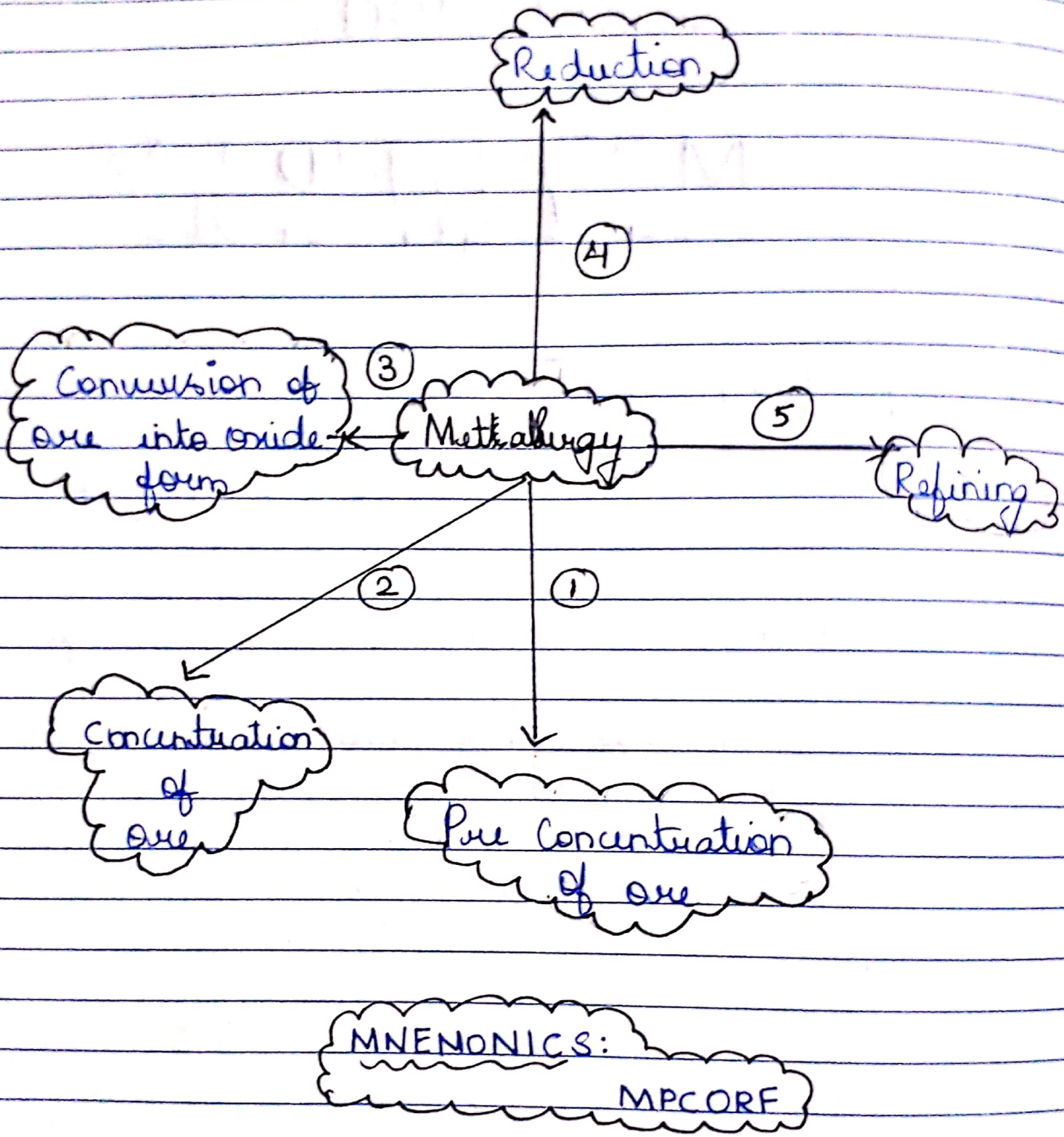
CORROSION
&
METALLURGY

METALS AND NON METALS

Author: S. Harini
Level: X
Unit: Metals and Non Metals

Abstract:

This concept deals how a metal is extracted by various suitable methods and how its gets corroded.



MNENONICS:

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TERMS AND DEFINITIONS

Metallurgy It is the science of extracting a metal from its ore most efficiently and economically.

Roasting Sulphide ores are strongly heated in the presence of air to convert it into oxide form. This process is known as roasting.

Calcination Carbonate ore are strongly heated in the absence of air to convert it into oxide form. This process is called calcination.

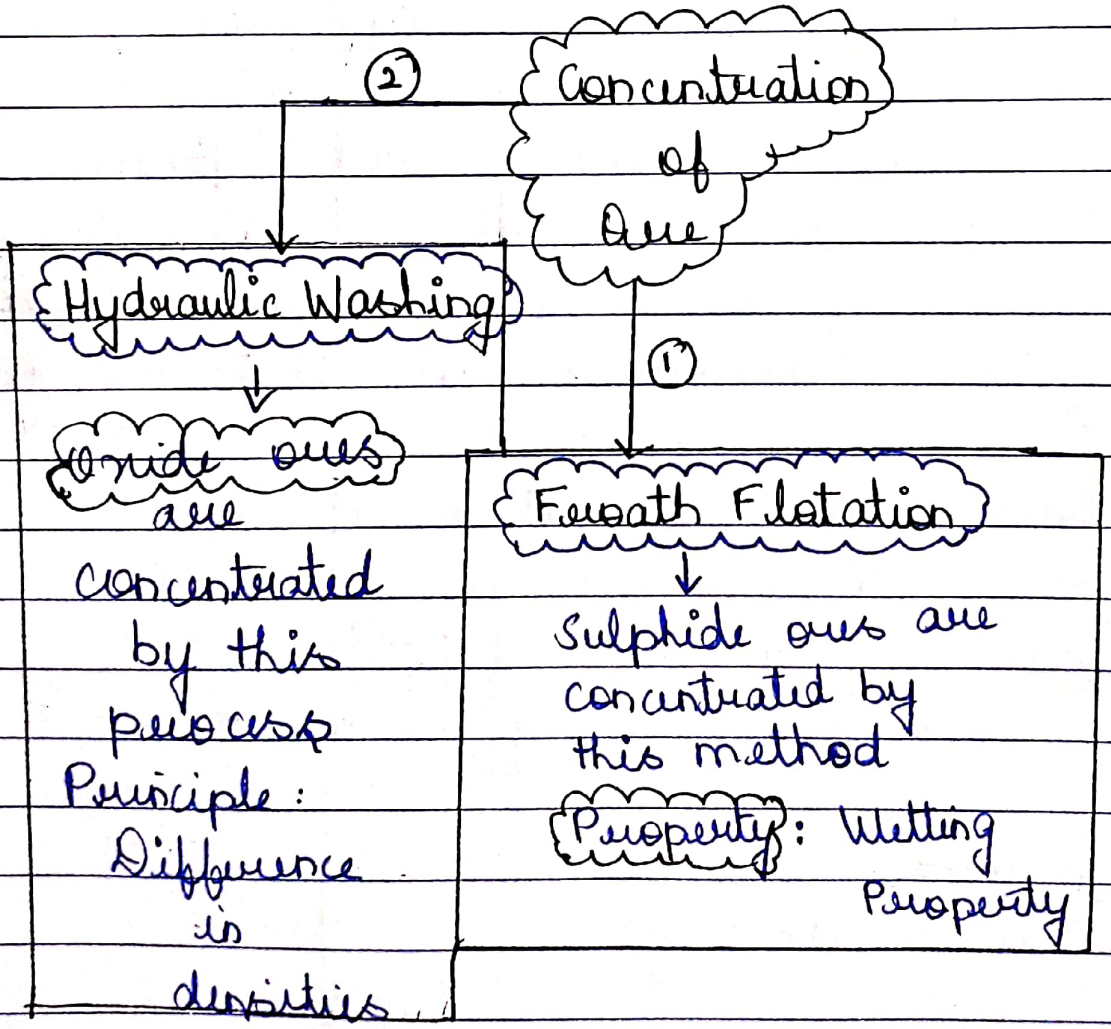
Steps involved in Metallurgy

Pre-Concentration Ores that are extracted from the earth's crust is crushed and grinded into fine powder in crushers and grinders.

Mineral: Elements that occur naturally in the earth's crust.

Concentration of Ore.

* Removal of earthy impurities from the extracted ore.
* The earthly impurities are called as gangue.



Conversion of the ore into oxide form.

Roasting → Sulphide ores
→ presence of O_2

$$ZnS + O_2 \xrightarrow{\Delta} ZnO + SO_2$$

(oxide form).

Calcination → Carbonate ores
- absence of O_2

$$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$$

(oxide form).

Reduction

Less Reactive :→ Reducing agent is heat

$$HgS \text{ (cinnabar)} + O_2 \xrightarrow{\Delta} HgO + SO_2$$

$$HgO \xrightarrow{\Delta} Hg + O_2$$

(reduced)

$$2CuS + O_2 \xrightarrow{\Delta} Cu_2O + SO_2$$

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

Moderately reactive → Reducing agents → Co, Al.

$$ZnO + C \longrightarrow Zn + CO$$

$$Fe_2O_3 + Al \longrightarrow Al_2O_3 + Fe + \Delta$$

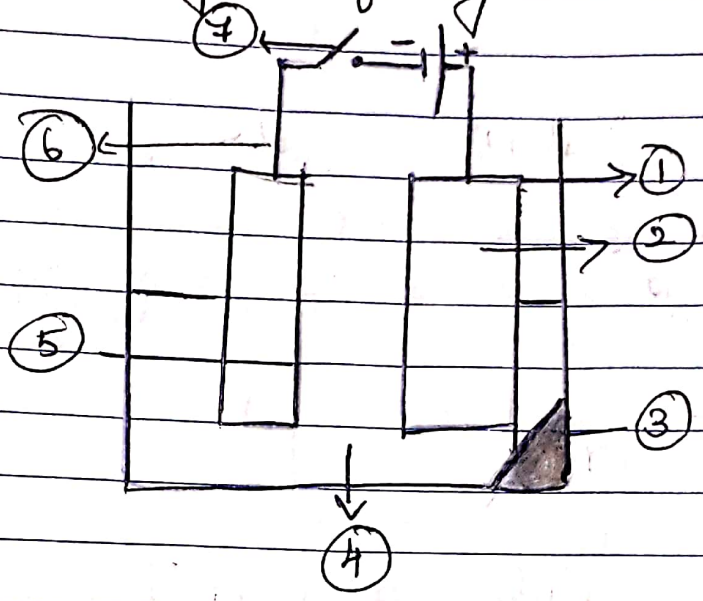
↓ (molten state).

This reaction is highly exothermic and the metal obtained is in the molten state. It is used to join railway tracks and to seal cracked machineries. This reaction is called thermit or alumino thermy reaction.

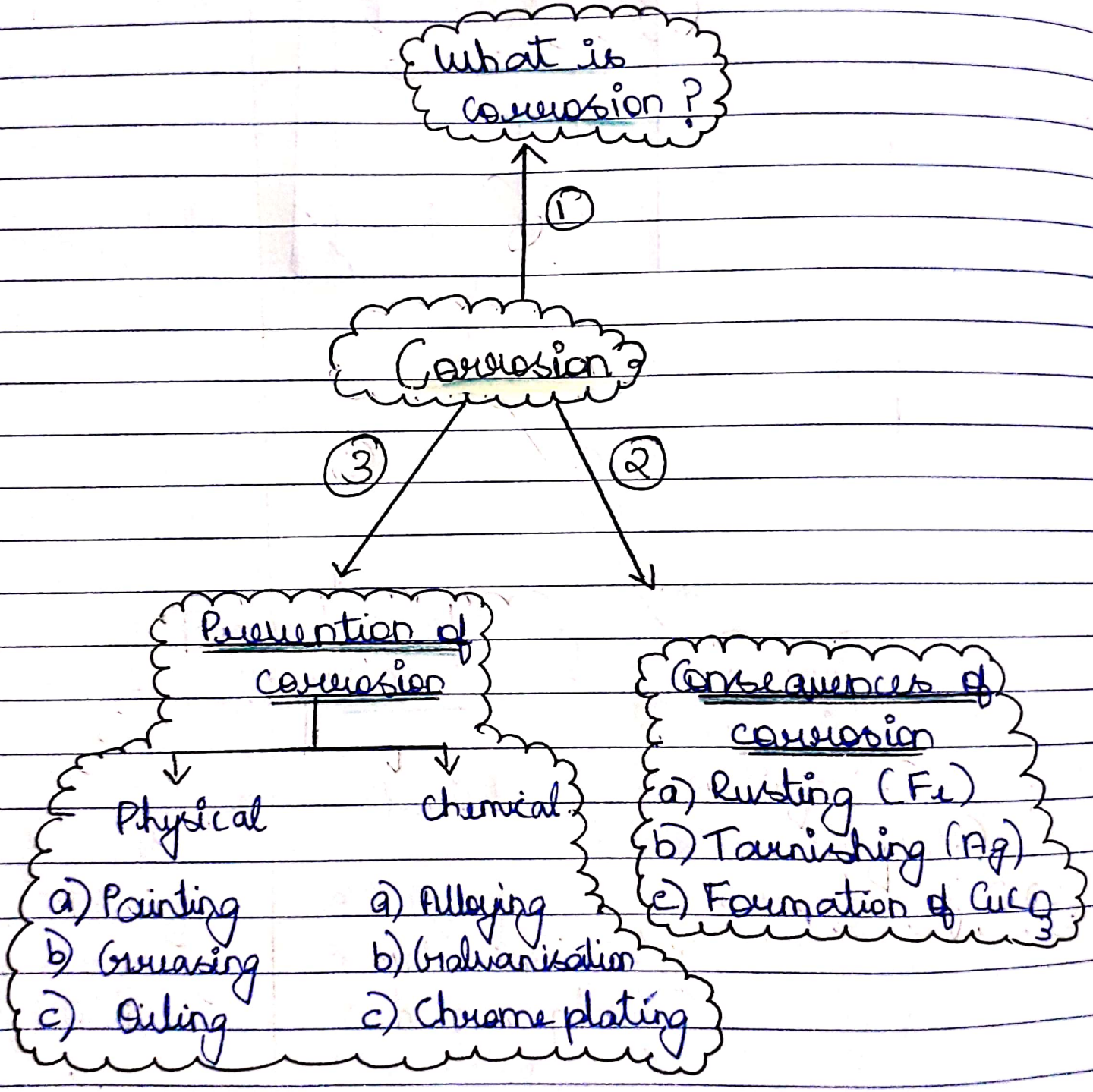
Highly reactive metals cannot be refined with reducing agents like Carbon as they have high affinity for oxygen than carbon. They are reduced electrolytically

Refining

* Electrolytic Refining.



1) Anode
2) Thick strip of impure metal
3) Anode mud
4) Electrolyte (acidified metal salt sol)
5) Thin strip of metal (pure)
6) Cathode
7) Key.


What is corrosion ?
1
Corrosion
3
2
Prevention of corrosion
Physical
a) Painting
b) Greasing
c) Oiling
Chemical
a) Alloying
b) Galvanisation
c) Chrome plating
Consequences of corrosion
a) Rusting (Fe_2)
b) Tarnishing (Ag)
c) Formation of $CuCO_3$

Terms And Definitions

Corrosion	Eating away of the surface of the metal when it is exposed to air, water and sulphide of the atmosphere is called as corrosion.
Rusting $Fe_2O_3 \cdot xH_2O$	Corrosion of iron is called rusting. When it is exposed to moist air (air + water) it gets rusted and leads to the formation of brown flaky substance called rust
Alloy	Alloy is a homogeneous mixture of two metals or a metal and a non-metal. Eg: Stainless steel - Alloy of Fe, Ni, Cr. ↓ ↓ ↓ 74% 18% 8%
Alloying	The process of making an alloy is known as alloying.
Galvani-sation	The process of coating a layer of zinc over iron objects to prevent corrosion is known as galvanisation.

Consequences of corrosion:

* When iron is exposed to moist air it gets corroded and leads to formation of rust

* Copper reacts with moist CO_2 in air and forms a green coating of $CuCO_3$

* Silver reacts with sulphide of atmosphere and gets tarnished with a black coating of silver sulphide (Ag_2S)

Prevention of Corrosion

Physical Methods

a) Painting: When iron objects are painted with a strong layer it restricts corrosion as it prevents exposure to moist air.

b) Greasing and Oiling: A generous layer of grease and oil restricts corrosion.

Chemical Methods

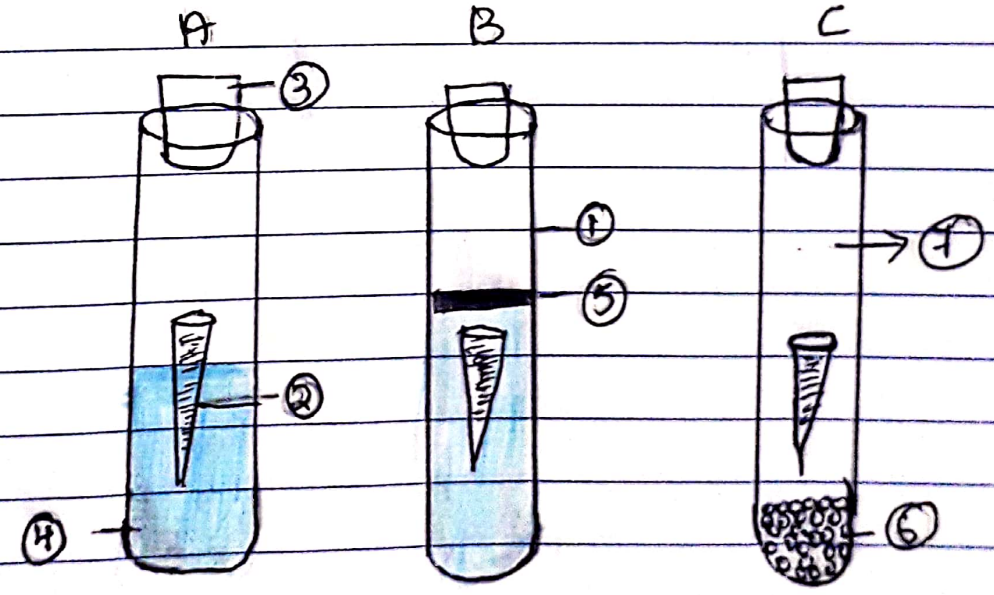
a) Alloying:

* Alloying increasing increases the properties of the basic metal
* Alloy has lesser conductivity and melting point than its constituent metals.

common Alloys

Stainless steel - Iron, chromium, nickel
Amalgam - Alloy of mercury
Solder - Lead (Pb) and Tin (Sn)
Bronze - Copper (Cu), Tin (Sn)
Brass - Copper (Cu), Zinc (Zn)
Duralumin - Aluminium, Copper, Magnesium and Manganese.

Activity to demonstrate corrosion



1) Test Tube
2) iron nail
3) Cork
4) Water
5) layer of oil
6) anhydrous $CaCl_2$
7) dry air

* Test tube A gets corroded as it has the necessary conditions (moist air)
* Test tube B does not show corrosion as the layer of oil prevents the entry of air.
* Test tube C has anhydrous $CaCl_2$ which absorbs moisture. Hence the iron nail does not get corroded.