INDIAN SCHOOL AL WADI AL KABIR		
Class: XII	**Department: SCIENCE 2023-24** **CHEMISTRY**	**Date: 15/11/2023**
Worksheet No.: 9	**Topic:** d- and f- Block Elements	**Note: A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.**

I. MULTIPLE CHOICE QUESTIONS (1 MARK)

1. Which of the following is the most common oxidation state of copper?
(a) +1
(b) +2
(c) +3
(d) +4

2. Which of the following would be paramagnetic?
(a) Zn^{2+}
(b) Cu^{+}
(c) Sc^{3+}
(d) Mn^{2+}

3. Which of the following is a d-block element that does not form coloured compounds?
(a) Zinc
(b) Chromium
(c) Cobalt
(d) Nickel

4. Which of the following is a catalyst used in the Haber process?
(a) Iron
(b) Nickel
(c) Platinum
(d) All of the above

5. Which of the following is a characteristic of lanthanide contraction?
(a) The atomic radius of the lanthanides decreases gradually.
(b) The ionic radius of the lanthanides decreases gradually.
(c) The ionization energy of the lanthanides increases gradually.
(d) All of the above

6. When manganese dioxide is fused with KOH in air. It gives
(a) potassium permanganate (b) potassium manganate
(c) manganese hydroxide (d) Mn_3O_4.

7. Which metal has highest melting point?
(a) Pt
(b) W
(c) Pd
(d) Au.

II. ASSERTION REASON TYPE QUESTIONS (I MARK)

For the following questions, two statements are given- one labelled *Assertion* (A) and theother labelled *Reason* (R). Select the correct answer to these questions from the codes (i),(ii), (iii) and (iv) as given below

(a) Both A and R are true and R is the correct explanation of the assertion.
(b) Both A and R are true but R is not the correct explanation of the assertion.
(c) A is true but R is false.
(d) A is false but R is true.

8. Assertion: Transition metals show variable valency.
Reason: Transition metals have a large energy difference between the ns^2 and (n–1)d electrons.
9. Assertion: Cuprous ion (Cu+) is colourless whereas cupric ion (Cu++) is blue in the aqueous solution.
Reason: Cuprous ion (Cu+) has unpaired electrons while cupric ion (Cu++) does not.
10.. Assertion: Transition metals are good catalysts.
Reason: V_2O_5 is used in the preparation of H_2SO_4 by contact process.

III. 2 MARKS QUESTIONS

11 Explain the following observations:
(i) Transition elements generally form coloured compounds.
(ii) Zinc is not regarded as a transition element.
12. Assign reasons for the following:
(i) Copper (I) ion is not known in aqueous solution.
(ii) Actinoids exhibit greater range of oxidation states than lanthanoids.
13. How would you account for the following:
(i) Cr^{2+} is reducing in nature while with the same d-orbital configuration (d^4) Mn^{3+} is an oxidising agent.
(ii) In a transition series of metals, the metal which exhibits the greatest number of oxidation states occur in the middle of the series.

.

1V 3 MARKS QUESTIONS

14. What is meant by 'lanthanoid contraction'?
15. Why do transition elements show variable oxidation states?

16. How would you account for the following:

(i) Many of the transition elements and their compounds can act as good catalysts.

(ii) The metallic radii of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second series.

(iii) There is a greater range of oxidation states among the actinoids than among the lanthanoids.

V 5 MARKS QUESTIONS

17. Explain the following observations:

(i) Generally, there is an increase in density of elements from titanium (Z = 22) to copper (Z = 29) in the first series of transition elements.

(ii) Transition elements and their compounds are generally found to be good catalysts in chemical reactions

18. Explain the following observations:

(i) Transition elements generally form coloured compounds.

(ii) Zinc is not regarded as a transition element

19 Complete the following chemical reaction equations:

$$(i)\ MnO_4^-(aq) + C_2O_4^{2-}(aq) + H^+(aq) \longrightarrow$$

$$(ii)\ Cr_2O_7^{2-}(aq) + Fe^{2+}(aq) + H^+(aq) \longrightarrow$$

VI PASSAGE BASED /CASE STUDY BASED QUESTIONS

20. A student was asked to prepare a solution of potassium permanganate (KMnO4) in water and then titrate it against a solution of ferrous ammonium sulphate (FAS). The student observed that the colour of the solution changed from purple to colourless.

Answer the following questions based on this information:

a. Write the balanced chemical equation for the reaction that took place.
b. What is the oxidation state of manganese in $KMnO_4$?
c. What is the oxidation state of iron in FAS.

21. A student was given a sample of a compound that contained a transition metal. The student performed several tests on the compound and obtained the following observations:

1. The compound is blue in color.
2. The compound is soluble in water.
3. The compound reacts with sodium hydroxide to form a blue precipitate.
4. The compound reacts with hydrochloric acid to form a green solution.

Answer the following questions based on this information:

a. What is the transition metal present in the compound?
b. What is the oxidation state of the transition metal in the compound?
c. Why is this transition metal stable in the Oxidation state present in this compound?

Q. No.	ANSWERS
1.	(b) +2
2.	(d) Mn^{2+}
3.	(a) Zinc
4.	(a) Iron
5.	(d) All of the above
6.	(b) potassium manganate
7.	(b) W
8.	(c) A is true but R is false.
9.	(c)A is true but R is false
10	(b) Both A and R are true but R is not the correct explanation of the assertion.
11	(i) Transition elements have vacant d orbitals. So, due to the presence of vacant d-orbital, they produce coloured compound. When visible light strikes a transition metal complex or ion, the unpaired electrons in the lower energy d-orbitals are promoted to higher energy d-orbitals, a process is known as the d-d transition. Since the energy involved in the d-d transition is quantized, only a specific wavelength is absorbed, while the rest of the visible spectrum is transmitted. As a result, transmitted light has a complementary colour to the absorbed colour. (ii) As zinc atom has completely filled d orbitals in its ground state as well as oxidised state, therefore, it is not regarded as transition element.
12.	(i) In an aqueous medium, Cu^{2+} is more stable than Cu^{+}. This is because energy is required to remove one electron from Cu^{+} to Cu^{2+}, high hydration energy of Cu^{2+} compensates for it. Therefore, Cu^{+} ion in an aqueous solution is unstable. It disproportionate to give Cu^{2+} and Cu. (ii) Actinides exhibit larger oxidation states than lanthanides, because of the very small energy gap between 5f, 6d and 7s subshells. Thus, the outermost electrons get easily excited to the higher energy levels, giving variable oxidation states.
13	(i) Cr^{2+} is reducing as its configuration changes from d4 to d3 a more stable half-filled t2g configuration while Mn^{3+} is oxidising as Mn^{3+} to Mn^{2+} results a more stable half-filled d5 configuration (ii) In the middle of the series (d5 configuration) there is a participation of two ns electrons and (n-1)d electrons in the bond formation. Therefore, the elements in the middle of the transition series exhibit maximum oxidation state. (e.g., Mn present in 3d series.
14	Lanthanide contraction is the gradual decrease in the atomic and ionic size of lanthanoids with an increase in atomic number. With an increase in the atomic number, the positive charge on nucleus increases by one unit and one more electron enters same 4f subshell. The electrons in 4f subshell imperfectly shield each other. Shielding in a 4f subshell is lesser than in d subshell. With the increase in nuclear charge, the valence shell is pulled slightly towards the nucleus. This causes

	lanthanide contraction.
15	The d block elements show variable oxidation state because transition metals have (n-1)d orbitals empty that are closer to the outermost ns orbital in energy levels.
16	(i) Transition elements are capable of exhibiting different oxidation states. (ii) The atomic radii of the metals of the third series of transition elements are virtually the same as those of the corresponding members of the second series due to filling of orbitals which have poor shielding effect (lanthanide contraction). (iii) Actinides exhibit larger oxidation states than lanthanides, because of the very small energy gap between 5f, 6d and 7s subshells. Thus, the outermost electrons get easily excited to the higher energy levels, giving variable oxidation states.
17	(i) This is due to decrease in metallic radius coupled with increase in atomic mass results in a general increase in the density. (ii) This property is due to their ability to exhibit variable oxidation states (incomplete d-orbitals) which enable them to form unstable intermediates.
18	(i) When visible light strikes a transition metal complex or ion, the unpaired electrons in the lower energy d-orbitals are promoted to higher energy d-orbitals, a process is known as the d-d transition. Since the energy involved in the d-d transition is quantized, only a specific wavelength is absorbed, while the rest of the visible spectrum is transmitted. As a result, transmitted light has a complementary colour to the absorbed colour. (ii) As zinc atom has completely filled -orbitals in its ground state as well as oxidised state, therefore, it is not regarded as transition element.
19	(i) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$ (ii) $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightleftharpoons 6Fe^{+3} + 2Cr^{+3} + 7H_2O$
20	(a) $MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$ (b) +7 (c) +2
21	(a) Cu (b) +2 (c) Hydration energy of Cu^{2+} is high

PREPARED BY **Ms JENESHA JOSEPH**	**CHECKED BY** **HoD SCIENCE**