Maharashtra Board Solutions Class 12 Chemistry: Chapter 8- Transition and Inner Transition Elements

Class 12 - Chapter 8 Transition and Inner Transition Elements

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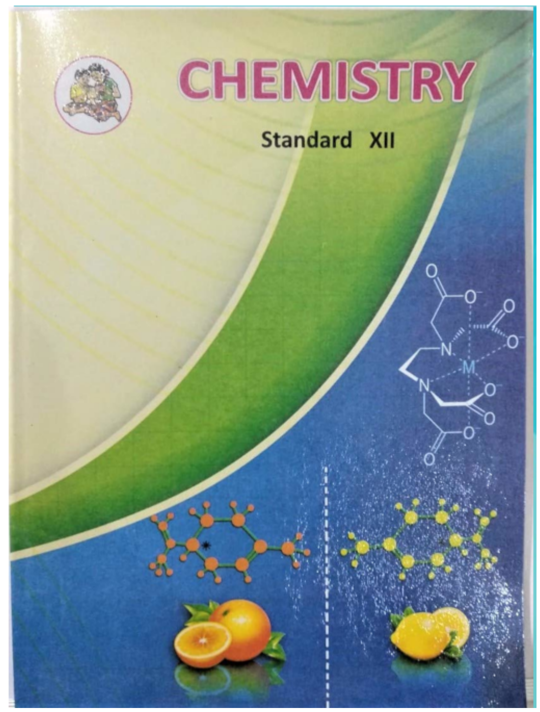

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Maharashtra Board Solutions Class 12 Chemistry: Chapter 8- Transition and Inner Transition Elements

Class 12: Chemistry Chapter 8 solutions. Complete Class 12 Chemistry Chapter 8 Notes.

Maharashtra Board Solutions Class 12 Chemistry: Chapter 8- Transition and Inner Transition Elements

Maharashtra Board 12th Chemistry Chapter 8, Class 12 Chemistry Chapter 8 solutions

1. Choose the most correct option.

Question i.

Which one of the following is diamagnetic

a. $Cr^{3\oplus}$

b. $Fe^{3\oplus}$

c. $Cu^{2\oplus}$

d. $Sc^{3\oplus}$

Answer:

d. $Sc^{3\oplus}$

Question ii.

Most stable oxidation state of Titanium is

a. +2

b. +3

c. +4

d. +5

Answer:

c. +4

Question iii.

Components of Nichrome alloy are

a. Ni, Cr, Fe

b. Ni, Cr, Fe, C

c. Ni, Cr

d. Cu, Fe

Answer:

(c) Ni, Cr

Question iv.

Most stable oxidation state of Ruthenium is

a. +2

b. +4

c. +8

d. +6

Answer:

(b) +4

Question v.

Stable oxidation states for chromium are

a. +2, +3

b. +3, +4

c. +4, +5

d. +3, +6

Answer:

d. +3, +6

Question vi.

Electronic configuration of Cu and Cu^{+1}

a. $3d^{10}$, $4s^{0}$; $3d^{9}$, $4s^{0}$

b. $3d^{9}$, $4s^{1}$; $3d^{9}4s^{0}$

c. $3d^{10}$, $4s^{1}$; $3d^{10}$, $4s^{0}$

d. $3d^{8}$, $4s^{1}$; $3d^{10}$, $4s^{0}$

Answer:

c. $3d^{10}$, $4s^{1}$; $3d^{10}$, $4s^{\circ}$

Question vii.

Which of the following have d0s0 configuration

a. $Sc^{3\oplus}$

b. $Ti^{4\oplus}$

c. $V^{5⊕}$

d. all of the above

Answer:

d. All of the above

Question viii.

Magnetic moment of a metal complex is 5.9 B.M. Number of unpaired electrons in the complex is

a. 2

b. 3

c. 4

d. 5

Answer:

d. 5

Question ix.

In which of the following series all the elements are radioactive in nature

a. Lanthanoids

b. Actinoids

c. d-block elements

d. s-block elements

Answer:

b. Actinides

Question x.

Which of the following sets of ions contain only paramagnetic ions

a. $Sm^{3\oplus}$, $Ho^{3\oplus}$, $Lu^{3\oplus}$

b. $La^{3\oplus}$, $Ce^{3\oplus}$, $Sm^{3\oplus}$

c. $La^{3\oplus}$, $Eu^{3\oplus}$, $Gd^{3\oplus}$

d. $Ce^{3\oplus}$, $Eu^{3\oplus}$, $Yb^{3\oplus}$

Answer:

d. $Ce^{3\oplus}$, $Eu^{3\oplus}$, $Yb^{3\oplus}$

Question xi.

Which actinoid, other than uranium, occur in a significant amount naturally?

a. Thorium

b. Actinium

c. Protactinium

d. Plutonium

Answer:

a. Thorium

Question xii.

The flux added during extraction of Iron from hematite are its?

a. Silica

b. Calcium carbonate

c. Sodium carbonate

d. Alumina

Answer:

b. Calcium carbonate

2. Answer the following

Question i.

What is the oxidation state of Manganese in

(i) MnO2−4(ii)MnO−4?

Answer:

Oxidation state of Manganese in

(i)MnO2−4is+6(ii)MnO−4is+7

***Question ii.**

Give uses of $KMnO_4$

Question iii.

Why salts of $Sc^{3\oplus}$, $Ti^{4\oplus}$, $V^{5\oplus}$ are colorless?

Answer:

(i) Sc^{3+} salts are colourless :

- The electronic configuration of $_{21}Sc$ [Ar| $3d^1$ $4s^2$ and Sc^{3+} [Ar] d°.
- Since there are no unpaired electrons in 3d subshell, d → d transition is not possible.
- Therefore, Sc^{3+} ions do not absorb the radiations in the visible region. Hence salts of Sc^{3+} are colourless (or white).

(ii) Ti^{4+} salts are colourless :

- The electronic configuration of $_{22}Ti$ [Ar] $3d^2 4s^2$ and Ti^{4+} : [Ar] d°

- Since there are no unpaired electrons in 3d subshell, d-*d transition is not possible.
- Therefore, Ti^{3+} ions do not absorb the radiation in visible region. Hence salts of Ti^{3+} are colourless.

(iii) Vs^{5+} salts are eolourless :

- The electronic configuration of $_{23}V$: [Ar] $3d^3 4s^2$ and V^{5+} : [Ar] 3d°
- Since there are no unpaired electrons in 3d-subshell, d – d transition is not possible.
- Therefore, V^{5+} ions do not absorb the radiations in the visible region. Hence, V^{5+} salts are colourless, a

Question iv.

Which steps are involved in the manufacture of potassium dichromate from chromite ore?

Answer:

Steps in the manufacture of potassium dichromate from chromite ore are :

- Concentration of chromite ore.
- Conversion of chromite ore into sodium chromate (Na_2CrO_4).
- Conversion of Na_2CrO_4 into sodium dichromate ($Na_2Cr_2O_7$).
- Conversion of $Na_2Cr_2O_7$ into $K_2Cr_2O_7$.

Question v.

Balance the following equation

(i) $KMnO_4 + H_2C_2O4 + H_2SO_4 \rightarrow MnSO_4 + K_2SO_4 + H_2O + O_2$

(ii) $K_2Cr_2O_7 + KI + H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3I_2$

Answer:

(i) $2KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$

(ii) Acidified potassium dichromate oxidises potassium iodide (KI) to iodine (I2). Potassium dichromate is reduced to chromic sulphate. Liberated iodine turns the solution brown $K_2Cr_2O_7 + 6KI + 7H_2SO_4 \rightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3I_2$ [Oxidation state of iodine increases from – 1 to zero]

Question vi.

What are the stable oxidation states of plutonium, cerium, manganese, Europium?

Answer:

Stable oxidation states :

Plutonium + 3 to + 7

Cerium + 3, + 4

Manganese + 2, + 4, + 6, + 7

Europium +2, +3

Question vii.

Write the electronic configuration of chromium and copper.

Answer:

Chromium ($_{24}Cr$) has electronic configuration,

$_{24}Cr$ (Expected) : $Is^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ 4s^2$

(Observed) : $Is^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

Explanation :

- The energy difference between 3d- and 45-orbitals is very low.
- d-orbitals being degenerate, they acquire more stability when they are half-filled ($3d^5$).

- Therefore, there arises a transfer of one electron from 45-orbital to 3d-orbital in Cr giving more stable half-filled orbital. Hence, the configuration of Cr is [Ar] $3d^5$ $4s^1$ and not [Ar] $3d^4$ $4s^2$.

Copper ($_{29}CU$) has electronic configuration,

$_{29}Cu$ (Expected) : Is^2 $2s^3$ $2p^6$ $3s^3$ $3p^6$ $3d^9$ $4s^2$

(Observed) : Is^2 $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^{10}$ $4s^1$

Explanation :

- The energy difference between 3d- and 45-orbitals is very low.
- d-orbitals being degenerate, they acquire more stability when they are completely filled.
- Therefore, there arises a transfer of one electron from 45-orbital to 3d-orbital in Cu giving completely filled more stable d-orbital.

Hence, the configuration of Cu is [Ar] $3d^{10}$ $4s^1$ and not [Ar] $3d^9$ $4s^2$.

Question viii.

Why nobelium is the only actinoid with +2 oxidation state?

Answer:

- Nobelium has the electronic configuration $_{102}NO$: [Rn] $5f^{14}6d°7s^2$
- No^{2+} : [Rn] $5f^{14}6d°$
- Since the 4f subshell is completely filled and 6d° empty, + 2 oxidation state is the stable oxidation state.
- Other actinoids in + 2 oxidation state are not as stable due to incomplete 4f subshell.

Question ix.

Explain with the help of balanced chemical equation, why the solution of Ce(IV) is prepared in acidic medium.

Answer:

Ce^{4+} undergoes hydrolysis as, $Ce^{4+} + 2H_2O \rightarrow Ce(OH)_4 + 4H^+$.

Due to the presence of H^+ in the solution, the solution is acidic.

Question x.

What is meant by 'shielding of electrons' in an atom?

Answer:

The inner shell electrons in an atom screen or shield the outermost electron from the nuclear attraction. This effect is called the shielding effect.

The magnitude of the shielding effect depends upon the number of inner electrons.

Question xi.

The atomic number of an element is 90. Is this element diamagnetic or paramagnetic?

Answer:

The 90th element thorium has an electronic configuration, [Rn] $6d^2 7s^2$. Since it has 2 unpaired electrons it is paramagnetic.

3. Answer the following

Question i.

Explain the trends in atomic radii of d-block elements

Answer:

1. The atomic or ionic radii of 3-d series transition elements are smaller than those of representative elements, with the same oxidation states.
2. For the same oxidation state, there is an increase in nuclear charge and a gradual decrease in ionic radii of 3d-series elements is observed. Thus ionic radii of ions with oxidation state + 2 decreases with increase in atomic number.
3. There is slight increase is observed in Zn^{2+} ions. With the higher oxidation states, effective nuclear charge increases. Therefore ionic radii decrease with increase

in oxidation state of the same element. For example, Fe^{2+} ion has ionic radius 77 pm whereas Fe^{3+} has 65 pm.

Question ii.

Name different zones in the Blast furnace. Write the reactions taking place in them.

Answer:

(i) Zone of combustion : The hot air oxidises coke to CO which is an exothermic reaction, due to which the temperature of furnace rises.

$C + {}^{1/2} O_2 \rightarrow CO$ $\Delta H= - 220kJ$

Some part of CO dissociates to give finely divided carbon and O_2.

$2CO \rightarrow 2C + O_2$

The hot gases with CO rise up in the furnace and heats the charge coming down. CO acts as a fuel as well as a reducing agent.

(ii) Zone of reduction : At about 900 °C, CO reduces Fe_2O_3 to spongy (or porous) iron.

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

Carbon also reduces partially Fe_20_3 to Fe.

$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$

(iii) Zone of slag formation : At 1200 K limestone, $CaCO_3$ in the charge, decomposes and forms a basic flux CaO which further reacts at 1500 K with gangue (SiO_2, Al_2O_3) and forms a slag of $CaSiO_3$ and Ca_3AlO_3.

$CaCO_3 + CaO + CO_2$.

$CaO + SiO_2 \rightarrow CaSiO_3$

$12CaO + 2Al_2O_3 \rightarrow 4Ca_3AlO_3 + 3O_2$

The slag is removed from the bottom of the furnace through an outlet.

(iv) Zone of fusion : The impurities in ore like MnO_2 and $Ca_3(PO_4)_2$ are reduced to Mn and P while SiO_2 is reduced in Si. The spongy iron moving down in the furnace melts in the fusion zone and dissolves the impurities like C, Si, Mn, phosphorus and sulphure. The molten iron collects at the bottom of furnace. The lighter slag floats on the molten iron and prevents its oxidation.

The molten iron is removed and cooled in moulds. It is called pig iron or cast iron. It contains about 4% carbon.

Question iii.

What are the differences between cast iron, wrought iron and steel?

Answer:

Cast iron	Wrought iron	Steel
(1) Hard and brittle (2) Contains 4% carbon. (3) Used for making pipes, manufacturing automotive parts, pots, pans, utensils	(1) Very soft (2) Contains less than 0.2% carbon. (3) Used for making pipes, bars for stay bolts, engine bolts and rivets.	(1) Neither too hard nor too soft. (2) Contains 0.2 to 2% carbon (3) Used in buildings infrastructure, tools, ships, automobiles, weapons etc.

Question iv.

Iron exhibits +2 and +3 oxidation states. Write their electronic configuration. Which will be more stable? Why?

Answer:

The electronic configuration of Fe^{2+} and Fe^{3+} :

Fe^{2+} : $Is^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$

Fe^{3+} : $Is^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$

Due to loss of two electrons from the 4.v-orbital and one electron from the 3d-orbital, iron attains 3^+ oxidation state. Since in Fe^{3+}, the 3d-orbital is half-filled, it gets extra stability, hence Fe^{3+} is more stable than Fe^{2+}.

Question v.

Give the similarities and differences in elements of 3d, 4d and 5d series.

Answer:

Similarity :

- They are placed between .s-block and p-block of the periodic table.
- All elements are metals showing metallic characters.
- Some are paramagnetic.
- Most of them give coloured compounds.
- They have catalytic properties.
- They form complexes.
- They have variable oxidation states.

Differences :

- In 4d and 5d series lanthanide and actinoid contraction is observed. In 3d series atomic size changes are less marked.
- 4d and 5d elements have high coordination numbers compared to 3d elements.
- 4d and 5d series have similar properties whereas 3d series have different properties.

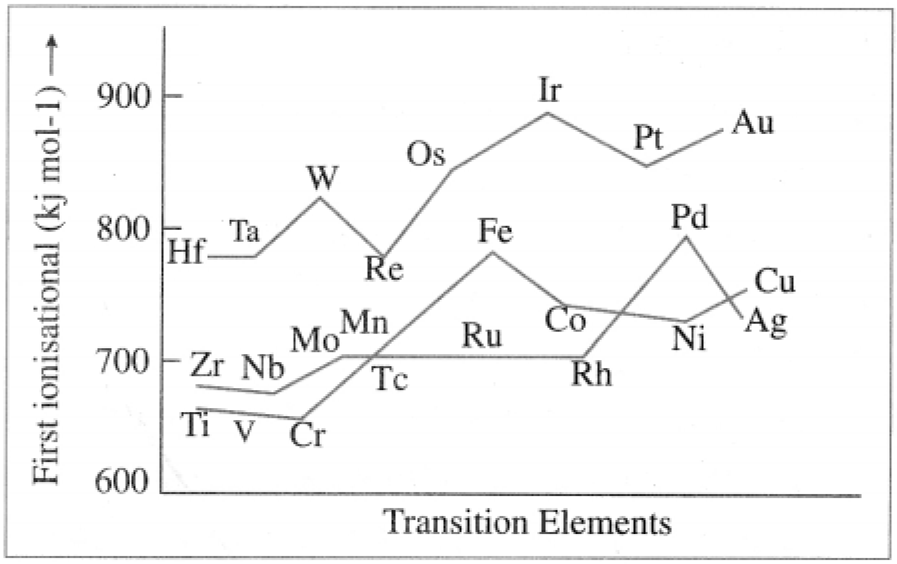
Question vi.

Explain trends in ionisation enthalpies of d-block elements.

Answer:

1. The ionisation enthalpies of transition elements are quite high and lie between those of 5-block and p-block elements. This is because the nuclear charge and

atomic radii of transition elements lie between those of 5-block and p-block elements.



The first ionisation enthalpies of transition elements

1. As atomic number of transition elements increases along the period and along the group, first ionisation enthalpy increases even though the increase is not regular.
2. If IE_1; IE_2 and IE_3 are the first, second and third ionisation enthalpies of the transition elements, then $IE_1 < IE_2 < IE_3$.
3. In the transition elements, the added last differentiating electron enters into (n – 1) d-orbital and shields the valence electrons from the nuclear attraction. This gives rise to the screening effect of (n – 1) d-electrons.
4. Due to this screening effect of (n – 1) d electrons, the ionisation enthalpy increases slowly and the increase is not very regular.

Question vii.

What is meant by diamagnetic and paramagnetic metal? Give one example of diamagnetic and paramagnetic transition metal and lanthanoid metal.

Answer:

1. Paramagnetic substances : When a magnetic field is applied, substances which are attracted towards the applied magnetic field are called paramagnetic substances. Example : Ni^{2+}, Pr^{4+}
2. Diamagnetic substances : When a magnetic field is applied, substances which are repelled by the magnetic fields are called diamagnetic substances. Example : Zn^{2+}, La^{3+}
3. Ferromagnetic substances : When a magnetic field is applied, substances which are attracted very strongly are called ferromagnetic substances. These substances can be magnetised. For example, Fe, Co, Ni are ferromagnetic.

Question viii.

Why the ground-state electronic configurations of gadolinium and lawrencium are different than expected?

Question ix.

Write steps involved in the metallurgical process

Answer:

The various steps and principles involved in the extraction of pure metals from their ores are as follows.:

- Concentration of ores in which impurities (gangue) are removed.
- Conversion of ores into oxides or other reducible compounds of metals.
- Reduction of ores to obtain crude metals.
- Refining of metals giving pure metals.

Question x.

Cerium and Terbium behaves as good oxidising agents in +4 oxidation state. Explain.

Answer:

- The most stable oxidation state of lanthanoids is +3.
- Hence, Ce^{4+} (cerium) and Tb^{4+} (terbium) tend to get + 3 oxidation state which is more stable.

- Since they get reduced by accepting electron, they are good oxidising agents in + 4 oxidation state.

Question xi.

Europium and Ytterbium behave as good reducing agents in +2 oxidation state explain.

Answer:

- The most stable oxidation state of lanthanoids is + 3.
- Hence, Eu^{2+} and Yb^{2+} tend to get + 3 oxidation states by losing one electron.
- Since they get oxidised, they are good reducing agents in + 2 oxidation state.

Activity :

Make groups and each group prepare a PowerPoint presentation on the properties and applications of one element. You can use your imagination to create some innovative ways of presenting data.

You can use pictures, images, flow charts, etc. to make the presentation easier to understand. Don't forget to cite the reference(s) from where data for the presentation is collected (including figures and charts). Have fun!

Do you know? (Textbook Page No 165)

Question 1.

In which block of the modern periodic table are the transition and inner transition elements placed?

Answer:

The transition elements are placed in d-block and inner transition elements are placed in *f*-block of the modern periodic table.

Use your brain power! (Textbook Page No 167)

Question 1.

Fill in the blanks with correct outer electronic configurations.

Answer:

Answers are given in bold.

2nd series										
	Y	Zr	Nb	Mo	Te	Ru	Rh	Pd	Ag	Cd
Z	39	40	41	42	43	44	45	46	47	48
valence shell electronic configuration	$4d^1 5s^2$	$4d^2 5s^2$	$4d^4 5s^1$	**$4d^5 5s^1$**	$4d^6 5s^1$	**$4d^7 5s^1$**	$4d^8 5s^1$	$4d^{10} 5s^0$	**$4d^{10} 5s^1$**	$4d^{10} 5s^2$
3rd series										
	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg
Z	57	72	73	74	75	76	77	78	79	80
valence shell electronic configuration	$5d^1 6s^2$	**$5d^2 6s^2$**	$5d^3 6s^2$	$5d^4 6s^2$	**$5d^5 6s^2$**	$5d^6 6s^2$	$5d^7 6s^2$	$5d^9 6s^1$	**$5d^{10} 6s^1$**	$5d^{10} 6s^2$
4th series										
	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uvb
Z	89	104	105	106	107	108	109	110	111	112
valence shell electronic configuration	$6d^1 7s^2$	$6d^2 7s^2$	**$6d^3 7s^2$**	$6d^4 7s^2$	$6d^5 7s^2$	$6d^6 7s^2$	$6d^7 7s^2$	$6d^8 7s^2$	**$6d^{10} 7s^1$**	$6d^{10} 7s^2$

Try this….. (Textbook Page No 168)

Question 1.

Write the electronic configuration of Cr and Cu.

Answer:

$_{24}Cr$: [Ar] $3d^5 4s^1$ $_{30}Cu$: [Ar] $3d^{10} 4s^1$

Can you tell? (Textbook Page No 168)

Question 1.

Which of the first transition series element shows the maximum number of oxidation states and why?

Answer:

- $_{25}Mn$ shows the maximum number of oxidation states, + 2 to +7.
- $_{25}Mn$: [Ar] $3d^5 4s^3$
- Mn has incompletely filled J-subshell.
- Due to small difference in energy between 3d and 4s -orbitals, Mn can lose (or share) electrons from both the orbitals.
- Hence Mn shows oxidation states from + 2 to +7.

Question 2.

Which elements in the 4d and 5d-series will show maximum number of oxidation states?

Answer:

In 4d-series maximum number of oxidation states are for Ruthenium Ru (+ 2, +3, + 4„ +6, +7, + 8). In 5d-series, maximum number of oxidation states are for Osmium, Os (+ 2 to + 8).

Try this ….. (Textbook Page No 168)

Question 1.

Write the electronic configuration of Mn^{6+}, Mn^{4+}, Fe^{4+}, Co^{5+}, Ni^{2+}.

Answer:

Ions	Electronic configuration of valence shell
Mn^{6+}	[Ar] $3d^1$
Mn^{4+}	[Ar] $3d^3$
Fe^{4+}	[Ar] $3d^4$

Co^{5+} [Ar] $3d^4$

Ni^{2+} [Ar] $3d^8$

Try this ….. (Textbook Page No 171)

Question 1.

Pick up the paramagnetic species from the following : Cu^{1+}, Fe^{3+}, Ni^{2+}, Zn^{2+}, Cd^{2+}, Pd^{2+}.

Answer:

The following ions are paramagnetic : Fe^{3+}, Ni^{2+}, Pd^{2+}

Try this ….. (Textbook Page No 171)

Question 1.

What will be the magnetic moment of transition metal having 3 unpaired electrons?

(a) equal to 1.73 B.M.?

(b) less than 1.73 BM.

(c) more than 1.73 B.M.?

Answer:

By spin-only formula, μ=n(n+2)−−−−−−−√ where n is number of unpaired electrons.

μ=3(3+2)−−−−−−−√=3(5)−−−−√=3.87 B.M

Thus the value is more than 1.73 B.M.

Use your brain power! (Textbook Page No 171)

Question 1.

A metal ion from the first transition series has two unpaired electrons. Calculate the magnetic moment.

Answer:

$\mu=\sqrt{n(n+2)}=\sqrt{2(2+2)}=\sqrt{8}=2.84$ B.M.

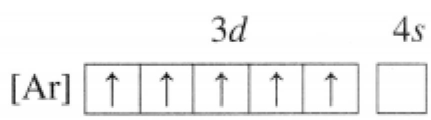
Problem (Textbook Page No 172)

Question 1.

Calculate the spin-only magnetic moment of divalent cation of a transition metal with atomic number 25.

Answer:

For element with atomic number 25. electronic configuration of its divalent cation will be : [Ar] $3d^5$.



There are 5 unpaired electrons.

$\therefore\ n=5.$

$\therefore\ \mu=\sqrt{5\ (5+2)}=5.92$ B.M.

Try this….. (Textbook Page No 172)

Question 1.

Calculate the spin-only magnetic moment of a divalent cation of element Slaving atomic number 27.

Answer:

Electronic configuration of divalent ion of an element with atomic number 27 : [Ar] $3d^7$;

[Ar]	↑↓	↑↓	↑	↑	↑

There are 3 unpaired electrons.

$\therefore n = 3.$

$\therefore \mu = \sqrt{3 \ (3+2)} = 3.87$ B.M.

Can you tell? (Textbook Page No 172)

Question 1.

Compounds of s and p-block elements are almost white. What could be the absorbed radiation? (uv or visible)?

Answer:

The white colour of a compound indicates the absorption of uv radiation.

Can you tell? (Textbook Page No 181)

Question 1.

Why f-block elements are called inner transition metals?

Answer:

f-block elements are called inner transition elements since f-orbital lies much inside the f-orbital in relation to the transition metals, These elements have 1 to 14 electrons in their f-orbital.

Question 2.

Are there an similarities between transition and inner transition metals?

Answer:

There are some properties similarity between transition and inner transition metals.

- They are placed between s and p-block elements.
- They are metals with filling of inner suhshells in their electronic configuration.

- They show variable oxidation slates.
- They show magnetism.
- They form coloured compounds.
- They have catalytic property.

Problem (Textbook Page No 184)

Question 1.

Which of the following will have highest fourth ionisation enthalpy, La^{4+}, Gd^{4+}, Lu^{4+}.

Answer:

La : $4f^{\circ}5d^{1}6s^{2}$

Gd : $4f^{1}5d^{1}6s^{2}$

Lu : $4f^{14}5d^{1}6s^{2}$

Lu will have the highest fourth ionisation enthalpy since Lu^{3+} has the most stable configuration of $4f^{14}$.

Use your brain power! (Textbook Page No 185)

Question 1.

Do you think that lanthanoid complex would show magnetism?

Answer:

Lanthanoid complexes may show magnetism.

Question 2.

Can you calculate the spin only magnetic moment of lanthanoid complexes using the same formula that you used for transition metal complexes?

Answer:

You cannot calculate magnetic moment of lanthanoid complexes using spin only formula as you have to consider orbital momentum also.

Question 3.

Calculate the spin only magnetic moment of La^{3+}. Compare the value with that given in the table.

Answer:

La^{3+} ion has no unpaired electron.

$$\therefore \mu = \sqrt{n\ (n+2)}$$
$$= \sqrt{0\ (0+2)}$$
$$= 0$$

La^{3+} ion has zero value of magnetic moment same as given in the table.

Effective magnetic moments of lanthanoids in +3 oxidation state

Ln	Ln^{3+} oxidation state	No. of unpaired electrons	Observed magnetic moment, $\mu_{eff\ B.M}$
La	$4f^0$	0	0
Ce	$4f^1$	1	2.3-2.5
Pr	$4f^2$	2	3.4-3.6
Nd	$4f^3$	3	3.5-3.6
Pm	$4f^4$	4	--
Sm	$4f^5$	5	1.4-1.7
Eu	$4f^6$	6	3.3-3.5
Gd	$4f^7$	7	7.9-8.0
Tb	$4f^8$	6	9.5-9.8
Dy	$4f^9$	5	10.4-10.6
Ho	$4f^{10}$	4	10.4-10.7
Er	$4f^{11}$	3	9.4-9.6
Tm	$4f^{12}$	2	7.1-7.6
Yb	$4f^{13}$	1	4.3-4.9
Lu	$4f^{14}$	0	0

Maharashtra Board Solutions Class 12 Chemistry

About About Maharashtra State Board (MSBSHSE)

The Maharashtra State Board of Secondary and Higher Secondary Education or MSBSHSE (Marathi: महाराष्ट्र राज्य माध्यमिक आणि उच्च माध्यमिक शिक्षण मंडळ), is an **autonomous and statutory body established in 1965**. The board was amended in the year 1977 under the provisions of the Maharashtra Act No. 41 of 1965.

The Maharashtra State Board of Secondary & Higher Secondary Education (MSBSHSE), Pune is an independent body of the Maharashtra Government. There are more than 1.4 million students that appear in the examination every year. The Maha State Board conducts the board examination twice a year. This board conducts the examination for SSC and HSC.

The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

FAQs

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Who developed the Maharashtra State board books?

As of now, the MSCERT and Balbharti are responsible for the syllabus and textbooks of Classes 1 to 8, while Classes 9 and 10 are under the Maharashtra State Board of Secondary and Higher Secondary Education (MSBSHSE).

How many state boards are there in Maharashtra?

The Maharashtra State Board of Secondary & Higher Secondary Education, conducts the HSC and SSC Examinations in the state of Maharashtra through its nine Divisional Boards located at Pune, Mumbai, Aurangabad, Nasik, Kolhapur, Amravati, Latur, Nagpur and Ratnagiri.

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