Book Name: Selina Concise

EXERCISE- 7 (A)

Solution 1:

Three classes in which elements are classified are:
Metals , Non-metals and Metalloids
Copper was the first metal used by man.

Solution 2:

(a) The metal which is a constituent of blood pigment is Iron (Fe)
(b) The metal which is a constituent of plant pigment is Magnesium (Mg).

Solution 3:

(a) Nitrogen: It is used to preserve food.
(b) Hydrogen: It is used in the hydrogenation of vegetable oils to make ghee.
(c) Carbon: It is essential for the growth and development of living beings.

Solution 4:

The metal which is present in abundance in earths crust is aluminium.
The non-metal which is present in abundance in the earth crust is oxygen.

Solution 5:

Metals are defined as the elements which form positive ions by the loss of electrons.
Non-metals are the elements which form negative ions by the gain of electrons.

Solution 6:

(a) Alkali metals: They are placed in IA group, the first column on the left of the periodic table.
(b) Alkaline earth metal: They are placed in IIA group, the second column on the left of the periodic table.
(c) Iron and Zinc: Fe is placed in VIII group and Cu is placed in IB group.
(d) Aluminium: It is placed in IIIA group present on the right of periodic table.

Solution 7:

(a) Alkali metals:-

(i) Bonding: All alkali metal salts are ionic in nature.

(ii) Action of air: The react rapidly with oxygen and water vapour in the air.

(iii) Action of water: They react violently with water and produce hydrogen gas.

$2M + 2H_2O \longrightarrow 2MOH + H_2$

(iv) Action of acid: They react violently with dil. HCl and dil. H_2SO_4 to produce hydrogen gas.

$2M + 2HCl \longrightarrow 2MCl + H_2$

(b) Alkaline earth metal:-

(i) Bonding: All alkaline earth metal salts except beryllium are ionic compounds.

(ii) Action of air: They are less reactive than alkali metals.

(iii) Action of water: They react with water to produce hydrogen gas.

$M + 2H_2O \longrightarrow M(OH)_2 + H_2$

(iv) Action of acid: They react with dilute HCl and dil. H_2SO_4 to produce hydrogen gas.

$M + 2HCl \longrightarrow MCl_2 + H_2$

Solution 8:

Elements which show properties of both metals and non-metals are called metalloids. For example: Silicon, Germanium.

Solution 9:

Hydrogen is placed with alkali metals as it has one electron similar to the alkali metals.

Solution 10:

(a) Bromine
(b) Lead
(c) Gallium
(d) Carbon
(e) Sodium
(f) Sodium
(g) Tungsten
(h) Carbon fibre
(i) Carbon
(j) Mercury

Solution 11:

(i) Ion formation: Metals form positive ions by loss of electrons whereas non- metals form negative ions by gain of electrons.

(ii) Discharge of ions: Metals are discharged at the cathode during electrolysis whereas non-metals are liberated at the anode during electrolysis.

(iii) Nature of oxide formed: Oxides of metals are usually basic. Soluble basic oxides dissolve in water forming an alkaline solution whereas oxides of non-metals are usually acidic. Soluble acidic oxides dissolve in water forming an acidic solution.

(iv) Oxidizing and reducing property: Metals ionize by loss of electrons and hence are reducing agents whereas non-metals ionize by gain of electrons and hence are oxidizing agents.

(v) Reaction with acids: Metals above hydrogen in activity series usually replace hydrogen from dilute non-oxidising acids whereas non-metals do not react with dilute hydrochloric acid or sulphuric acid.

Solution 12:

(a) $Na - \underline{e^-} \longrightarrow Na^+$

(b) $N + 3e^- \longrightarrow N^{3-}$

(c) $Cl + e^- \longrightarrow \underline{Cl^-}$

(d) $Mg - \underline{2e^-} \longrightarrow Mg^{2+}$

(e) $M + 2HCl \longrightarrow MCl_2 + \underline{H_2}$

(f) $Mg + H_2SO_4 \longrightarrow \underline{MgSO_4} + \underline{H_2}$

Solution 13:

(a) Fe_2O_3

(b) PbO

(c) M_2O_7

(d) NO

Solution 14:

(a) Hydrochloric acid:

$2Na + 2HCl \longrightarrow NaCl + H_2$

$Be + 2HCl \longrightarrow BeCl_2 + H_2$

(b) Oxygen:

$4Na + O_2 \longrightarrow 2Na_2O$

$Mg + O_2 \longrightarrow 2MgO$

(c) Sulphuric acid:

$2Na + H_2SO_4 \longrightarrow Na_2SO_4 + H_2$

$Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$

(d) Water

$2Na + H_2O \longrightarrow 2NaOH + H_2$

$Mg + H_2O \longrightarrow Mg(OH)_2 + H_2$

EXERCISE 7 (B)

Solution 1:

(a) Mercury and gallium
(b) Sodium and potassium
(c) Mercury
(d) Iodine
(e) Graphite
(f) Zinc
(g) Neon , Argon
(h) CrO_3 , Mn_2O_7
(i) Al_2O_3,PbO
(j) Potassium , sodium
(k) Basic copper(II) sulphate
(l) Aluminium , Oxygen
(m) Hydrogen
(n) Carbon
(o) Iron

Solution 2:

(a) Occurrence of metals: The metals placed at the top of activity series are most reactive, so they always exist in the combined state whereas the metals placed below the activity series are least reactive, so they can be found in the isolated state also.
(b) Tendency to corrosion: The metals lying above the hydrogen in activity series can easily react with moisture and air and corrode easily whereas the metals such as gold and platinum do not corrode easily.
(c) Reaction with water: The ability of the metals to reduce water to hydrogen decreases on moving down the series.
Potassium and sodium reacts with cold water whereas magnesium reacts with warm water and aluminium, zinc and iron reacts with steam.
(d) Reaction with acids: All the metals above hydrogen, in the activity series, reduce hydrogen ions from dil. hydrochloric or sulphuric acid and give out hydrogen gas. The rate of reaction decreases on moving down the series.

Solution 3:

(a) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

(b) $Mg + H_2O \longrightarrow MgO + H_2$

(c) $3Fe + 4H_2O \rightleftharpoons Fe_3O_4 + 4H_2$

(d) $Fe + 2HCl \longrightarrow FeCl_2 + H_2$

Solution 4:

The metals placed higher in the activity series (i.e. Na and K) are stable to heat and soluble in water.
Whereas metals like Ca, Mg, Al, Zn, Fe, Pb, Cu decompose on heating with decreasing vigour to form metal oxide and carbon dioxide.
The metals which lie below in the activity series (i.e. Hg, Ag) decompose on heating to form metal, oxygen and carbon dioxide.

Solution 5:

(a) Alkali metals like sodium and potassium are kept in kerosene as they react with moisture and air.

(b)

(i) Basic lead carbonate is a mixture of lead hydroxide and lead carbonate.

(ii) Brown powder is mainly hydrated iron(III) oxide ($Fe_2O_3.xH_2O$)

Solution 6:

Oxides of metals like Na, K, Ca, Mg, Al are stable to heat and so can be reduced only by electrolysis.
Zinc oxide can be reduced by coke only.
Oxides of iron, lead and copper are reduced by C, CO, H_2 and NH_3.
Oxides of mercury and silver decompose to give metal and oxygen.

Solution 7:

Metal A is more reactive than Metal B.

(a) Metal A is Na (Sodium). Metal B is Ca (Calcium).

Reaction with HCl:

$2Na + 2HCl \longrightarrow 2NaCl + H_2$

$Ca + 2HCl \longrightarrow CaCl_2 + H_2$

Reaction with H_2SO_4 :

$2Na + H_2SO_4 \longrightarrow Na_2SO_4 + H_2$

$Ca + H_2SO_4 \longrightarrow CaSO_4 + H_2$

(b)

(i) Oxides: Sodium and calcium oxides are stable to heat.
(ii) Hydroxides: Sodium hydroxide is stable to heat whereas calcium hydroxide decomposes on heating to metal oxide and water vapour.
(iii) Carbonates: Sodium carbonate is stable to heat whereas calcium carbonates decompose on heating to form calcium oxide and carbon dioxide.
(iv) Nitrates: Sodium nitrate on heating form nitrite and oxygen whereas calcium nitrate decomposes on heating to form calcium oxide, nitrogen dioxide and oxygen.

Solution 8:

(a)

Metals	Non-metals
(i) Good conductors of heat	Poor conductors of heat
(ii) Malleable	Non-Malleable
(iii) Form positive ions	Forms negative ions
(iv) Form basic oxides	Form acidic oxides

(b) Valence electrons present in:
(i) Metals have 1, 2 or 3 valence electrons.
(ii) Non-metals have 5, 6 or 7 valence electrons.

Solution 9:

When the surface of metal is attacked by air, moisture or any other substance around it, the metal is said to corrode and the phenomenon is known as corrosion.
Necessary conditions for corrosion are:

1. Presence of oxygen and moisture.
2. Metals which are placed higher in the activity series corrode more easily.

Solution 10:

Conditions for increase of corrosion are:

1. Presence of oxygen and moisture.
2. Metals which are placed higher in activity series corrode more easily
3. Dissolved salts in water act as electrolyte and enhance the rate of corrosion.
4. The presence of pollutants like NO_2 and CO_2 increases rusting.

Solution 11:

Corrosion of metals is an advantage as it prevents the metal underneath from further damage. For example: On exposure to air, the surface of metal like aluminium and Zinc forms layers of their oxides which are very sticky and impervious in nature and hence act as protective layer. This layer protects the metal from further damage.

Solution 12:

Rusting is the slow oxidation of iron by atmospheric oxygen in the presence of water.
Equation:
$4Fe + 3O_2 + 2x\ H_2O \longrightarrow 2Fe_2O_3.xH_2O$

Solution 13:

Two conditions necessary for rusting of iron are:

1. Air
2. Water

Solution 14:

By painting an iron object, the iron do not come in contact with atmospheric reagents. This prevents rusting.

Solution 15:

Galvanisation is the process of applying a protective zinc coating to steel or iron, in order to prevent rusting.
The zinc coating does not allow iron to come in contact with air and moisture and thus protects it from rusting.

Solution 16:

Silver gets tarnished when exposed to the atmosphere which contains pollutant H_2S and forms a black coating of Ag_2S.
Copper forms a green deposit on its surface when exposed to moist air. This is usually basic copper (II) sulphate.

Solution 17:

Aluminium forms white colour oxide on exposure to the atmosphere. This white colour oxide prevents it from further corrosion whereas iron reacts with air to form hydrated oxide called rust. So, iron undergoes corrosion to greater extent.

Solution 18:

The noble metals such as gold and platinum do not corrode easily.

Solution 19:

Gold is the most unreactive metal so it does not react with air or water and other gases in atmosphere. So gold does not corrode. That is why gold look new after several years of use.

EXERCISE 7 (C)

Solution 1:

The process used for the extraction of metals in their pure form from their ores is referred to as Metallurgy.
The processes involved in Metallurgy are:
1. Crushing and Grinding
2. Concentration
3. Roasting and calcination
4. Reduction
5. Refining

Solution 2:

(a) A metal which occurs as sulphide is lead.
(b) A metal which occurs as halide is silver.
(c) A metal which occurs as carbonate is zinc.
(d) A metal which occurs as oxide is iron.

Solution 3:

(a) Minerals are naturally occurring compounds of metals which are generally present with other matter such as soil, sand, limestone and rocks. Ores are those minerals from which the metals are extracted commercially at low cost and comfortably. All ores are minerals, but all minerals are not necessarily ores.
(b) Ores are those minerals from which the metals are extracted commercially at low cost and with minimum effort. A **metallic compound** is a **compound** that contains one or more **metal** elements. **Examples**: $AgNO_3$ - Silver nitrate is a **metallic compound**.

Solution 4:

The metals that can be extracted from the following ores are:

(a) Bauxite- Aluminium
(b) Calamine- Zinc
(c) Haematite- Iron

Solution 5:

Three objectives achieved during the roasting of ores is:
1. It removes moisture from ores.
2. It makes the ore porous and more reactive.
3. It expels volatile impurities.
4. It converts sulphide ores into oxides.

Solution 6:

(a) Hydraulic washing: The difference in the densities of the ore and the gangue is the main criterion.
(b) Forth floatation: This process depends on the preferential wettability of the ore with oil and the gangue particles by water.
(c) Electromagnetic separation: Magnetic properties of the ores.

Solution 7:

(a) The processes involved in
(i) Processes involved in concentration are:
1. Hydrolytic method
2. Magnetic Separation
3. Froth floatation
4. Leaching

(ii) Processes involved in Refining of ores are:
1. Distillation
2. Liquation
3. Oxidation
4. Electro- refining

(b) Potassium and sodium oxides cannot be reduced by carbon, carbon monoxide and hydrogen.

Solution 8:

(a) Flux: A flux is a substance that is added to the charge in a furnace to remove the gangue.
(b) Gangue: Earthly impurities including silica, mud etc., associated with the ore are called gangue.
(c) Slag: It is the fusible product formed when flux reacts with impurities during the extraction of metals.
(d) Smelting: Smelting is the process of reducing the roasted oxide ore and removing the gangue with the help of an appropriate flux added with the ore.

Solution 9:

Iron and zinc are quite reactive and hence they do not occur in the free state. The compounds of metals found in nature are their oxides, carbonate and sulphides.

Solution 10:

Black copper oxide is reduced to brown/red.

$CuO + H_2 \xrightarrow{\Delta} Cu + H_2O$

Solution 11:

Comparison of roasting and calcinations:

Roasting	Calcination
(i) The ore is heated in the excess of air. (ii) Generally, sulphide ores are roasted, so SO_2 is given off. $2ZnS + 3O_2 \xrightarrow{800^0C-900^0C} 2ZnO + 2SO_2$ (iii) Volatile impurities are removed as oxides and the ore becomes porous and more reactive.	(i) The ore is heated in the absence of air. (ii) Carbonate and hydrated ores are calcined and so,CO_2 and water vapours are given off. (iii) Moisture and organic impurities are removed and the ore becomes porous and more reactive.

Solution 12:

(a) Ore of zinc is zinc blende (ZnS).
(b) It is concentrated by Froth floatation process.
(c) Concentrated ore is changed into oxide by heating ZnS in excess of air.

$2ZnS + 3O_2 \xrightarrow{800^0C} 2ZnO + 2SO_2$

Solution 13:

Oxides of highly active metals like potassium, sodium, calcium, magnesium and aluminium have great affinity towards oxygen and so cannot be reduced by carbon or carbon monoxide or hydrogen.

Metals in the middle of activity series (iron, zinc, lead, copper) are moderately reactive and are not found in oxide form. These are found in nature as sulphides or carbonate. These are first converted into oxides and can be reduced by C, CO or H_2.

$ZnO + C \xrightarrow{400^0C} Zn + CO$

$PbO + CO \xrightarrow{\Delta} Pb + CO_2$

Metals low in the activity series is very less reactive and oxides of these metals are reduced to metals by heating alone.

Solution 14:

(a) Iron(II) oxide:

$4FeO + O_2 \longrightarrow 2Fe_2O_3$

$Fe_2O_3 + 3CO \xrightarrow{600^0C-400^0C} 2Fe + 3CO_2$

(b) Zinc oxide is reduced by coke.

$Zn\,O + C \xrightarrow{\Delta} Zn + CO$

Solution 15:

Aluminium has a great affinity towards oxygen and so cannot be reduced by carbon or carbon monoxide. So it is extracted from its oxide by electrolysis.
Metals like copper, lead and iron are placed in the middle of the activity series and re moderately reactive and their oxides can be reduced by carbon, CO and hydrogen.
Mercury and silver are less reactive and are placed lower in the reactivity series. The oxides of these metals are reduced to metals by heating their oxides.

Solution 16:

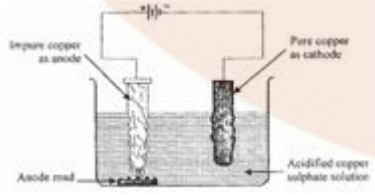
The process used for the concentration of the ore is froth floatation process.

Solution 17:

(a) The purification depends upon:
1. Nature of metal.
2. Nature of impurities present in the metal.
3. Purpose for which metal is to be used

(b) Methods used for purification are:
1. Distillation
2. Liquation
3. Oxidation
4. Electro-refining

(c) The impure metal is made the anode, while a thin sheet of pure metal is made the cathode. Electrolyte used is a salt solution of a metal which is to be refined. Pure metal deposits at the cathode and impurities settle down forming anode mud.



Solution 18:

Balanced equations are:

(a) $2Ag_2O \xrightarrow{\Delta} 4Ag + O_2$

(b) $3MnO_2 + 4Al \xrightarrow{\Delta} 3Mn + 2Al_2O_3 + heat$

(c) $Cu(OH)_2 \xrightarrow{\Delta} CuO + H_2O$

(d) $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

(e) $2NaNO_3 \xrightarrow{\Delta} 2NaNO_2 + O_2$

(f) $2Pb(NO3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$

(g) $2AgNO_3 \xrightarrow{\Delta} 2Ag + 2NO_2 + O_2$

(h) $2Cu_2O + Cu_2S \xrightarrow{\Delta} 6Cu + SO_2$

(i) $HgS + O_2 \xrightarrow{\Delta} Hg + SO_2$

EXERCISE .7 (D)

Solution 1:

Position in the Periodic Table : Period 3,Group IIIA(13)

Solution 2:

The chemical names and formulae of the ores of aluminium are:

Ore	Chemical name	Formula
Bauxite	Hydrated aluminium oxide	$Al_2O_3.2H_2O$
Cryolite	Sodium aluminium fluoride	Na_3AlF_6
Corundum	Anhydrous aluminium oxide	Al_2O_3

Solution 3:

Bauxite ore contains approximately 60% aluminium oxide. The rest being sand, ferric oxide and titanium oxide.

Solution 4:

Red mud consists of ferric oxide, sand etc. left after bauxite dissolves in NaOH forming sodium aluminate and is removed by filtration.

Solution 5:

As aluminium has great affinity for oxygen, so it is stable compound. It is not easily reduced by common reducing agents like carbon, carbon monoxide or hydrogen. Hence, electrolytic reduction is chosen as the method for reducing alumina.

Solution 6:

The ionization reactions of electrolyte in Hall's process.

1. Cryolite:$Na_3AlF_6 \rightleftharpoons 3Na^+ + Al^{3+} + 6F^-$
2. Fluorspar:$CaF_2 \rightleftharpoons Ca^{2+} + 2F^-$
3. Alumina: $Al_2O_3 \rightleftharpoons 2Al^{3+} + 3O^{2-}$

The reaction at the cathode and anode are:

Cathode:

$4Al^{3+} + 12e^- \longrightarrow 4Al$

Anode:

$6O^{2-} - 12e^- \longrightarrow 6[O]$

$3O + 3O \longrightarrow 3O_2$

The anode has to be replaced from time to time as it gets oxidized by the oxygen evolved at the anode.

Solution 7:

(a) The process by which refining of aluminium is done is called Hoope's electrolytic process.

(b) Molten impure aluminium forms the bottom layer. The bottom layer has carbon lining and serves as anode.
Pure molten aluminium with carbon electrodes serves as cathode in top layer.

(c) Reactions at the two electrodes are:
Anode: $Al - 3e^- \longrightarrow Al^{3+}$
Cathode : $Al^{3+} + 3e^- \longrightarrow Al$

Solution 8:

Reaction of aluminium:

(a) Air: Aluminium forms oxide at room temperature.
Aluminium powder burns in air at about 800^0C forming its oxide and nitride with a bright light.

$4Al + 3O_2 \longrightarrow 2Al_2O_3$

$2Al + N_2 \longrightarrow 2AlN$

(b) Water: Water has no action on aluminium due to layer of oxide on it.
When steam is passed over pure heated aluminium, hydrogen is produced.

$2Al + 3H_2O \longrightarrow Al_2O_3 + 3H_2$

(c) Acid: It reacts with acids to produce salt and hydrogen.

$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$

Dilute sulphuric acid reacts with metal to liberate hydrogen.

$2Al + 3H_2SO_4$ (dilute) $\longrightarrow Al_2(SO_4)_3 + 3H_2$

Concentrated sulphuric acid reacts with aluminium to produce sulphur dioxide.

$2Al + 6H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 6H_2O + 3SO_2$

Dilute and concentrated nitric acid does not attack the metal aluminium.

(d) Base: Aluminium reacts with boiling and dilute alkalies to produce meta aluminate while with fused alkali produce aluminate.

$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$
(Sodium meta aluminate)

$2Al + 6NaOH \longrightarrow 2Na_3AlO_3 + 3H_2$
(Sodium aluminate)

Solution 9:

The role of cryolite in the electrolytic reduction of alumina in Hall's process is :

1. Lowers the fusion temperature from 2050^0C to 950^0C and enhances conductivity.
2. Increases its conductivity since pure alumina is almost a non-conductor of electricity.
3. Cryolite acts as a solvent for the electrolytic mixture.

Solution 10:

(a) Aluminium is more active metal but it gets oxidized and forms a thin protective layer on its surface which prevents further corrosion.

(b) Aluminium vessels should not be cleaned with powders containing alkalis because it results in the formation of meta aluminates and hydrogen.

$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$

Solution 11:

(a) The main ores of iron and zinc are:

Name	Ore	Formula
Iron	Red Haematite	Fe_2O_3
Zinc	Zinc blende	ZnS

(b) Conversion of Impure Bauxite to Sodium aluminate

$Al_2O_3.2H_2O + 2NaOH \xrightarrow{150^0C-200^0C} 2NaAlO_2 + 3H_2O$

Impurities such as Fe_2O_3 and SiO_2 remain unaffected with conc.NaOH.

Conversion of Sodium aluminate to Aluminium hydroxide.

$NaAlO_2 + 2H_2O \xrightarrow{50^0C-60^0C} NaOH + Al(OH)_3$

Conversion of $Al(OH)_3$ to pure Alumina.

$2Al(OH)_3 \xrightarrow{1100^0C} Al_2O_3 + 3H_2O$

(c) A layer of aluminium is formed on iron at high temperature during cooking and food becomes deficient in iron.

Solution 12:

(a) In the electrolytic reduction of alumina, the graphite (anode) is oxidized by oxygen to CO and further forms CO_2, so it is consumed and has to be replaced from time to time.

$2C + O_2 \longrightarrow 2CO$

$2CO + O_2 \longrightarrow 2CO_2$

(b) Roasting provides oxygen to convert metallic sulphides into metallic oxide and SO_2 which takes place when heated in excess of air.

Carbonate is converted into oxide by loss of CO_2 which takes place in the absence of air and when heated strongly.

(c) Aluminium has a great affinity towards oxygen and so cannot be reduced by carbon or carbon monoxide or hydrogen whereas lead oxide can be easily reduced to metal lead by carbon.

$PbO + C \longrightarrow Pb + CO$

Solution 13:

(a) Flux combines with the gangue to form a fusible mass called slag.
(b) It forms slag[$CaSiO_3$] with silica.
(c) It is removed from upper outlet, slag being lighter float on molten iron.

Solution 14:

(a) Froth flotation process: Zinc blende[ZnS]
(b) Magnetic Separation: Haematite[Fe_2O_3]

Solution 15:

Electrolytic Reduction

(i) It is removal of oxide or halide from a metal.
(ii) Oxides of highly active metals like Na,K,Ca,Mg,Al are reduced by electrolytic reduction of their fused salts.
(iii) Oxides of these metals have great affinity for oxygen than carbon and cannot be reduced by carbon or CO or hydrogen.

Electrolytic refining of metals is the separation of residual impurities like Si and phosphorus.

(i) Presence of other metals and non-metals like Si and phosphorus.
(ii) Unreduced oxides and sulphides of metals.

It depends upon:

(i) Nature of metal
(ii) Purpose for which metal is to be obtained.
(iii) Nature of impurities present.

Impure metal is made anode while a thin sheet of pure metal is made cathode and electrolyte used is a salt of solution of a metal to be refined.

Solution 16:

The three ways in which metal zinc differs from the non-metal carbon is:

1. Zinc has a valency 2 and carbon has valency 4.
2. Zinc does not form hydride but carbon does (CH_4).
3. Oxides of zinc are amphoteric (ZnO) whereas oxides of carbon are acidic (CO_2) and neutral (CO).

EXERCISE. 7 (E)

Solution 1:

(a) To prevent from rusting.
(b) Due to strong electropositive nature, it easily forms Zn^{+2} ions.
(c) Antiseptic in face creams.

Solution 2:

(a) Aluminium:

(i) Being a strong, light and corrosion resistant metal, it is used in alloys.
(ii) Aluminium is light, it has high tensile strength, is resistant to corrosion, good conductor of heat, unaffected by organic acids and has attractive appearance. So it is used for making cooking utensils, in building and construction work.
(iii) Aluminium has a strong affinity for oxygen so it is used as a deoxidizer in the manufacture of steel.

(b) Zinc:
1. Zinc has a strong electropositive character, so it is used for coating iron and steel sheets to prevent them from rusting and this process is known as galvanization.
2. Due to strong electropositive nature, it forms Zn^{+2} ions, so it is used to make dry cell containers which act as negative electrode.
3. Zinc act as a reducing agent for many organic reductions and these reductions are employed in manufacturing drugs, dyes.

Solution 3:

(a) Zinc is electropositive metal than iron, gets oxidized and saves iron. Also zinc forms protective layer of ZnO on iron. This layer is sticky and impervious in nature and protects the iron metal underneath from rusting.
(b) A neutral gas other than oxygen which is formed at anode during electrolysis of fused alumina is carbon monoxide.
(c) Nitric acid can be stored in aluminium containers as the dilute and conc. nitric acid does not react with aluminum. It renders aluminium passive due to the formation of an oxide film on its surface.

Solution 4:

(a) Cast iron: It is used in drain pipes, gutter covers, weights and railings.
(b) Wrought iron: It is used in chains, horse shoes and electromagnets.
(c) Mild steel: It is to manufacture nuts, bolts etc.
(d) Hard steel: It is used to make tools.

Solution 5:

(a) Galvanized iron sheets
(b) Zinc
(c) Zinc

Solution 6:

(a) Aluminium being strong, light and corrosion resistant metal is used for making alloy.
(b) Aluminium is light, malleable and does not rust so it is used for wrapping chocolates.
(c) To prevent them from rusting.
(d) It is used in aluminothermy as it is a good reducing agent.
(e) As aluminium forms a film of aluminium oxide, it protects the ships from corrosion. So it is used for making ships.

Solution 7:

(a) A mixture of 3 parts of ferric oxide (Fe_2O_3) and one part of aluminium powder (Al).
(b) A mixture of Potassium chlorate and magnesium powder is the ignition mixture.
(c) $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe + heat$

Solution 8:

Alloy is a homogeneous mixture of two or more metals or of one or more metals with certain non-metallic elements.
The properties of alloys are often greatly different from those of the components.
For example: Gold is too soft to be used without small percentage of copper.
A low percentage of molybdenum improves the toughness and wear resistance of steel.
Bell metal is more sonorous than copper or tin.
Alnico an alloy of aluminium, nickel and cobalt can lift 60 times its own mass.
These added elements improve hardness, wear resistance, toughness and other properties.

Solution 9:

Alloy's name	Composition	Uses
1. Stainless steel	73% Fe,18%Cr,8%Ni,1%C	Used for making utensils, cutlery, ornamental pieces and surgical instruments.
2. Manganese steel	85% Fe,1%C ,14%Mn	Used for making rock drills and armour plates.
3. Tungsten steel	84%Fe, 5%W, 1%C	Used for cutting tools for high speed lathes.

Solution 10:

The other element in Brass is Zinc.
The other elements in Bronze are Tin and Zinc.

Solution 11:

(a) Duralumin
(b) Solder
(c) Brass
(d) Zinc amalgam

Solution 12:

A mixture or an alloy of mercury with a number of metals or an alloy such as sodium, zinc, gold and silver as well as with some non-metals is known as amalgam.
Dental amalgam is a mixture of mercury and a silver tin alloy.

Solution 13:

(a) Two properties of brass that make it more useful than its components are:
(i) It is malleable and ductile.
(ii) It resists corrosion.
(iii) Can be easily cast.
(b) A metal which forms a liquid alloy at ordinary temperature is sodium.

Solution 14:

Magnalium is an alloy of aluminium with composition 90-95% and magnesium with composition 10-5%. It is used for making aircrafts.

Solution 15:

The constituents of

(a) Duralumin are aluminium (95%), copper (4%), magnesium (0.5%) and manganese (0.5%).
(b) Solder are lead (50%) and tin (50%).
(c) Bronze are copper (80%), tin (18%) and zinc (2%).
(d) Invar are iron (63%), nickel (36%) and carbon (1%).

MISCELLANEOUS EXERCISE

Solution 1:

(a) Bauxite: Aluminium is extracted from its main ore bauxite $Al_2O_3.2H_2O$. It contains 60% Al_2O_3.

(b) Sodium hydroxide: Sodium hydroxide dissolves bauxite to form sodium meta aluminate, removes insoluble impurities from Al_2O_3 by forming red mud.

$$Al_2O_3.2H_2O + 2NaOH \xrightarrow{150^0C-200^0C} 2NaAlO_2 + 3H_2O$$

$$NaAlO_2 + 2H_2O \xrightarrow{50^0C-60^0C} NaOH + Al(OH)_3$$

$$2Al(OH)_3 \xrightarrow{1100^0C} Al_2O_3 + 3H_2O$$

(c) Cryolite: Cryolite lowers the M.P. from 2050^0C to 950^0C and enhances conductivity.

(d) Graphite: Acts as cathode as well as anode.

Solution 2:

(a) Copper
(b) Iron
(c) Zinc
(d) Magnesium

Solution 3:

Arrangement of metal in decreasing order of reactivity are:
Sodium > Magnesium > Zinc > Iron > copper

Solution 4:

(a)

(i) The aluminium oxide forms sodium aluminate.

$$Al_2O_3.2H_2O + 2NaOH \xrightarrow{150°C-200°C} 2NaAlO_2 + 3H_2O$$

(ii) he iron(III) oxide does not dissolve in NaOH and is removed by filtration.

(b)

(i) The process used for the purification of bauxite is called Bayer's process.

(ii) he equation for the action of heat on aluminium hydroxide is:

$$2Al(OH)_3 \xrightarrow[1000^0C]{heat} Al_2O_3 + 3H_2O$$

(c)

(i) The formula of the cryolite is Na_3AlF_6.

(ii) Conduc

(iii) In electrolytic process, the graphite acts as anode. The anode has to be replaced from time to time as it gets oxidized by the oxygen evolved at the anode.

(iv) The reaction that occurs at cathode is:

$$4Al^{3+} + 12e^- \longrightarrow Al$$

(d) In construction the alloy of aluminium -duralumin is used because it is hard and resistant to corrosion.

Solution 5:

(a) Three balanced equations for purification of bauxite are:

$Al_2O_3.2H_2O + 2NaOH \xrightarrow{150^0C-200^0C} 2NaAlO_2 + 3H_2O$

$NaAlO_2 + 2H_2O \xrightarrow{50^0C-60^0C} NaOH + Al(OH)_3$

$2Al(OH)_3 \xrightarrow{1100^0C} Al_2O_3 + 3H_2O$

(b) Fluorspar and cryolite are used for dissolving Al_2O_3.This chemical is used in the middle state.

(c) Reaction at anode:

$6O^{-2} - 12e^- \longrightarrow 6[O]$

$3O+3O \longrightarrow 3O_2$

Anode is oxidized to carbon monoxide and then to carbon dioxide.

$2C + O_2 \longrightarrow 2CO$

$2CO + O_2 \longrightarrow 2CO_2$

(d) In Aluminium thermite welding, the reduction with aluminium is highly exothermic and heat generated is sufficient to melt the metal.

$Fe_2O_3 + 2Al \longrightarrow 2Fe + Al2O_3 + Heat$

Solution 1(2005):

(i)

1. Zinc: Froth Flotation, Zinc Blende,Coke
2. Aluminium: Bauxite, Cryolite, Sodium hydroxide solution

(ii)

1. Sodium hydroxide.
2. Cryolite

(iii) The formula of Cryolite is Na_3AlF_6.

Solution 2(2005):

(a) Stainless steel : Iron, Chromium

(b) Brass: Copper , Zinc

Solution (2006):

(a) Mercury

(b) Roasting

(c) $CaSiO_3$

(d) Cryolite

(e) Graphite

Solution 1(2007):

Acidic oxide(D)
Discharged at anode (F)
Covalent chlorides (I)
5,6,7 valence electrons (L)
Brittle(C)

Solution 2(2007):

(i) Sodium hydroxide
(ii) $2Al(OH)_3 \xrightarrow[1000^0\,C]{heat} Al_2O_3 + 3H_2O$
(iii) Graphite
(iv) Reaction at cathode:
$Al^{3+} + 3e^- \longrightarrow Al$
(v) Reaction at anode:
$Al - 3e^- \longrightarrow Al^{3+}$

Solution 1(2008):

(i) A is made of carbon and B is thick graphite rod.
A ⟶ Cathode
B ⟶ Anode
(ii) Aluminium is formed at electrode A.
(iii) two aluminium compound in the electrolyte C is Na_3AlF_6, Al_2O_3.
(iv) It is necessary to continuously replace electrode B from time to time as it gets oxidized by the oxygen evolved.

Solution 2(2008):

Brass is an alloy of copper and Zinc.