INDIAN SCHOOL AL WADI AL KABIR		
Class: XII	**Department: SCIENCE 2026 – 2027** **SUBJECT: CHEMISTRY**	**Date: 03/11/2026**
Worksheet No.: 9 with answers	**TOPIC: THE d– AND f-BLOCK ELEMENTS**	**Note:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS

1. Which of the following shows maximum number of oxidation states?

a) Mn b) Ti c) Sc d) Cu

2. Which property of transition metals enables them to form alloys?

a) High ionisation enthalpy b) Similar atomic radii

c) Catalytic property d) Complex formation **(2026 March)**

3. In 3d series, the element with lowest enthalpy of atomization is …….

a) Zn b) Sc c) Cu d) Ni

4. Which of the following characteristics of transition metals is associated with their catalytic activity?

a) Paramagnetic nature b) Colour of hydrated ions

c) High enthalpy of atomisation d) Variable oxidation states.

5. In 3d series, the element with highest melting point is …….

a) Mn b) Zn c) Cr d) Fe

6. Name a transition element which does not exhibit variable oxidation states.

a) Copper b) Scandium c) Zinc d) Iron

7. Identify the wrong statement from the following

a) Cr^{2+} is an oxidizing agent

b) Mn^{3+} is an oxidizing agent

c) Both Cr^{2+} and Mn^{3+} ions have d^4 configuration

d) Third ionization energy of Mn is relatively high.

8. The spin only magnetic moment of Ni^{2+} ion is …….

a) 3.9 BM b) 2.8 BM c) 1.7 BM d) 8.9 BM

9. Which of the following ion is colourless in aqueous solution?

a) Sc^{3+} b) Ti^{2+} c) V^{4+} d) Cr^{2+}

10. The number of unpaired electrons present in Cu^{+} is …….

a) 0 b) 1 c) 2 d) 3

Read the given passage and answer the questions that follow:

Nearly all the transition elements display typical metallic properties such as high tensile strength, ductility malleability, high thermal and electrical conductivity and metallic lustre. With the exceptions of Zn, Cd, Hg and Mn, they have one or more typical metallic structures at normal temperatures. The transition metals are very much hard and have low volatility. Their melting and boiling points are high.

11. Zinc is not considered as a transition element. Why?

12. The enthalpy of atomization of zinc is very low. Why?

13. Third ionization enthalpy of Zn is quite high. Give reason.

Assertion and Reason Type

14. Assertion: Scandium is considered as a transition element.

Reason: Sc atom has completely filled d orbitals ($3d^{10}$) in its ground state as well as in its oxidized state.

a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
b) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
c) Assertion is correct, but reason is wrong statement.
d) Assertion is wrong, but reason is correct statement.

15. Assertion: Cu cannot liberate hydrogen from acids.

Reason: Copper has positive electrode potential

a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
b) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
c) Assertion is correct, but reason is wrong statement.
d) Assertion is wrong, but reason is correct statement.

16. Assertion: In 3d series, density increases from titanium to copper.

Reason: In general, transition metals contain unpaired electrons.

a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
b) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

c) Assertion is correct, but reason is wrong statement.
d) Assertion is wrong, but reason is correct statement.

Question – Answer Type:

17. The highest oxidation state is exhibited in oxoanions of a metal. Why? **1**

18. Write one difference between transition elements and p-block elements with reference to variability of oxidation states. **1**

19. Name an element of lanthanoid series which is well known to show +4 oxidation state. Is it a strong oxidising agent or reducing agent? **(2026 March)** **1**

20. What is lanthanoid contraction? Write its one consequence. **2**

21. Give reasons for the following: **2**

(i) Transition elements and their compounds act as catalysts

(ii) Transition metals form alloys.

22. Complete the following reactions: **2**

i) $2Cu^{2+} + 4I^{-} \rightarrow$

ii) $2\ Cr^{2+}(aq) + 2\ H^{+}(aq) \rightarrow$

23. Use the data to answer the following and also justify giving reason : **2**

	Cr	Mn	Fe	Co
$E^{o}_{M^{2+}/M}$	– 0·91	– 1·18	– 0·44	– 0·28
$E^{o}_{M^{3+}/M^{2+}}$	– 0·41	+ 1·57	+ 0·77	+ 1·97

(a) Which is a stronger reducing agent in aqueous medium, Cr^{2+} or Fe^{2+} and why ?

(b) Which is the most stable ion in +2 oxidation and why ?

24. Answer the following: **3**

a) The only oxidation state shown by Scandium is +3. Why?

b) MnO is basic while Mn_2O_7 is acidic. Give reason.

c) What is the general electronic configuration of lanthanoids?

25. Account for the following : **3**

(i) Manganese shows maximum number of oxidation states in 3d series.

(ii) E^o value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+}.

(iii) Ti^{4+} is colourless whereas V^{4+} is coloured in an aqueous solution.

26.a)

$E^{\ominus}_{M^{2+}/M}$	Cr	Mn	Fe	Co	Ni	Cu	Zn
	− 0·91	− 1·18	− 0·44	− 0·28	− 0·25	+ 0·34	− 0·76

(5)

From the given E values of the first-row transition elements, answer the following questions:

(i) Why is $E^{\Theta}_{Mn2+/Mn}$ value highly negative as compared to other elements?

(ii) What is the reason for the irregularity in the above E^{Θ} values?

(iii) Why is $E^{\Theta}_{Cu2+/Cu}$ value exceptionally positive?

b) (i) Which ion amongst the following is colourless and why?

Ti^{4+}, Cr^{3+}, V^{3+} (Atomic number of Ti = 22, Cr = 24, V = 23)

(ii) Why is Mn^{2+} much more resistant than Fe^{2+} towards oxidation?

27. **(5)**

a) Out of Cu_2Cl_2 and $CuCl_2$, which is more stable in aqueous solution and why?

b) Write the general electronic configuration of f-block elements.

c) Predict which of the following will be coloured in aqueous solution and why?

Sc^{3+}, Fe^{3+}, Zn^{2+}

d) How can you obtain potassium dichromate from sodium chromate?

e) Write the products obtained on heating $KMnO_4$ at 513K **(2026 March)**

ANSWERS

1.	a) Mn
2.	b) Similar atomic radii
3.	a) Zn
4.	d) Variable oxidation states
5.	c) Cr
6.	b) Scandium
7.	a) Cr^{2+} is an oxidizing agent
8.	b) 2.8 BM
9.	a) Sc^{3+}
10.	a) 0
11.	Zinc has completely filled d orbitals ($3d^{10}$) in its ground state as well as in its stable oxidised state. Hence it is not regarded as a transition element.
12.	Zinc does not contain unpaired electrons. Therefore, it has weak metallic bonding.
13.	In Zn, third electron needs to be removed from a more stable d^{10} configuration.
14.	c) Assertion is correct, but reason is wrong statement.
15.	a) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion
16.	b) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion
17.	Due to the ability of oxygen to stabilise higher oxidation states through multiple bonds with metal.
18.	Transition elements show variable oxidation states that differ by 1 unit whereas p-block elements it differs by 2 units. Heavier transition elements are stable in higher oxidation state whereas p-block elements are stable in lower oxidation state.
19.	Cerium / Terbium; Oxidizing agent
20.	Steady decrease in atomic radii with increase in atomic number due to poor shielding effect of 4f orbital electrons is called lanthanoid contraction. Consequence: Elements of 5d series have almost same size as 4d series.
21.	i) Due to variable oxidation state and ability to form multiple oxidation states. ii) Alloys are formed by atoms with metallic radii that are within about 15 percent of each other. Because of similar radii and other characteristics of transition metals, alloys are readily formed by these metals.
22.	i) $2Cu^{2+} + 4I^- \rightarrow Cu_2I_2(s) + I_2$ ii) $2\ Cr^{2+}(aq) + 2\ H^+(aq) \rightarrow 2\ Cr^{3+}(aq) + H_2(g)$
23.	(a) Cr^{2+}. It has lower standard electrode potential (E^θ), due to the stability of half-filled t_2g configuration of Cr^{3+} (b) Mn^{2+}. It has the highest negative standard electrode potential due to the stability of half-filled d^5 configuration of Mn^{2+}

24.	a) At +3 state, stable d^0 configuration is obtained. b) MnO has Mn in +2 oxidation State, Mn_2O_7 has Mn in +7 Oxidation state. Higher the oxidation state, higher is the acidic character. c) $4f^{1-14}\ 5d^{0-1}\ 6s^2$
25.	i) Due to the presence of maximum no. of unpaired electrons. ii) Cr is more stable in +3 oxidation state due to stable half filled t_2g configuration whereas Mn is more stable +2 oxidation state due to half filled $3d^5$ configuration. iii) V^{4+} is coloured due to the presence of one unpaired electron whereas there is no unpaired electron in Ti^{4+}
26.	a) *(i)* Because of the stable half-filled $3d^5$ configuration in Mn^{2+}. *(ii)* Because of the irregular sum of $(\Delta_i H_1 + \Delta_i H_2)$ values and much less sublimation enthalpies for Mn and V. *(iii)* Because of high $\Delta_a H^0$ and low $\Delta_{hyd} H^0$ b) *(i)* Ti^{4+} no unpaired electrons in d-orbital / no d-d transition / d^0 configuration. *(ii)* Mn^{2+} is d^5 and is more stable than $Mn^{3+}(d^4)$ whereas $Fe^{3+}(d^5)$ is more stable than $Fe^{2+}(d^4)$.
27.	a) $CuCl_2$ is more stable than Cu_2Cl_2 as Cu^{+2} is more stable than Cu^+ due to high $\Delta_{hyd}H^0$ b) $(n-2)f^{1-14}\ (n-1)\ d^{o-1}\ ns^2$ c) Fe^{3+}, presence of unpaired electron leading to d-d transition. d) $2Na_2CrO_4 + 2\ H^+ \rightarrow Na_2Cr_2O_7 + 2\ Na^+ + H_2O$ $Na_2Cr_2O_7 + 2\ KCl \rightarrow K_2Cr_2O_7 + 2\ NaCl$ e) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$.

Prepared by: *Mr Anoop Stephen*	*Checked by:* *HOD Science*