EXERCISE

Q.1 Choose the correct alternatives (any number of correct options).

1. Covalent bond is present in molecule
(A) F$_2$ (B) HF (C) NaF (D) NaCl

2. Which of the following is/are ionic compounds?
(A) Na$_2$O (B) CaO (C) Cl$_2$O (D) Cl$_2$O$_7$

3. Which of the following is/are ionic compounds?
(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

4. Which of the following is/are ionic compounds?
(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

5. Which statement/s is/are true?
(A) NaCl is ionic (B) NaCl is covalent
(C) NaCl is ionic in gas phase (D) NaCl is ionic in solid state

6. Which of the following molecule/s is/are ionic?
(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

7. Which of the following molecule/s is/are ionic?
(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

8. Magnesium compound (s) of oxygen is/are the reason of the number of oxygen
(A) MgO (B) MgO$_2$ (C) Mg$_2$O (D) Mg$_2$O$_3$

9. Magnesium compound (s) of oxygen is/are the reason of the number of oxygen
(A) MgO (B) MgO$_2$ (C) Mg$_2$O (D) Mg$_2$O$_3$

10. Which of the following is/are ionic?
(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

11. Which of the following is/are ionic?
(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

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(A) Na$_2$O$_2$ (B) CaO$_2$ (C) Cl$_2$O (D) Cl$_2$O$_7$

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Multiple Choice Questions

1) d and f blocks elements are called:

a) s block b) f block

c) transition elements d) actinide

2) Zn, Cd, Hg are not regarded as transition elements because they have completely filled:

a) f orbitals b) d orbitals c) s orbitals d) p orbitals

3) Mn has maximum oxidation states, and goes up to:

a) +8 b) +10 c) +7 d) +2

4) Mixture of ZnO and CraO3 is used for the manufacture of _____.

a) ethanol b) acetone

c) methyl alcohol d) primary alcohol

5)_____ is used to oxidize SO2 to SO3 in the manufacture of H2SO4.

a) V2O5 b) H2SO4 c) PO4 d) SO2

6)_____ is mixture of two or more than two metals.

a) transition elements b) alloy

c) brass d) nichrome

7) Brass is a strong alloy of

a) barium b) magnesium c) manganese d) copper

8) Those compounds which contain complex molecules or complex ions capable of independent existence are called

a) coordination compound b) organometallic compound

c) alloys d) ligands

9) A metal atom is surrounded by a number of

a) alloys b) ligands

c) complex compound d) coordination sphere

10) Those ligands which how two donatable electron pairs are called.

a) polydentate ligands b) bisteriate ligands c) ligands d) alloys

11) Potassium dichromate (VI) solution acidified which dilute sulphuric acid is commonly as an

a) reducing agent b) oxidising agents

c) reduction d) none

12) When Potassium manganate solution run into the reaction, the solution becomes.

a) odorless b) colourless c) tasteless d) bitter

13) Chromate (VI) ions will give a bright yellow precipitate of _____

a) chromium b) sulphuric acid

c) HCl d) lead chromate

14) Manganese can exist in a number of oxidation states, but most stable in an oxidation state of

a) +2, +4 and +7 b) +3, +6 and +8

c) +1, +2 and +7 d) +6, +3 and +6

15) Complete the following reaction.

a) $[Mn(H_2O)_6]2 + 2OH \longrightarrow [Mn(H_2O)_4(OH)_2] + 2H_2O$

b) $[Mn(H_2O)_2]2 + 2H_2O \longrightarrow [Mn(H_2O)_4(OH)_2] + 2H_2O$

c) $[Mn(H_2O)_2] 2+ 2H_2O \longrightarrow [Mn(H_2O)_4(OH)_2] + 2H_2O$

d) $[Mn(H_2O)_{10}]2 + 6H_2O \longrightarrow [Mn(H_2O)_4(OH)_2] + 2H_2O$

16) Coinage metals are actually.

a) halogens b)alkali metals

c) transition metals d) Alkaline earth metals

17) Which are repelled by magnetic field?

a) paramagnetic b) ferromagnetic

c) diamagnetic d) none

18) The unit of Magnetic moments is

a) coulombs (Q) b) amperes (A)

c) bohr magneton (BM) d) watts (W)

19) Potassium manganate (VII) is usually used in

a) neutral or alkaline solution b) alkali solution

c) transition metals d) oxidising agent

20) Potassium magnate (VII) oxidizes

a) carbon-hydrogen bonds b) carbon-carbon double bonds

c) carbon-oxygen bonds d) none

21) Alkaline potassium manganate (VII) solution oxidizes any hydrocarbon side chain attached to a benzene ring back to a single

a) CH_3 b) COOH group

c) CH_3OH d) $KMnO_4$

22) Potassium magnate (VII) solution is always used in

a) basic solution b) acidic solution

c) neutral solution d) both acidic as well as basic solution

23) Iron exists in two common oxidation state

a) +2 (Fe^{2+}) and +3 (Fe^{3+}) b) +4 (Fe^{4+}) and +2 (Fe^{2+})

c) +5 (Feb and +6 (Fe^{6+}) d) +3 (Fe^{3+}) and +4 (Fe^{4+})

24) (Fe^{2+}) ion is thus a

a) oxidizing agent b) reducing agent

c) oxidizing agent as well as reducing agent d) none

25)Ammonia can act as both a

a) base and a liquid b) acid and a liquid

c) acid and a base d) base and neutral

26)Complete the following reaction. 2[Fe$(H_2O)_6]^{3+}$ +3CO_3^{2-} →

a) 2 Fe$[(H_2O)_3(OH)_3]$ + 3 CO_2+ 3 H_2O

b) 2 Fe$[(H_2O)_3(OH)_3]$ +6 CO_2+ H_2O

c) [Fe (H_2O) $(OH)_3]]$ + CO_2 + H_2O

d) [Fe (H_2O) $(OH)_3]$]+ 2CO_2+ H_2O

Answers

1)	c	**2)**	b)	**3)**	c)	**4)**	c)
5)	a)	**6)**	b)	**7)**	d)	**8)**	a)
9)	b)	**10)**	b)	**11)**	b)	**12)**	b)
13)	d)	**14)**	a)	**15)**	a)	**16)**	b)
17)	c)	**18)**	c)	**19)**	a)	**20)**	b)
21)	b)	**22)**	d)	**23)**	a)	**24)**	b)
25)	a)	**26)**	a)				

Short Answers and Questions

Q1 Why are they called transition elements?

Answer

They are called transition because they occupy a position in short periods (series) and in a certain common oxidation states are called transition elements.

They are called d-block or f-block elements. They are also called transition elements because they show such properties which are transitional between those of s-block and p-block elements. Transition elements have high melting points, high boiling points, high density and high ionisation energy.

Q2 Write down the 3 general features of transition elements.

Answer

They are d-block metals.

Some of the transition elements are important use in the industry. These are Fe, Ni, Cu, Ag, Au, Pt, Cr, Mn, Co, Ti, V.

They also all have low ionisation energy, high melting and boiling points, they show good conductivity of heat and electricity.

They form alloys with other metals and their compounds of particular metals as well. With a few exceptions, they show variable oxidation states.

Their ions are coloured and they form complex ions and the solution ions.

Q3 Why is Zn group included in transition elements?

Answer

Zn, Cd and Hg are not regarded as transition elements because they have completely filled d-orbitals in their ground state and in their common oxidation states they form compounds with cerrovac-holds ions and ions which their chemical behaviour is similar to transition elements.

Q4 What is oxidation state of transition elements?

Answer

Transition elements are electropositive, as they loose positive oxidation states. All (s) series elements show an oxidation state of +2 in addition to higher oxidation state when the electron who enters take part in bonding.

They show variable oxidation states. The reason is that they have d electrons in addition to s electrons. The energy difference between the (n-1)d and ns orbitals is very small. For example, the atomic Sc group of d-2 and ns orbitals are very close to each other. The d-2 d electrons can make non n-s electrons, in the ground state of the atom. The d-2 d electrons can make non n-s electrons, in the ground state of the atom. For example, in the case of transition elements, and in the case of Fe, among the d series the number of oxidation states, and goes up to +6.

Q5 Why transition elements are used as catalyst?

Answer

Most of the transition elements are used as catalyst. The compounds of transition elements are used as catalyst. The reason is that they have the ability to form unstable intermediate compounds. This provides a low energy pathway for the reactants.

They also form interstitial compounds which can absorb an catalyst to the reacting species. Some of the important catalyst.

Q6 Why transition metals form alloy with each other and with donor the interstitial compounds?

Answer

Alloy is mixture of two or more than two metals. Transition metals form alloy with each other.

Interstitial compounds have atomic radius <10 pm. Interstitial compounds are formed when small atoms like H, C, N, B are trapped in the lattice of transition metals. Properties of interstitial compounds are very similar to those of parent metals. Properties:

- Alloys are prepared according to the requirements, their characteristics are different and their properties are common which are as follows:
- They are very hard and strong.
- They are strong and flexible but their alloys can also be prepared.
- They have long life because they do not corrode.
- They are durable.
- They have high melting points.

Q7 Define coordination compounds, and explain them.

Answer

Coordination compounds which contain complex molecules or complex ions capable of independent existence are called coordinate compounds or complex compounds. Such compounds is formed by the coordination of an electron pair donor to metals atom or ion.

In order to understand let us make substance, that is KCl and ferric (CN)3. When mixed together in solution form a new substance. The new substance is represented 1 KCl molecules and 1 ferric(CN)3 in the Mass the new compounds have been given the formula K3[Fe(CN)6].

$$4KCl + FeCl_3 \rightarrow K_4[Fe(CN)_6]$$

Complex compound is consisted of these compounds:

- A positive or negative complex ion or complex cation or complex anion.
- A central metal atom or ion which is cations or transition elements.
- Electron pair donor which is negatively charged, positively charged or neutral.

Q8. Define ligand? and write down its types?

Answer

The atom ion or neutral molecule which surrounds the central metal atom or ion and donate the electron pair is called ligand.

Example

K4[Fe(CN)6],K4[Ni(CN)4],CN, is the ligand.

Types

- Monodentate ligands: Those ligands which have only one donatable electron pair. Eg. NH_3,H_2O etc. Cl^-, CN^-, OH^-
- Bidentate ligands: Those ligands which have six donatable electron pairs. Eg. ethylenediamine(en)(EDTA)

Q9. Define charge on coordination sphere a lipacy with example?

Answer

If is the ligandsis sum of charges present on the central metal ion and total charge on the ligands.

Example

In Fe (CN)6 the charge present on the metal ion and total charge on the ligands.

Example in K_4 [Fe (CN)6] the charge on the coordination sphere can be calculate as below

$$K_4[Fe(CN)_6] \longrightarrow 4K^+ + [Fe(CN)_6]^{4-}$$

Since charge on each ligand is −1

Charge on ion is −4

Charge on ion = −3

So the charge on the coordination sphere = +4 + 3 = +

Q10. Define coordination member i with example?

Answer

Complexes with CO is ion the most common ones formed by transition metal atoms.

In ligand in a coordination compound may be arranged around the metal ion either at the corners of hexagonal prism or at the apices of a tetrahedron or at the apices of a square octahedron. These arrangements together with the number of ligands attached to the central metal ion are called the coordination number of the central metal ion. Coordination ions tetrahedral examples such as NH_4 $CO4$, Ni4+ and square octahedrals. Sugar planar geometry is found in complexes of Cu+, Ni+, Pt+ and Au+ etc ions.

Q11. Write down the the oxidation of the vanadium (III)?

Answer

The vanadium (III) ion is very easily oxidized if you remove the carbon ions from the field and you once solution this solution is stable. It turns green because of its contact with oxygen in the air. It is oxidized back to vanadium (III).

If it allowed to stand for a long time the solution eventually turns blue as the air oxidized it back to the vanadium (IV). ions. +3V+ ions.

The first stage of the oxidation is

$$V^{3+} + O_2 \rightarrow VO^{2+} + O_2^{-} + H^+ \rightarrow VO^{2+}$$

The corresponding equation for the ion is

$$2V^{2+} + 2H^+ \rightarrow 2V^{3+} + H_2$$

So if you mix together zinc and VO3 ion the presence of acid to provide the ions.

$$VO_3^- + 2H^+ + e \rightarrow VO^{2+} + O_2^- + H_2O$$

$$2V^{2+} + 2H^+ \rightarrow 2V^{3+} + H_2$$

You can write these down and combine them to give the ionic equations for the reaction if you want to

$$2 \times (VO3 + 2H^+ \rightarrow VO^{2+} + H_2O)$$

$$2V^{2+} \rightarrow 2V^{3+} + 2e^-$$

$$2VO3 + 4H^+ + 2e^- \rightarrow 2VO^{2+} + 2H_2O$$

The other stage of the reaction

V^{3+} ions for all the stage of the reaction oxidation (V) to Vanadium (II).

$$VO^{2+} + 2H^+ + e \rightarrow V^{3+} + H_2O$$

$$VO^{2+} + 2H^+ + e \rightarrow VO^{2+} + H_2O, E^0 = +0.34V$$

$$V^{3+} + e \rightarrow V^{2+}, E^0 = -0.26V$$

And here is the ions value again

$$2V^{3+} + 2e \rightarrow 2V^{2+}, E^0 = -0.7V$$

Q12. Write down the oxidation of vanadium (II) by nitric acid?

Answer

First step:

$$V^{2+} + e \rightarrow V^{3+}, E^0 = -0.26V$$

$$VO_3^- + 2H^+ + 3e \rightarrow VO^{2+} + H_2O, \quad E^0 = +0.34V.$$

The vanadium reaction has the more negatively E^0 value and so will be more to the left the nitric acid reaction more to the right.

Nitric acid will oxidate vanadium (II) to vanadium (III).

The second stage is

$$VO^{2+} + 2H^+ + e \rightarrow VO^{2+} + H_2O, E^0 = +0.34V$$

$$VO^{2+} + 2H^+ + e \rightarrow VO^{2+} + H_2O, E^0 = +1.70V.$$

The VO3 ion's again has the more negative E^0 value and so moves to the right. The more negative (less positive) ionisation reaction moves to the left.

Nitric acid will certainly oxidate vanadium (II) to vanadium (V).

$$VO3 + 2H^+ + e \rightarrow VO^{2+} + H_2O, E^0 = +1.70V$$

$$VO^{2+} + 4H^+ + 2e \rightarrow VO^{2+} + 2H_2O, E^0 = +1.70V$$

Q13. Write down the use of potassium dichromate (VI) as an oxidising agent in organic chemistry?

Answer

Potassium dichromate (VI) (orange) with dilute sulphuric acid is commonly used as an oxidising agent in organic chemistry. It is a reasonably powerful oxidising agent and the reaction is generally that it takes the whole of the organic molecule. It is used to

Oxidize secondary alcohols to ketones.

Oxidize primary alcohols to aldehydes.

Oxidize primary alcohols to carboxylic acid.

If the alcohol is ancestor and you will find the aldehyde as soon as it is formed you will extract as the main product.

$$CrO^{2-} + 8H^+ + 3(CH3)2OH \rightarrow 2Cr^{3+} + 7OH^- + 3(CH3)2O$$

If the oxidising agent is in excess and you don't want the product to escape for electrolysis by heating the reaction under reflux.

$$Cr_2O_7^{2-} + 8H^+ + 3(CH3)2OH \rightarrow 2Cr^{3+} + 7H2O + 3(CH3)2CO$$

In organic chemistry these equations are often simplified to concentrate on what is happening to the organic molecules. For example the last two could be written.

$$CH3CH(OH)-CH3 \xrightarrow{[O]} CH3CO(=O)-CH3$$

$$CH3CH(OH)-CH3 \xrightarrow{[O]} CH3CO(=O)-H$$

The oxygen within it square brackets comes from oxygen from an oxidising agent.

Q14. Write down the reaction of manganese (IV) ions in solutions oxidation states.

Answer

Acidiodide ions remove hydrogen ions from the H2S ligands attached to the manganese ion.

Once a hydrogen ion has been removed from two of the H2S molecules, you are left with a complex with no charge or neutral complex.

This is neutral or VO3 and a paramagnetic it remains.

$$[Mn(H_2O)_6]^{2+} \rightarrow [Mn(H_2O)_4(OH)_2] + 2H_2O$$

The reaction of heterosexsamphoric (II) ions with oxidation states. Manganese (II) ions are oxidized to Mn (III) ions in acidic solution. Manganese (II) ions are more reversing than iron the oxygen comes from the oxygen complex.

$$[Mn(H_2O)_6]^{2+} + 2MnO_4^- \rightarrow [Mn(H_2O)_4(OH)_2] + 2MnO$$

Q15. Write down the reaction of the iron ions with oxidation states.

Answer

Potassium manganate (VI) is usually used in neutral or alkaline solution it organic chemistry. Potassium manganate (VI) is a powerful oxidising agent. Potassium manganate (VI) oxidizes primary alcohols to carboxylic acids. The potassium manganate (VI) solution is usually made mildly alkaline with sodium carbonate solution, and the hydroxide ions changes ions.

A testing for a C=C double bond.

Potassium manganate (VI) solution (colour, carbon dioxide bound, and a gas through the colour change).

Ethene for example is oxidized to ethanol. C2 ions.

$$\underset{CH_2OH}{CH_2} + H_2O + [O] \xrightarrow{KMnO_4} \underset{CH_2OH}{CH_2OH}$$

The oxygen in a purple bracket is taken to mean oxygen from an oxidising agent, Oxidation of aromatic side chains.

Alkaline potassium manganate (VI) solution oxidises any hydrocarbon side chain attached to a benzene ring to a single −COOH group, provided the benzene ring is resonance, it is

In case of the ethyl side chain you will also get C02 with longer side chains, you will produce all other products but it would cause the main product will be benzoic acid.

Q16. Discuss the problems related the use of potassium manganate (VI) ions?

Answer

There are two things you need to be aware of potassium manganate (VI) can't be used in the presence of hydrochloric acid. Potassium manganate (VI) will oxidize. A unknown amount of the potassium manganate (VI) would be used in side reaction and so the titration result would be inaccurate. That's way we don't actually the solution with hydrochloric acid.

Potassium manganate (V) is isn't a primary standard. That means that it can't be used to make up a solution of known concentration by weighing and dissolving.

It is strongly colored that it is impossible to see what all the crystals are. You need have distinctive, and no special of time it oxidizes the H2S it dissolved into the solution. Potassium manganate (VI) solution usually from a fairly complicated mixture of ions.

This is manganese (IV) oxide and it produced when the manganate (VI) ions react with H2S.

Q17. Discuss how to oxidized the hydrogen peroxide.

Answer

The hydrogen peroxide oxidizes nitrogen dioxide to nitrogen pentoxide. The ions from the acid and the hydrogen is obtained mainly from natural gas (methane) ion is used as a catalyst.

$$H_2 + 2N_2 \rightarrow 2NH_3$$

Q18. Discuss ion ions as a catalyst in the reaction between per sulphate ions and iodide ions?

Answer

The reaction between per sulphate ions (peroxodisulphate ions S2O8 and iodide ions in solution can be combined using either ion (I) or ion (II) ions. The ion of equation for the reaction is

$$S_2O_8^{2-} + 2I^- \rightarrow 2SO_4^{2-} + I_2$$

Ion is very easily oxidized under alkaline condition. Oxygen in the air oxidizes the ion. (It hydrolyses precipitate to Fe (OH)3 hydroxide especially around top of the tube. The darkening of the precipitate comes from some effect.

In the iron (II) ions

$$[Fe(H_2O)_6]^{2+} \longrightarrow [Fe(H_2O)_5(OH)]$$

Q19. Write down the reaction of the iron ions with ammonia solution.

Answer

Ammonia can act as both a base and a ligand. In these cases, it simply act as a base and removes hydrogen ions from the aqua complex.

In the iron (II) ions

$$[Fe(H_2O)_6]^{2+} + 2NH_3 \longrightarrow [Fe(H_2O)_4(OH)_2] + 2NH_4^+$$

$$[Fe(H_2O)_6]^{2+} \longrightarrow [Fe(H_2O)_5(OH)]$$

On standing precipitates darkens a bit and orange around the top.

The appearance is just the same as in when you add sodium hydroxide solution. The precipitate again changes colour in the iron (II) hydroxide complex is oxidized by the air to iron (III) hydroxide.

Q20. Write down the complex ions and reaction, of tetraoxo copper (II) ions with carbonate ions?

Answer

Solution salts

The colour changes are

$$[Cu(H_2O)_4]^{2+} \xrightarrow{CO_3^{2-}} [Cu(H_2O)_3CO_3] \xrightarrow{CO_3^{2-}} [Cu(H_2O)_2(CO_3)_2]^{2-}$$

The reaction of tetraoxo copper (II) ions with carbonate ions.

$$[Cu(H_2O)_4]^{2+} \longrightarrow CuCO_3$$