	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	**Department: SCIENCE 2021 - 22** **SUBJECT :CHEMISTRY**	**Date of submission:** **27.02.2022**
Worksheet No: 11 **WS WITH ANS.**	**Chapter: 8 The d- and f- Block Elements**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

I. Answer the following questions. Each question carries one mark

1. **Define transition elements**.

Ans. Transition element is defined as the one which has incompletely filled *d* orbitals in its ground state or in any one of its oxidation states.

2. What is the position of the d block elements in the periodic table?

Ans. The d block elements are in the middle of s and p blocks, comprising the groups 3 to 12. They are the four rows of elements in the periods 4^{th} (3d series), 5^{th} (4d series), 6^{th} (5d series) and 7^{th} (6d series).

3. **Zinc, cadmium and mercury of group 12 are not regarded as transition metals, Why?**

Ans. Zinc, cadmium and mercury of group 12 have full d^{10} configuration (d orbitals are completely filled) in their ground state as well as in their common oxidation states and hence, are not regarded as transition metals

4. **Why d- block elements are named as 'transition elements** '?

Ans. The *d*–block elements occupies the middle of the periodic table and their properties are in transition between *s*– and *p*– block elements.

5. **Write the general electronic configuration of d block elements**.

Ans. [Noble gas] (n-1) $d^{1\text{-}10}ns^{0\text{-}2}$

6. **Write the general outer electronic configuration of d- block elements**.

Ans. The general outer electronic configuration of d- block elements is (n-1) $d^{1–10}$ $ns^{0–2}$

7. **Write the general electronic configuration of f- block elements**.

Ans. The general electronic configuration of f- block elements

(Lanthanoids) is[Xe] $4f^{1-14}$ $5d^{0-1}$ $6s^2$

8. Name a member of the lanthanoid series which is well known to exhibit +4 oxidationstate.
Ans. Cerium

9. The outer electronic configuration of Cr is $3d^5\ 4s^1$ instead of $3d^4 4s^2$, why?

Ans. Half filled ($3d^5$) orbitals are relatively more stable, hence one electron of 4s orbital jumps to 3d orbital.

10. **The outer electronic configuration of Cu is $3d^{10}\ 4s^1$ instead of $3d^9 4s^2$, why**?

Ans. Completely filled ($3d^{10}$) orbitals are relatively more stable, hence one electron of 4sorbital jumps to 3d orbital.

11. **Account for high melting point and boiling points of transition metals**.

Ans. The melting and boiling points of transition metals are high because of the involvement of greater number of electrons from (n-1)*d* orbitals in addition to the n*s* electrons in the interatomic metallic bonding.

12. What is the trend in melting points of transition metals in a series?

Ans. The melting points of the transition metals in a series r i s e to a maximum at the middle of the series (i.e. Cr or Mo or W - element with d^5 configuration) and fall regularly as the atomic number increases.

13. Why do transition metals have higher enthalpies of atomization?

Ans. Involvement of a large number of unpaired electrons of d orbitals favour stronger interatomic interactions resulting in stronger bonds between the atoms of a metal and higher enthalpies of atomization.

14. **Name one 3d series elements, that do not show variable oxidation states**.

Ans. Sc (+3)

15. Transition metals exhibit variable oxidation states in its compounds, why?

Ans. Transition metals exhibit variable oxidation states in its compounds due to theavailability of both ns & (n – 1) d electrons for bond formation.

16. **Name 3d series metal which shows highest oxidation state**.

Ans.

The highest oxidation state shown by 3d series transition metals is +7 by Mn.

17. **Name a metal in the 3d series of transition metals which exhibit +1 oxidation statemost frequently**.

Ans. copper

18. **What is the trend in oxidation state of transition metals?**

Ans. The oxidation state increases with increase in atomic number & reaches a maximum in the middle and then decreases.

19. 3d series transition metals exhibit +2 as the most common oxidation state (exceptSc) why?

Ans. The +2 oxidation state, which commonly occurs for nearly all the transition metals isdue to the loss of their outer 4*s* electrons

20. Why transition metals and their compounds shows paramagnetic behaviour?

Ans. The transition metal ions are generally containing one or more unpaired electrons inthem & hence their compounds are generally paramagnetic.

21. Name an of alloys of transition metals with non-transition metals.

Ans. Brass (Cu & Zn) or Bronze (Cu & Sn)

22. What is the principal oxidation state exhibited by the lanthanoids?

Ans. The principal oxidation state of lanthanoids is +3.

23. Write the spin-only formula used to calculate the magnetic moment of metal ions.

Ans. The magnetic moment is determined by using the spin only formula,

$\mu = \sqrt{n(n+2)}$ where n is the number of unpaired electrons and μ is themagnetic moment in units of Bohr magneton (BM).

24. Why is Sc^{3+} (or Zn^{2+}) diamagnetic?

Ans. Sc^{3+}(Z=21) $3d^0$ no unpaired electron, n=0, μ=0.

Zn^{2+}(Z=30) $3d^{10}$ no unpaired electron, n=0, μ=0)

25. What is the most common oxidation state of lanthanoids and actionoids?

Ans. The most common oxidation state of lanthanoids and actionoids is +3.

26. Why transition metals forms alloys readily?

Ans. Transition metals readily form alloys with other transition metals because of their similar radii

27. Give one use of transition metal alloy.

Ans. Ferrous alloys containing chromium, vanadium, tungsten, molybdenum and manganeseare used for the production of a variety of steels.

II. Answer the following questions. Each question carries TWO marks.

28.Name two characteristic properties exhibited by d – block elements due to their partly filled d orbitals.

Ans. The characteristic properties exhibited by d – block elements due to their partlyfilled d orbitals are variable; (i) Oxidation states

(ii) Formation of coloured ions.

29. Name two typical metallic properties displayed by transition elements.

Ans. High tensile strength, ductility, malleability, high thermal and electrical conductivity and metallic lustre etc.

30. a.What are interstitial compounds? Give example.

Ans. Interstitial compounds are those which are formed when small atoms like H, C or N aretrapped inside the crystal lattices of transition metals.

Example; TiC, Mn_4N, Fe_3H, $VH_{0.56}$ and $TiH_{1.7}$, etc.

30.b. Give any two physical characteristics of interstitial compounds.

Ans. Two physical characteristics of interstitial compounds are:

(i) They have high melting points, higher than those of pure metals.

(ii) They are very hard and they retain metallic conductivity.

31.Calculate the 'spin only' magnetic moment of M^{2+} (aq) ion (Z = 27).

Ans. M (z= 27) , $3d^7\ 4s^2$

M^{2+} $3d^7\ 4s^0$ hence it has 3 unpaired electrons n= 3

$$\mu = \sqrt{n(n+2)}$$

= 3.87 BM

32. The second ionisation enthalpy is high for Cr and Cu, why?

Ans: The second ionisation enthalpy is unusually high values for Cr and Cu because when M^+ ion ionize to M^{+2} ion , the d^5 and d^{10} configurations of the M^+ ions (i.e Cr^+ or Cu^+) are disrupted, with considerable loss of exchange energy .

33. Why first ionisation enthalpy of Cr is lower than that of Zn ?

IE_1 of Cr is lower, because removal of an electron from Cr does not change the d ($3d^5\ 4s^1$ to $3d^5\ 4s^0$)

IE_1 value for Zn is higher, because removal of electron from 4s level needs more energy.Zn (z= 30, $3d^{10}\ 4s^2$)

34. What is the action of heat on potassium permanganate? Give equation.

Ans. It decomposes at 513K to potassium manganate, manganese dioxide and oxygen.

$$2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$$

35. The transition metals generally form coloured compounds, why?

Ans. The compounds of transition elements shows colour due to presence of unpaired electron & ability to undergo d-d transition.

When an electron from a lower energy d orbital is excited to a higher energy d orbital, the energy of excitation corresponds to the frequency of light absorbed. This frequency generally lies in the visible region.

36. **Give reason "transition metals and their many compounds acts as good catalysts".** Ans. Transition metals and their many compounds acts as good catalysts, it is due to

a. partially filled (n-1) d orbital
b. variable oxidation state and provide a suitable surface for thereaction to take place.

37. Explain giving reason "transition metals form a large number of complexcompounds".

Ans.Transition metals form a large number of complex compounds due to

(i) Small size & high charge density of the ions of transition metals.

(ii) Presence of vacant d orbitals of suitable for bond formation.

38. What is lanthanoid contraction? Write any one consequence of lanthanoidcontraction.

Ans. Steady decrease in the size of lanthanoids with increase in atomic number is known as lanthanoid contraction. Due to lanthanoid contraction radii of members of 3rd transition series are very much similar to corresponding members of 2nd series.

39. Write any two consequences of lanthanoid contraction.

Ans. Two consequences of lanthanoid contractions are:

(i) The radii of the members of the third transition series to be very similar to those of the corresponding members of the second series. Ex. The almost identical radii of Zr (160 pm)and Hf (159 pm) & Nb (146pm) & Ta (146pm)

(ii) Difficulty in separation of lanthanoids due to similarity in chemical properties.

40. Name the two series of f-block.

Ans. The *f*-block consists of the two series, lanthanoids (the fourteen elements followinglanthanum) and actinoids (the fourteen elements following actinium.

Answer the following questions. Each question carries THREE marks

41. Name the metal of the 1st row transition series that

i) has highest value for magnetic moment

ii) has zero spin only magnetic moment in its +2 oxidation state.

iii) exhibit maximum number of oxidation states.

Ans. i) Chromium ii) Zinc iii) Manganese

42. **Transition metals form a large number of complex compounds. Give reason**.

Ans. Transition metals for complex compounds due to,

i) small sizes of metal cations

ii) their ionic charges and

iii) availability of d orbitals for bond formation.

43. **Explain the trend in atomic size of 3d series of transition elements with reason.**

Ans. With increase in atomic number in 3d series - atomic size decreases (Sc to Cr) , thenremain almost constant (Cr to Cu) and increase slightly at the end (Cu to Zn).

Reason: In the beginning of the series the screening (or shielding effect) effect of a delectron is not that effective, hence the net electrostatic attraction between the nuclear charge and the outermost electron increases, hence atomic size radius decreases. In the middle of the series, increase in nuclear charge and increase in screening effect balance each other. So atomic radii become almost constant.

Increase in atomic radii towards the end is due to the electro – electron repulsions causes theexpansion of electron cloud.

Prepared by : Ms. Jenifer Robinson