the following statement is not suitable with this statement.
 (A) positive electric charge of nucleus increases from Cr to Cu.
 (B) Shielding effect increases for attraction of electron present in 4s-orbital.
 (C) Electrons present in 4s-orbital are attracted more towards the nucleus.
 (D) The value of $e^- - e^-$ repulsion in 3d-orbital.
24. 'Instead of decrease the atomic radius of Zn is found to be increased'. Which of the following statement is incorrect for this statement ?
 (A) Shielding effect decreases the repulsion of positive charge of nucleus towards electrons of 4s-orbital.
 (B) Repulsion between electron - electron in 3d-orbital increases more than the value of attraction of electrons of 4s-orbital and nucleus.
 (C) Expansion of orbit in Zn.
 (D) 3d-orbital of Zn is completely filled.
25. Which two elements have the value of second ionization enthalpy more than those of their neighbouring elements?
 (A) Cu, Zn (B) Cu, Cr (C) Cr, Mn (D) Mn, Zn
26. **Two statements are given. Among these one is statement (A) and other is Reason (R) Select correct option by reading instructions carefully.**
Statement (A) : The value of second ionization enthalpy of Cr is more than their neighbouring elements.
Reason (R) : Cr attain stable electronic configuration $[Ar]3d^5$ after loss of one e^- . To remove second electron from Cr, so much energy is required.
 (A) Statement (A) and Reason (R) are true. Reason (R) is correct explanation of statement (A).
 (B) Statement (A) and Reason (R) are true. Reason (R) is not correct explanation of statement (A).
 (C) Statement (A) is false but Reason (R) is true.
 (D) Statement (A) is true but Reason (R) is false.
27. On what does the thermodynamic stability of transition metal elements depend ?
 (A) Atomic radius
 (B) Magnitude of ionization enthalpy.
 (C) Repulsion force between electron-electron
 (D) Metallic property
28. In which of the following medium stability of transition metal ions is more ?

- (A) Acidic medium (B) Basic medium (C) Aqueous medium (D) in free form
29. Which of the following will determine the stabilities of different oxidation state of transition metal ion ?
 (A) Ionization enthalpy (B) Ionic radius
 (C) Metallic property (D) Electrode potential
30. Under what condition the stability of transition metal ions be more in aqueous medium ?
 (A) more positive value of reduction potential.
 (B) more negative value of reduction potential
 (C) more negative value of oxidation potential.
 (D) less positive value of oxidation potential.
31. Increasing order of ionic radii of Ce^{3+} , La^{3+} , Pm^{3+} , Yb^{3+} ions is
 (A) $\text{La}^{3+} < \text{Ce}^{3+} < \text{Pm}^{3+} < \text{Yb}^{3+}$ (B) $\text{Yb}^{3+} < \text{Pm}^{3+} < \text{Ce}^{3+} < \text{La}^{3+}$
 (C) $\text{La}^{3+} = \text{Ce}^{3+} < \text{Pm}^{3+} < \text{Yb}^{3+}$ (D) $\text{Yb}^{3+} < \text{Pm}^{3+} < \text{La}^{3+} < \text{Ce}^{3+}$
32. Which of the following has the highest second ionization enthalpy ? (Atomic number of V, Cr, Mn and Fe are 23, 24, 25 and 26 respectively)
 (A) V (B) Cr (C) Mn (D) Fe
33. Radius of $_{57}\text{La}^{3+}$ is $1.06 \text{ \AA}$. Which of the following value is nearer value of radius of $_{71}\text{Lu}^{3+}$?
 (A) $1.40 \text{ \AA}$ (B) $1.06 \text{ \AA}$ (C) $0.85 \text{ \AA}$ (D) $1.60 \text{ \AA}$
34. What is the correct order of ionic radii of Y^{3+} , La^{3+} , Eu^{3+} and Lu^{3+} ?
 (A) $\text{Y}^{3+} < \text{La}^{3+} < \text{Eu}^{3+} < \text{Lu}^{3+}$ (B) $\text{Y}^{3+} < \text{Lu}^{3+} < \text{Eu}^{3+} < \text{La}^{3+}$
 (C) $\text{Lu}^{3+} < \text{Eu}^{3+} < \text{La}^{3+} < \text{Y}^{3+}$ (D) $\text{La}^{3+} < \text{Eu}^{3+} < \text{Lu}^{3+} < \text{Y}^{3+}$

Answers : 22. (D), 23. (C), 24. (A), 25. (B), 26. (A), 27. (B), 28. (D), 29. (D), 30. (B), 31. (D), 32. (B), 33. (C), 34. (C)

• **Characteristic properties of Elements of first transition series :**

- Most of ionic and covalent compounds of transition elements are coloured due to presence of incompletely filled 3d-orbitals.
- When visible light falls on transition metal ions, they absorb light of definite wavelength and emit the remaining light.
- During absorption of light the electrons in d-orbital of ions receive energy and go to the d-orbital having higher energy. This transition is called d-d transition.
- The energy of all five d-orbitals is equal but according to crystal field theory, the d-orbitals split into different energy levels in transition compounds having tetrahedral and octahedral geometry.
- Transition metals and their certain compounds increase the rate of reaction.
- Hence they are useful catalysts.
- These substances used as catalyst are in solid state.
- The random and pointed peak points on the surface at the ends of the edges of their particles are responsible centres for catalytic work.
- The molecule, atom or ion of a substance, in which there are unpaired electrons, possess paramagnetism. So they are called paramagnetic substances.
- While molecule, atom or ion in which all the electrons are paired, possess diamagnetism. Hence they are called diamagnetic substances.
- Because of paramagnetism, paramagnetic substance produces magnetic moment.

- Magnetic moment is produced due to rotation of unpaired electron on its axis and orbital rotation.
- The value of magnetic moment based on only rotation on axis can be determined by the formula, $\mu = \sqrt{n(n+2)} \text{ BM}$, where, n = no. of unpaired electrons.
- Due to axial rotation the magnetic moment values obtained experimentally are slightly more or less than the theoretical values.
- The size of transition metal ions is small.
- The nuclear electric charge and ionic electric charge of transition metal ions is comparatively more.
- The electronic configuration of transition metal ion is favourable for formation of complexes.
- As very less difference between energy values of 3d, 4s, 4p or 4d orbitals, hybridisation of different types can be possible.
- Transition metal ions exhibit various oxidation states. Thus varieties of complex compounds can be formed.

35. Most of the ionic and covalent compounds of transition elements are coloured because...
 (A) d-orbitals are completely filled (B) d-orbitals are incompletely filled.
 (C) d-d transition is observed (D) both (B) and (C)
36. What is the colour of aqueous solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$?
 (A) green (B) yellow (C) orange (D) colourless
37. What colour is emitted, when visible light passes through aqueous solution of $[\text{Co}(\text{NH}_3)_6]^{3+}$?
 (A) Red (B) Green (C) yellow (D) Red and green
38. Which of the following ions have violet colour ?
 (A) V^{4+} , Cr^{3+} (B) V^{3+} , Mn^{3+} (C) V^{2+} , Cr^{3+} (D) Mn^{3+} , Ti^{3+}
39. What is the colour of V^{3+} ion ?
 (A) Green (B) Purple (C) Violet (D) Colourless
40. What is the colour of $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ solution ?
 (A) violet (B) pink (C) purple (D) colourless
41. "Transition metals and their certain compounds are used as catalyst." Which of the following statement is not appropriate for this statement ?
 (A) The substances used as catalyst are in solid and liquid state.
 (B) The random and pointed peak points on the surface at the ends of the edges of their particles are responsible centres for catalytic work.
 (C) The required activation energy of the reaction decreases.
 (D) Rate of chemical reaction increases.
42. Which catalyst is used in obtaining SO_3 from SO_2 in contact process for manufacturing of H_2SO_4 ?
 (A) $\text{ZnO} - \text{Cr}_2\text{O}_3$ (B) NO (C) V_2O_5 (D) Au
43. What is the magnetic moment of $\text{Co}^{3+}_{(\text{aq})}$?
 (A) 3.87 BM (B) 4.90 BM (C) 2.83 BM (D) 5.92 BM
44. Which of the following metal ion has zero magnetic moment ?
 (A) Cu^{2+} (B) Sc^{2+} (C) Ti^{4+} (D) V^{4+}

45. Which of the following compound of transition metal ion has 3.87 BM magnetic moment ?
 (A) FeSO_4 (B) CrCl_3 (C) NiCl_2 (D) CuSO_4
46. "Transition metal ions form complex compounds." This statement is not appropriate for which of the following statement ?
 (A) Nuclear electrical charge and ionic electrical charge are comparatively more in transition metal ions.
 (B) Very less difference between the energy values of 3d, 4s, 4p or 4d orbitals.
 (C) Transition metal ions exhibit only one oxidation state.
 (D) Electronic configurations of transition metal ions is favourable for formation of complexes.
47. What is the correct order of energy during splitting of d-orbitals in octahedral complex compounds ?
 (A) $d_{x^2-y^2} = d_{z^2} < d_{xy} = d_{yz} = d_{zx}$ (B) $d_{x^2-y^2} = d_{z^2} > d_{xy} = d_{yz} = d_{zx}$
 (C) $d_{x^2-y^2} = d_{xy} > d_{z^2} = d_{yz} = d_{zx}$ (D) $d_{x^2-y^2} = d_{xy} < d_{z^2} = d_{yz} = d_{zx}$
48. Why is their deviation in the values of practical and theoretical magnetic moment ?
 (A) transition metal ions have variable valencies.
 (B) method of calculating magnetic moment is different.
 (C) rotation orbital combination
 (D) decrease in size of metal ion
49. Give correct order of theoretical magnetic moment.
 (A) $[\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-}$
 (B) $[\text{MnCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-}$
 (C) $[\text{Fe}(\text{CN})_6]^{4-} > [\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-}$
 (D) $[\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-} > [\text{MnCl}_4]^{2-}$
50. Which of the following pairs are coloured in its aqueous solution ?
 (Atomic number : Sc = 21, Ti = 22, Co = 27, Ni = 28 Cu = 29)
 (A) Ni^{2+} , Cu^+ (B) Ni^{2+} , Ti^{3+} (C) Sc^{3+} , Ti^{3+} (D) Sc^{3+} , Co^{3+}
51. Which of the following ion is most stable in its aqueous solution ?
 (A) ${}_{23}\text{V}^{3+}$ (B) ${}_{22}\text{Ti}^{3+}$ (C) ${}_{25}\text{Mn}^{3+}$ (D) ${}_{24}\text{Cr}^{3+}$
52. Which of the following pair is colourless among TiF_6^{2-} , CoF_6^{3-} , Cu_2Cl_2 and NiCl_4^{2-} ?
 (A) TiF_6^{2-} and Cu_2Cl_2 (B) CoF_6^{3-} and NiCl_4^{2-}
 (C) TiF_6^{2-} and CoF_6^{3-} (D) Cu_2Cl_2 and NiCl_4^{2-}
53. Which of the following compound is coloured ?
 (A) TiCl_3 (B) FeCl_3 (C) CoCl_2 (D) All of the given
54. In which of the following ion d-d transition can't be possible ?
 (A) Ti^{4+} (B) Cr^{3+} (C) Mn^{2+} (D) Cu^{2+}
55. What is the magnetic moment of central metal ion in K_2MnO_4 ?
 (A) 0.0 BM (B) 1.73 BM (C) 2.83 BM (D) 3.87 BM

Answers : 35. (B), 36. (C), 37. (A), 38. (B), 39. (C), 40. (D), 41. (C), 42. (B), 43. (D), 44. (D), 45. (B), 46. (C), 47. (B), 48. (C), 49. (B), 50. (B), 51. (D), 52. (A), 53. (D), 54. (A), 55. (B)

• **Interstitial compounds**

- The atoms in solid state of transition metals are arranged in definite crystal structure. There are definite voids between atoms in such an arrangement. Hence non-metallic atoms of smaller size viz. H, C, N and B can be easily arranged in the voids of crystal structure. The compounds formed in such a way are called interstitial compounds.
- The proportion of components in such compounds, is not definite, so they are called non-stoichiometric or non-proportionate compounds.
- The properties of metals like hardness, melting point, resistance to wear, resistance to corrosion etc. are notably increased.
- Interstitial compounds are used in preparation of tools, machinery parts, vehicles etc.

56. Under what circumstances interstitial compounds are formed ?

- (A) The atoms in solid state of transition metals are arranged in definite crystal structure.
- (B) There are definite voids between atoms in crystal structure.
- (C) H, C, N and B can be easily arranged in the voids of crystal structure.
- (D) All of the above.

57. Interstitial compounds are non-stoichiometric because...

- (A) small size of non-metal atoms present in the void.
- (B) chemical bond is not formed between non-metal elements of smaller size arranged in the voids and metal atom.
- (C) the proportion of components is not definite.
- (D) all of the above

58. Which of the following statement is not proper for interstitial compounds ?

- (A) Interstitial compounds are non-stoichiometric.
- (B) Proportion of components of interstitial compounds is not definite.
- (C) No change in characteristics properties of metals is observed.
- (D) No definite molecular formula.

Answers : 56. (D), 57. (D), 58. (C)
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• **Alloys :**

- The characteristic properties like hardness, conductance, malleability, resistance to corrosion are essential for machineries, tools, vehicles and vessels of house-hold usages. There is no pure metal having combination of all properties. Hence instead of using pure metals in practice, alloys prepared from two or more metal-elements are used frequently.
- Scientists Hume and Rothery presented rules as follows to obtain alloys of combination of useful properties.
- The atomic size of two metals forming the alloy must be same. There must not be more than 15 % difference in their atomic radii.
- The chemical properties of the metals used for preparation of alloys must be same.
- Their electronic configurations of valence shell must be the same.
- The crystal structures of pure metallic elements used for alloys must be similar.

e.g. 22 carat gold ornaments is the best example of alloy, which contain Au and Cu. The difference between atomic size of Au and Cu is about 14.5 %

- The difference in atomic sizes between Cr, Mn, Fe, Co, Ni, Cu metals is less than 2%. There is much less difference in the electronic configuration of valence shell of these elements. These elements form number of alloys having different proportions which are very useful in practice.
e.g., Stainless steel, Brass, Bronze, Nitinol, Cupronickel, German silver, Nichrome.
- Amalgam with mercury-alloy is well known.

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59. Which of the following rule of Hume and Rothery follow to obtain alloys of combination of useful properties ?
(A) There must not be more than 15 % difference in their atomic radii.
(B) The electronic configurations of valence shell must be the same.
(C) Crystal structure of alloys must be similar.
(D) All of the above.
60. Which scientists presented the rules to obtain alloy of combination of useful properties.
(A) Faraday and Werner (B) Hume and Rothery
(C) Waag and Gould-berg (D) Le-chatelier and Arrhenius
61. Which of the following properties are suitable for alloys used in practice ?
(A) Atomic size must be same.
(B) Chemical properties of the metal must be same.
(C) Crystal structure must be similar.
(D) All of the above.
62. Which of the following rule is not Hume and Rothery rule for alloys ?
(A) Chemical properties must be same.
(B) There must be more than 15% difference in their atomic radii.
(C) Electronic configuration of valence shell must be same.
(D) Crystal structure must be similar.
63. What is the difference of atomic size between Au and Cu in 22 carat gold ornaments ?
(A) 14.5 % (B) 15 % (C) 15.5 % (D) 14 %
64. What is the atomic size of Au and Cu used in 22 carat gold ornaments ?
(A) Au = 134 pm Cu = 119 pm (B) Au = 135 pm Cu = 117 pm
(C) Au = 134 pm Cu = 117 pm (D) Au = 117 pm Cu = 134 pm
65. Which of the following is the best alloy according to Hume and Rothery rule ?
(A) Stainless steel (B) Nitinol
(C) German silver (D) 22 carat gold
66. Which of the following metals have 2 % difference in their atomic sizes ?
(A) Cr, Mn, Fe, Co, Ni, Cu (B) Ti, V, Fe, Cr, Mn, Cu
(C) V, Cr, Ni, Cu, Zn, Fe (D) Cr, Mn, Fe, Cu, Zn, Sc
67. What is the proportion of components in stainless steel alloy ?
(A) Fe (80 %) Cr (15 %) Ni (5 %) (B) Fe (80 %) Cr (10 %) Ni (10 %)
(C) Fe (70 %) Cr (20 %) Ni (10 %) (D) Fe (70 %) Cr (15 %) Ni (15 %)
68. Which of the following alloy does not contain copper ?
(A) Nichrome (B) Bronze (C) German silver (D) Brass
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69. Which of the following is the application of bronze alloy ?
 (A) Musical instruments (B) Preparation of currency coins
 (C) Preparation of statues (D) Preparation of part of machine
70. Which alloy has marvellous property of memory ?
 (A) Cupronickel (B) Nitinol (C) Nichrome (D) Brass
71. Which alloy has more electrical resistance ?
 (A) Nichrome, Cupronickel (B) Brass, Nitinol
 (C) Nichrome, Bronze (D) Cupronickel, German silver
72. Which components and proportion of alloy possess strong corrosion resistant property ?
 (A) Cu (75-85 %) Ni (15-25 %) (B) Cu (50-55 %) Ni (45-50 %)
 (C) Cu (90 %) Sn (10 %) (D) Cu (70 %) Sn (30 %)
73. Which components and proportions are present in amalgam with mercury alloy ?
 (A) Hg (50 %) Ag (30 %) Sn (15 %) Cu (3 %) Zn (2 %)
 (B) Hg (50 %) Ag (30 %) Sn (12 %) Cu (5 %) Zn (3 %)
 (C) Hg (50 %) Ag (35 %) Sn (12 %) Cu (3 %) Zn (0.2 %)
 (D) Hg (50 %) Ag (35 %) Sn (10 %) Cu (3 %) Zn (0.2 %)
74. Where is amalgam alloy used ?
 (A) To prepare statue (B) Filling tooth cavity
 (C) In space reserach (D) Surgical instruments
75. Which statement is not proper for amalgam alloy used in filling tooth cavity ?
 (A) Alloy is hard.
 (B) All the metals are mixed some time before filling.
 (C) Do not expand in tooth cavity.
 (D) Alloy is soft that can fill in the cavity of tooth.
76. Components in german silver alloy...
 (A) Fe, Cr, Ni (B) Ag, Cu, Au (C) Cu, Zn, Ni (D) Cu, Zn, Sn
77. What is the percentage proportion of silver in german silver ?
 (A) 0 % (B) 1 %
 (C) 5 % (D) None

Answers : 59. (D), 60. (B), 61. (D), 62. (B), 63. (A), 64. (C), 65. (D), 66. (A), 67. (C), 68. (A), 69. (B), 70. (B), 71. (A), 72. (A), 73. (C), 74. (B), 75. (A), 76. (C), 77. (A),

• **Some important compounds of 3d-transition elements :**

- (1) Potassium dichromate ($K_2Cr_2O_7$)
 - (2) Potassium permanganate ($KMnO_4$)
- $K_2Cr_2O_7$ is orange coloured crystalline substance.
 - $KMnO_4$ is dark purple crystalline substance.
 - Both are soluble in water.
 - $K_2Cr_2O_7$ is strong oxidizing agent in acidic medium.

- KMnO_4 is oxidizing agent in acidic, basic and neutral medium.
- Both are used in laboratory and synthesis in organic compounds.
- $\text{K}_2\text{Cr}_2\text{O}_7$ is mainly useful in leather industry and formation of azo compounds.
- $\text{K}_2\text{Cr}_2\text{O}_7$ is used as antiseptic and titrant in redox titrations to determine the amount of metal ions like iron II.
- KMnO_4 is used as bleaching agent for cotton cloth, silk, wood and in textile industries, as antiseptic.
- KMnO_4 is useful as titrant in redox titrations to know the amount of metal ions like iron (II) and organic compounds like oxalic acid.
- d-block elements are useful as alloys, as catalyst, as electrode and as titrant.

78. $\text{FeCr}_2\text{O}_4 + \text{Na}_2\text{CO}_3 + \text{O}_2 \rightarrow x + y + z$
what are x, y and z product ?
(A) $x = \text{Na}_2\text{Cr}_2\text{O}_7$ $y = \text{FeO}$ $z = \text{CO}_2$ (B) $x = \text{Na}_2\text{CrO}_4$ $y = \text{Fe}_2\text{O}_3$ $z = \text{CO}$
(C) $x = \text{Na}_2\text{CrO}_4$ $y = \text{Fe}_2\text{O}_3$ $z = \text{CO}_2$ (D) $x = \text{Na}_2\text{Cr}_2\text{O}_7$ $y = \text{Fe}_3\text{O}_4$ $z = \text{CO}$
79. $\text{FeCr}_2\text{O}_4 + \text{Na}_2\text{CO}_3 + \text{O}_2 \rightarrow \text{Na}_2\text{CrO}_4 + \text{Fe}_2\text{O}_3 + \text{CO}_2$
what is the proportion of reactant and product in above reaction ?
(A) 4 : 8 : 7, 8 : 2 : 8 (B) 8 : 2 : 8, 4 : 8 : 7 (C) 4 : 6 : 4, 8 : 2 : 6 (D) 8 : 2 : 6, 8 : 6 : 4
80. $x + \text{H}^+ \rightarrow y + \text{Na}^+ + \text{H}_2\text{O}$
 $y + \text{KCl} \rightarrow \text{K}_2\text{Cr}_2\text{O}_7 + \text{NaCl}$
What are x and y ?
(A) $x = \text{H}_2\text{CrO}_4$ $y = \text{Na}_2\text{CrO}_4$ (B) $x = \text{Na}_2\text{Cr}_2\text{O}_7$ $y = \text{H}_2\text{CrO}_4$
(C) $x = \text{Na}_2\text{Cr}_2\text{O}_7$ $y = \text{Na}_2\text{CrO}_4$ (D) $x = \text{Na}_2\text{CrO}_4$ $y = \text{Na}_2\text{Cr}_2\text{O}_7$
81. Which colour is obtained when base is added to aqueous solution of $\text{K}_2\text{Cr}_2\text{O}_7$?
(A) orange (B) yellow (C) pink (D) colourless
82. Which substance is added to aqueous solution of $\text{K}_2\text{Cr}_2\text{O}_7$ to give orange colour ?
(A) H_2SO_4 (B) KOH (C) Na_2CO_3 (D) NaOH
83. Which of the following is not use of $\text{K}_2\text{Cr}_2\text{O}_7$?
(A) In leather industry (B) Reagent in COD measurement
(C) To know the proportion of oxalic acid (D) Cleaning of glasswares in laboratory
84. Which of the following is added in presence of air to form dark green coloured K_2MnO_4 by fusion of MnO_2 ?
(A) Sodium carbonate (B) Potassium nitrite
(C) Potassium hydroxide (D) Both (B) and (C)
85. Which coloured substance is formed by fusion of MnO_2 with KOH in presence of air ?
(A) Dark green coloured K_2MnO_4 (B) Purple coloured K_2MnO_4
(C) Yellow coloured K_2CrO_4 (D) Orange coloured $\text{K}_2\text{Cr}_2\text{O}_7$
86. In presence of which oxidizing agent fusion of manganese dioxide occurs ?
(A) Na_2CO_3 (B) KNO_3 (C) KOH (D) NaOH

87. $\text{MnO}_2 + x + \text{O}_2 \rightarrow y + \text{H}_2\text{O}$
 $y + z \rightarrow \text{KMnO}_4 + \text{K}_2\text{SO}_4 + \text{MnO}_2 + \text{H}_2\text{O}$
 What are x, y and z respectively ?
 (A) $x = \text{H}_2\text{SO}_4$ $y = \text{K}_2\text{MnO}_2$ $z = \text{KOH}$
 (B) $x = \text{H}_2\text{SO}_4$ $y = \text{K}_2\text{MnO}_4$ $z = \text{KOH}$
 (C) $x = \text{KOH}$ $y = \text{K}_2\text{MnO}_2$ $z = \text{H}_2\text{SO}_4$
 (D) $x = \text{KOH}$ $y = \text{K}_2\text{MnO}_4$ $z = \text{H}_2\text{SO}_4$
88. $\text{K}_2\text{MnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{KMnO}_4 + \text{K}_2\text{SO}_4 + \text{MnO}_2 + \text{H}_2\text{O}$
 Give proportion of mole of reactants and products.
 (A) 3 : 2, 2 : 2 : 1 : 2 (B) 2 : 3, 2 : 2 : 1 : 1
 (C) 3 : 2, 3 : 2 : 1 : 1 (D) 2 : 3, 3 : 1 : 2 : 1
89. Which of the following is not use of KMnO_4 ?
 (A) As antiseptic (B) As bleaching
 (C) Preparation of azo compounds (D) In redox titrations
90. Which substance is used to know the amount of oxalic acid ?
 (A) Potassium chromate (B) Potassium permanganate
 (C) Potassium dichromate (D) Potassium Manganate
91. What is the use of mercury ?
 (A) In thermometer (B) Filling in tooth cavity
 (C) Prepare electrode (D) In preparation of house hold vessels
92. What is the use of MnO_2 ?
 (A) As oxidant (B) In dry cell
 (C) As bleaching (D) As antiseptic
93. Which method is used to prevent water pipes and the roof on the house from corrosion ?
 (A) To paint
 (B) Connect with metal having more reduction potential
 (C) Changed into galvanized form with the help of zinc metal
 (D) Attach waterproof layer.
94. Give oxidation state of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$.
 (A) +2 (B) +4 (C) +6 (D) +7
95. Give use of potassium dichromate.
 (A) As oxidant to change ferric ion from ferrous ion in acidic medium.
 (B) As antiseptic
 (C) As reductant
 (D) In electroplating

Answers : 78. (C), 79. (A), 80. (D), 81. (B), 82. (A), 83. (C), 84. (C), 85. (A), 86. (B), 87. (D), 88. (A), 89. (C), 90. (B), 91. (A), 92. (B), 93. (C), 94. (C), 95. (A)
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● **Inner transition elements : f-block elements**

- The f-block elements are distributed into two series :
(1) lanthanide series (2) actinide series
- The series of fourteen elements immediately after lanthanum, Ce ($Z = 58$) to Lu ($Z = 71$) is called lanthanide series.
The elements of this series are known as lanthanoids. Its symbol is 'Ln'. Lanthanum has more similarity with lanthoids.
- The series of fourteen elements immediately after actinum, Th ($Z = 90$) to Lr ($Z = 103$) is called actinide series.
The elements of this series are known as actinoids.
As actinum possess more similarity with actinoids.
- General electronic structure of outermost electrons of f-block is $(n - 2)f^{0-14} (n - 1)d^{0-1} ns^2$

● **Lanthanide series**

- In the electronic configuration of elements of lanthanide series, $6s^2$ is common in all the elements but the electrons in 4f-orbital keep changing.
- All the lanthanoids and lanthanum element possess stable oxidation state +3.
- Electrons are filled in 5d orbital in electronic configuration of Ce, Gd and Lu
- In Gd, because of half filled orbital like $4f^7$ stability may be obtained while in Lu, $4f^{14}$.
- Orbital is completely filled. The filling of electron of Ce in 5d orbital is accepted at present as an exception.
- General electronic configuration of lanthanoids is $[Xe]4f^{1-14} 5d^{0-1} 6s^2$.
- Promethium (Pm) is a radioactive element.
- As we move from Ce to Lu, the atomic radii and ionic radii go on decreasing, which is called lanthanide contraction.
- Lanthanoids possess $Ln(OH)_3$ type hydroxides.
- These hydroxides are less badic than $Ca(OH)_2$ but more basic than $Al(OH)_3$.
- The size of ions decreases on going from Ce^{3+} to Lu^{3+} , hence their basicity decreases, that is $Ce(OH)_3$ is the most basic and $Lu(OH)_3$ is the least basic.
- These elements possess similarity in physical and chemical properties, so their seperation is carried out based on the difference in their basicity.
- Some ions of these elements are paramagnetic and are coloured.

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96. Which of the following series of elements are known as lanthanoids ?
(A) La to Lu (B) Ce to Lu (C) La to Yb (D) Ce to Yb
97. Which of the following series of elements are known as actinoids ?
(A) Th to Lr (B) Th to No (C) Ac to Lr (D) Ac to No
98. General electronic configuration of f-block elements is
(A) $(n - 2)f^{1-14} (n - 1)d^{0-1} ns^2$ (B) $(n - 2)f^{0-14} (n - 1)d^{1-2} ns^2$
(C) $(n - 2)f^{1-14} (n - 1)d^{0-1} ns^{1-2}$ (D) $(n - 2)f^{0-14} (n - 1)d^{0-1} ns^2$
99. Which orbital is common in the electronic configuration of lanthanide series ?
(A) $5d^1$ (B) $6s^1$ (C) $6s^2$ (D) $5d^0$
100. What is stable oxidation state of lanthanum and lanthanoids elements ?
(A) +2 (B) +3 (C) +3, +4 (D) +2, +3
-

101. Which of the following lanthanoids possess 5d orbital filled with electrons in their electronic configuration ?
 (A) La, Ce, Pm (B) La, Ce, Gd (C) Ce, Gd, Lu (D) La, Gd, Lu
102. What is general electronic configuration of lanthanoids ?
 (A) $[\text{Xe}] 4f^{0-14}5d^{0-1}6s^2$ (B) $[\text{Xe}] 4f^{1-14}5d^16s^2$
 (C) $[\text{Xe}] 4f^{0-14}5d^{0-1}6s^{1-2}$ (D) $[\text{Xe}] 4f^{1-14}5d^{0-1}6s^2$
103. What is the electronic configuration of Ce ($Z = 58$) ?
 (A) $[\text{Xe}] 4f^15d^16s^2$ (B) $[\text{Xe}] 4f^26s^2$ (C) $[\text{Xe}] 5d^26s^2$ (D) $[\text{Xe}] 4f^25d^16s^1$
104. Which of the following element of lanthanides is radioactive ?
 (A) Neo-dimeum (B) Promithium (C) Leutetium (D) Gadolinium
105. Which of the following statement is not proper for lanthanide contraction ?
 (A) As we move from Ce to Lu nuclear positive charge increases.
 (B) With increase in atomic number the addition of new electron is in $n = 6$ orbital.
 (C) As we move from Ce to Lu atomic radii decreases.
 (D) With increase in positive electric charge the electrons in 4f-orbital possess more attraction.
106. What is the basicity of $\text{Ln}(\text{OH})_3$ type hydroxides ?
 (A) More than $\text{Ca}(\text{OH})_2$ but less than $\text{Al}(\text{OH})_3$.
 (B) Less than $\text{Ca}(\text{OH})_2$ but more than $\text{Al}(\text{OH})_3$.
 (C) Same as $\text{Ca}(\text{OH})_2$.
 (D) Same as $\text{Al}(\text{OH})_3$.
107. Which property is the basis of separation of lanthanide elements ?
 (A) chemical properties (B) physical properties
 (C) based on ionic size (D) difference in their basicity
108. $\text{Ln} \xrightarrow{x, y} \text{LnC}_2$. Show x and y.
 (A) $x = \text{C}$ $y = 2773 \text{ K}$ (B) $x = \text{C}$ $y = 2770 \text{ K}$
 (C) $x = \text{CO}$ $y = 2775 \text{ K}$ (D) $x = \text{CO}$ $y = 2770 \text{ K}$
109. Which lanthanide element show +2 and +3 oxidation state ?
 (A) La (B) Gd (C) Ce (D) Eu
110. Ce ($Z = 58$) is the important member of lanthanide. Which statement is incorrect for Ce ?
 (A) Common oxidation state of Ce is +3 and +4.
 (B) +3 oxidation state is more stable than +4.
 (C) Ce does not show +4 oxidation state in its solution.
 (D) Ce (IV) acts as oxidant.
111. For which of the following statement, lanthanide contraction is responsible ?
 (A) Same oxidation state of Zn and Zr.
 (B) Almost same co-valent and ionic radius of Zn and Hf.
 (C) Same oxidation state of Zn and Nb.
 (D) Almost same co-valent and ionic radius of Zn and Yb.

112. Common oxidation state of lanthanide series is Ln (III). Which of the following statement is wrong for lanthanide elements ?
- (A) Ln(III) hydroxide possess basic character.
 (B) Due to large size of Ln(III) ion, in their compounds they are bound by ionic bond.
 (C) Generally Ln (III) compounds are colourless.
 (D) With increase in atomic number, the size of Ln(III) ions decreases.
113. Which of the following statement is wrong ?
- (A) $\text{La}(\text{OH})_3$ is less basic than $\text{Lu}(\text{OH})_3$.
 (B) As we move from Ce^{3+} to Lu^{3+} in lanthanide series, their ionic radii decreases.
 (C) Lanthanum is infact transition element.
 (D) Atomic radius of Zn and Hf are similar due to lanthanide contraction.
114. Give reason of stability of Gd^{3+} ion.
- (A) 4f orbital is completely filled.
 (B) 4f orbital is incompletely filled.
 (C) Electronic configuration is like inert gas.
 (D) 4f orbital is completely empty.
115. The stability of oxidation state of Lanthanide elements depends on
- (A) combination of hydration enthalpy & ionization enthalpy.
 (B) electronic configuration
 (C) enthalpy
 (D) internal enthalpy

Answers : 96. (B), 97. (A), 98. (D), 99. (C), 100. (B), 101. (C), 102. (D), 103. (A), 104. (B), 105. (B), 106. (B), 107. (D), 108. (A), 109. (D), 110. (A), 111. (B), 112. (B), 113. (A), 114. (B), 115. (A)

● **Actinide series :**

- In the electronic configuration of elements of actinide series $7s^2$ is common in all elements but electrons keep changing in 5f orbital.
- Irregularity is found more in electronic configuration of actinoids.
- Actinoids possess more than one oxidation states.
- In Cm, 5f orbital is half filled and in Lr, 5f orbital is completely filled to attain stability.
- General electronic configuration of actinoids is $[\text{Rn}] 5f^{0-14} 6d^{0-2} 7s^2$.
- All elements of actinoids are radioactive.
- Actinoids are like silver in appearance.
- More irregularity is observed in the metallic radii in actinoids than lanthanoids.
- Diversity is found in structure of actinoids.
- The values of ionization enthalpy of actinoids are less than the values of ionization enthalpy of lanthanoids.
- Oxidation states of actinoids are +2 to +6.
- Pyrophoric Misch metal (50% Ce + 40% La + 7% Fe + 3% other metals) is used as reducing agent and as stones in gas lighters.
- CeO_2 is useful in pigments.

- Ceric compounds are used as oxidizing agent in volumetric analysis.
- Oxides of lanthanoids are useful in preparation of optical glass of camera having high refractive index.
- Gadolinium sulphate is used to produce very low temperature by magnetic effect.
- Metals like uranium, plutonium and thorium are useful in production of atomic energy.

- 116.** Electronic configuration of which elements show irregularity ?
 (A) Th to Np (B) Ac to Cf (C) Th to Cf (D) Ac to Np
- 117.** Which statement is wrong for actinoids ?
 (A) More irregularity observed in metallic radius
 (B) The values of ionization enthalpy is less than lanthanoids.
 (C) Diversity in structure.
 (D) Stable oxidation state is +3 and +4.
- 118.** What is common electronic configuration of actinides ?
 (A) $[Rn] 5f^{0-14} 6d^{1-2} 7s^2$ (B) $[Rn] 5f^{1-14} 6d^{1-2} 7s^{1-2}$
 (C) $[Rn] 5f^{1-14} 6d^{0-2} 7s^2$ (D) $[Rn] 5f^{0-14} 6d^{0-2} 7s^2$
- 119.** What is the proportion of metals in pyrophoric misch metal ?
 (A) 50 % Ce, 40 % La, 7 % Fe, 3 % other metals.
 (B) 50 % Ce, 40 % La, 5 % Fe, 5 % other metals.
 (C) 50 % Ce, 40 % Fe, 7 % La, 3 % other metals.
 (D) 50 % Ce, 40 % Fe, 7 % Lu, 3 % other metals.
- 120.** What is the use of pyrophoric misch metal ?
 (A) As oxidant (B) As pigment
 (C) As stone in gas lighters (D) preparation of optical glass
- 121.** What are used as oxidizing agent in volumetric analysis ?
 (A) Oxides of lanthanides (B) Ceric compounds
 (C) CeO_2 (D) Gadolinium sulphate
- 122.** What are used in pigments ?
 (A) CeO_2 (B) Ceric compounds
 (C) Gadolinium sulphate (D) Oxides of lanthanides
- 123.** What are useful in preparation of optical glass of camera having high refractive index ?
 (A) Pyrophoric misch (B) Gadolinium sulphate
 (C) Ceric compounds (D) Oxides of lanthanides
- 124.** What is use of Gadolinium sulphate ?
 (A) As reductant (B) As oxidant
 (C) To produce very low temperature by magnetic effect
 (D) production of atomic energy
- 125.** Which of the following is used in production of atomic energy ?
 (A) Uranium (B) Plutonium (C) Thorium (D) All of the above

126. What is the main reason for more number of oxidation states of actinides than lanthanides ?
 (A) 4f orbital is more expanded than 5f orbital.
 (B) less energy difference between 5f and 6d orbital than 4f and 5d orbital.
 (C) more energy difference between 5f and 6d orbital than 4f and 5d orbital.
 (D) Actinides are more reactive than lanthanides.
127. In which factor actinide and lanthanide possess similarity ?
 (A) Electronic configuration (B) Oxidation state
 (C) Ionization Enthalpy (D) In preparation of complex
128. Which compound of lanthanide is used in pigments ?
 (A) $\text{Tb}(\text{OH})_3$ (B) $\text{Cu}(\text{OH})_3$ (C) $\text{Ce}(\text{OH})_3$ (D) CeO_2

Answers : 116. (A), 117. (D), 118. (D), 119. (A), 120. (C), 121. (B), 122. (A), 123. (D), 124. (C), 125. (D), 126. (B), 127. (B), 128. (D)

• **Column Type Questions :**

129. Match column A with column B and select correct option.

Column-A	Column-B
(1) V^{4+}	(P) Green
(2) Ni^{2+}	(Q) Pink
(3) Ti^{3+}	(R) Yellow
(4) Co^{2+}	(S) Blue (T) Purple

- (A) (1)–(S), (2)–(T), (3)–(P), (4)–(R)
 (B) (1)–(R), (2)–(P), (3)–(S), (4)–(T)
 (C) (1)–(S), (2)–(P), (3)–(T), (4)–(Q)
 (D) (1)–(T), (2)–(R), (3)–(P), (4)–(Q)

130. Match column A with column B and select correct option.

Column-A	Column-B
(1) Ti^{4+}	(P) Yellow
(2) Cr^{3+}	(Q) Pink
(3) Fe^{3+}	(R) Colourless
(4) Mn^{3+}	(S) Green (T) Purple

- (A) (1)–(T), (2)–(S), (3)–(Q), (4)–(R)
 (B) (1)–(R), (2)–(T), (3)–(P), (4)–(T)
 (C) (1)–(R), (2)–(S), (3)–(P), (4)–(T)
 (D) (1)–(S), (2)–(T), (3)–(R), (4)–(Q)

131. Match column A with column B and select correct option.

Column-A	Column-B
(1) FeCl_3	(P) 4.90 BM
(2) NiCl_2	(Q) 1.73 BM
(3) CoCl_3	(R) 2.83 BM
(4) CuCl_2	(S) 5.92 BM (T) 3.87 BM

- (A) (1)–(R), (2)–(P), (3)–(T), (4)–(P)
 (B) (1)–(R), (2)–(P), (3)–(Q), (4)–(S)
 (C) (1)–(S), (2)–(R), (3)–(Q), (4)–(T)
 (D) (1)–(S), (2)–(R), (3)–(P), (4)–(Q)

132. Match column A with column B and select correct option.

Column-A	Column-B
(1) Brass	(P) To prepare art model
(2) Nichrome	(Q) To prepare currency coins
(3) Cupronickel	(R) To prepare statue
(4) German Silver	(S) To Musical Instruments (T) To Electrical resistance wire

(A) (1)–(S), (2)–(T), (3)–(Q),(T), (4)–(P),(T)

(B) (1)–T, (2)–(S),(T) (3)–(Q), (4)–(P)

(C) (1)–(S), (2)–(T),(P) (3)–(S),(T), (4)–(R)

(D) (1)–(R),(T) (2)–(Q), (3)–(P), (4)–(T),(S)

133. Match column A with column B and select correct option.

Column-A	Column-B
(1) Bronze	(P) Cu (70%) Zn (30%)
(2) Cupronickel	(Q) Ni (60%) Cr (40%)
(3) Brass	(R) Cu (50-55%) Ni (45-50%)
(4) Nichrome	(S) Cu (75-85%) Ni (15-25%) (T) Cu (90%) Sn (10%)

(A) (1)–(T), (2)–(S), (3)–(Q), (4)–(R)

(B) (1)–(T), (2)–(R),(S) (3)–(P), (4)–(Q)

(C) (1)–(Q), (2)–(R), (3)–(T), (4)–(P)

(D) (1)–(S), (2)–(S), (3)–(R), (4)–(T)

134. Match column A with column B and select correct option.

Column-A	Column-B
(1) Brass	(P) shining as silver
(2) Nitinol	(Q) strong
(3) German Silver	(R) ductile (S) light in weight and strong
(4) Bronze	(T) marvellous property of memory

(A) (1)–(T), (2)–(R), (3)–(S),(Q) (4)–(P)

(B) (1)–(S), (2)–(T),(Q),(S) (3)–(P), (4)–(R)

(C) (1)–(R), (2)–(T), (3)–(S), (4)–(Q)

(D) (1)–(R), (2)–(S),(T) (3)–(P), (4)–(Q)

135. Select correct option for true and false statement (T = True, F = False)

(i) Stability of transition metal ion is less in aqueous medium.

(ii) Magnetic moment of CoCl_3 is 4.90 B.M.

(iii) $\text{Ce}(\text{OH})_3$ is least basic and $\text{Lu}(\text{OH})_3$ is most basic.

(iv) Promethium is radioactive element.

(v) German silver is used as electrical resistance wire

(A) TFTTF

(B) FTTFT

(C) FTFTT

(D) TFFTT

Answers : 129. (C), 130. (B), 131. (D), 131. (D), 132. (A), 133. (B), 134. (D), 135. (C).

