

Class XII
Subject Chemistry (SET – 1)
August Monthly Test (2022-23)

MM 35

Time 90 min

General Instructions:

There are 18 questions in this question paper. All questions are compulsory.

- Section A: Q. No. 1 to 10 are objective type questions and carry 1 mark each.
- Section B: Q. No. 11 to 13 are short answer questions and carry 2 marks each.
- Section C: Q. No. 14 to 16 are short answer questions and carry 3 marks each.
- Section D: Q. No. 17 and 18 are long answer questions carrying 5 marks each.
- There is no overall choice. However, internal choices have been provided.
- Use of calculators is not permitted.

SECTION A(1x10=10)

Read the passage given below and answer the following questions:

The transition elements have incompletely filled d-subshells in their ground state or in any of their oxidation states. The transition elements occupy positions in-between s- and p-blocks in groups 3-12 of the Periodic table. Starting from the fourth period, transition elements consist of four complete series: Sc to Zn, Y to Cd and La, Hf to Hg and Ac, Rf to Cn. In general, the electronic configuration of outer orbitals of these elements is $(n-1)d^{1-10} ns^{0-2}$. The electronic configurations of outer orbitals of Zn, Cd, Hg, and Cn are represented by the general formula $(n-1)d^{10} ns^2$. All the transition elements have typical metallic properties such as high tensile strength, ductility, malleability. Except for mercury, which is liquid at room temperature, other transition elements have typical metallic structures. The transition metals and their compounds also exhibit catalytic property and paramagnetic behavior. Transition metal also forms alloys. An alloy is a blend of metals prepared by mixing the components. Alloys may be homogeneous solid solutions in which the atoms of one metal are distributed randomly among the atoms of the other.

Q.1 Which of the following characteristics of transition metals is associated with higher catalytic activity?

- | | |
|----------------------------------|-------------------------------|
| (a) High enthalpy of atomization | (b) Variable oxidation states |
| (c) Paramagnetic behavior | (d) Colour of hydrated ions |

Q.2 Transition elements form alloys easily because they have

- | | |
|-----------------------------|-----------------------------------|
| (a) same atomic number | (b) same electronic configuration |
| (c) nearly same atomic size | (d) same oxidation states. |

Q.3 Which one of the following outer orbital configurations may exhibit the largest number of oxidation states?

- | | | | |
|-----------------|-----------------|-----------------|-----------------|
| (a) $3d^5 4s^1$ | (b) $3d^5 4s^2$ | (c) $3d^2 4s^2$ | (d) $3d^3 4s^2$ |
|-----------------|-----------------|-----------------|-----------------|

Q.4 The correct statement(s) among the following is/are

- (i) all d- and f-block elements are metals
(ii) all d- and f-block elements form coloured ions
(iii) all d- and f-block elements are paramagnetic.

- | | | | |
|--------------|-----------------------|-------------------------|-------------------------|
| (a) (i) only | (b) (i) and (ii) only | (c) (ii) and (iii) only | (d) (i), (ii) and (iii) |
|--------------|-----------------------|-------------------------|-------------------------|

Q.5 Which of the element is not considered as a transition element

- | | | | |
|--------|--------|--------|--------|
| (a) Cd | (b) Fe | (c) Cr | (d) Co |
|--------|--------|--------|--------|

Multiple choice questions

Q.6 Among the following which are ambidentate ligands?

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|-------------------|------------------|--------------------|--------------------|
| (i) SCN^- | (ii) NO^- | (iii) NO^+ | (iv) $C_2O_4^{2-}$ |
| (a) (i) and (iii) | (b) (i) and (iv) | (c) (ii) and (iii) | (d) (ii) and (iv) |

Q.7 Which of the following ligands form a chelate?

- | | | | |
|-------------|-------------|-------------|-------------|
| (a) Acetate | (b) Oxalate | (c) Cyanide | (d) Ammonia |
|-------------|-------------|-------------|-------------|

Q.8 The oxidation state of nickel in $[Ni(CO)_4]$ is

- | | | | |
|-------|-------|-------|-------|
| (a) 0 | (b) 4 | (c) 2 | (d) 3 |
|-------|-------|-------|-------|

Q.9 According to Werner's theory of coordination compounds

- | | |
|---|--|
| (a) Primary valency is ionisable | (b) Secondary valency is ionisable |
| (c) Primary and secondary valencies are ionisable | (d) Neither primary nor secondary valency is ionisable |

Q.10 Ammonia acts as a very good ligand but ammonium ion does not form complexes because

- (a) NH_3 is a gas while NH_4^+ is in liquid form.
- (b) NH_3 undergoes sp^3 hybridisation while NH_4^+ undergoes sp^3 d hybridisation
- (c) NH_4^+ ion does not have any lone pair of electrons
- (d) NH_4^+ ion has one unpaired electron while NH_3 has two unpaired electrons

SECTION B (2x3=6)

Q.11 Describe the steps of preparation of KMnO_4 .

Q.12 Transition elements form large no. of complex compounds. Give two reasons.

Q.13 Explain the synergic bonding in metal carbonyls.

SECTION B (3x3=9)

Q.14 What is the lanthanoid contraction? What are its causes and consequences?

Q.15 Make the cis and trans forms of the complex $[\text{CrCl}_2(\text{en})_2]^+$. Which one of these will be optically active?

Q.16 Aqueous copper sulphate solution (blue in colour) gives:

- (i) a green precipitate with aqueous potassium fluoride, and
- (ii) a bright green solution with aqueous potassium chloride

Explain these experimental results.

SECTION D (5x2=10)

Q.17 Give reasons-

- (i) Transition metals have high melting points.
- (ii) Second and third transition series have similar radii.
- (iii) Second ionization is difficult from Cu and Cr whereas it is easy for Zn.
- (iv) Most of the transition elements are paramagnetic.
- (v) Transition elements form interstitial compounds.

OR

- (a) Describe the steps of preparation of $\text{K}_2\text{Cr}_2\text{O}_7$.
- (b) Oxidise Fe^{2+} to Fe^{3+} by using $\text{Cr}_2\text{O}_7^{2-}$ in acidic medium
- (c) Oxidise NO_2^- to NO_3^- by using $\text{Cr}_2\text{O}_7^{2-}$ in acidic medium

Q.18 Write the formulas for the following coordination compounds:

- (i) Tetraamminediaquacobalt (III) chloride
- (ii) Potassium tetracyanonickelate (II)
- (iii) Tris(ethane-1,2-diamine) chromium(III) chloride
- (iv) Amminebromidochloridonitrito-N-platinate (II)
- (v) Iron(III) hexacyanoferrate (II)

OR

- (a) Explain $[\text{Co}(\text{NH}_3)_4]^{2+}$ is an inner orbital complex whereas $[\text{Ni}(\text{NH}_3)_4]^{2+}$ is an outer orbital complex.
- (b) FeSO_4 solution mixed with $(\text{NH}_4)_2\text{SO}_4$ solution in 1:1 molar ratio gives the test of Fe^{2+} ion but CuSO_4 solution mixed with aqueous ammonia in 1:4 molar ratio does not give the test of Cu^{2+} ion. Explain why?