Metals and Non-Metals

Class 10th Chemistry

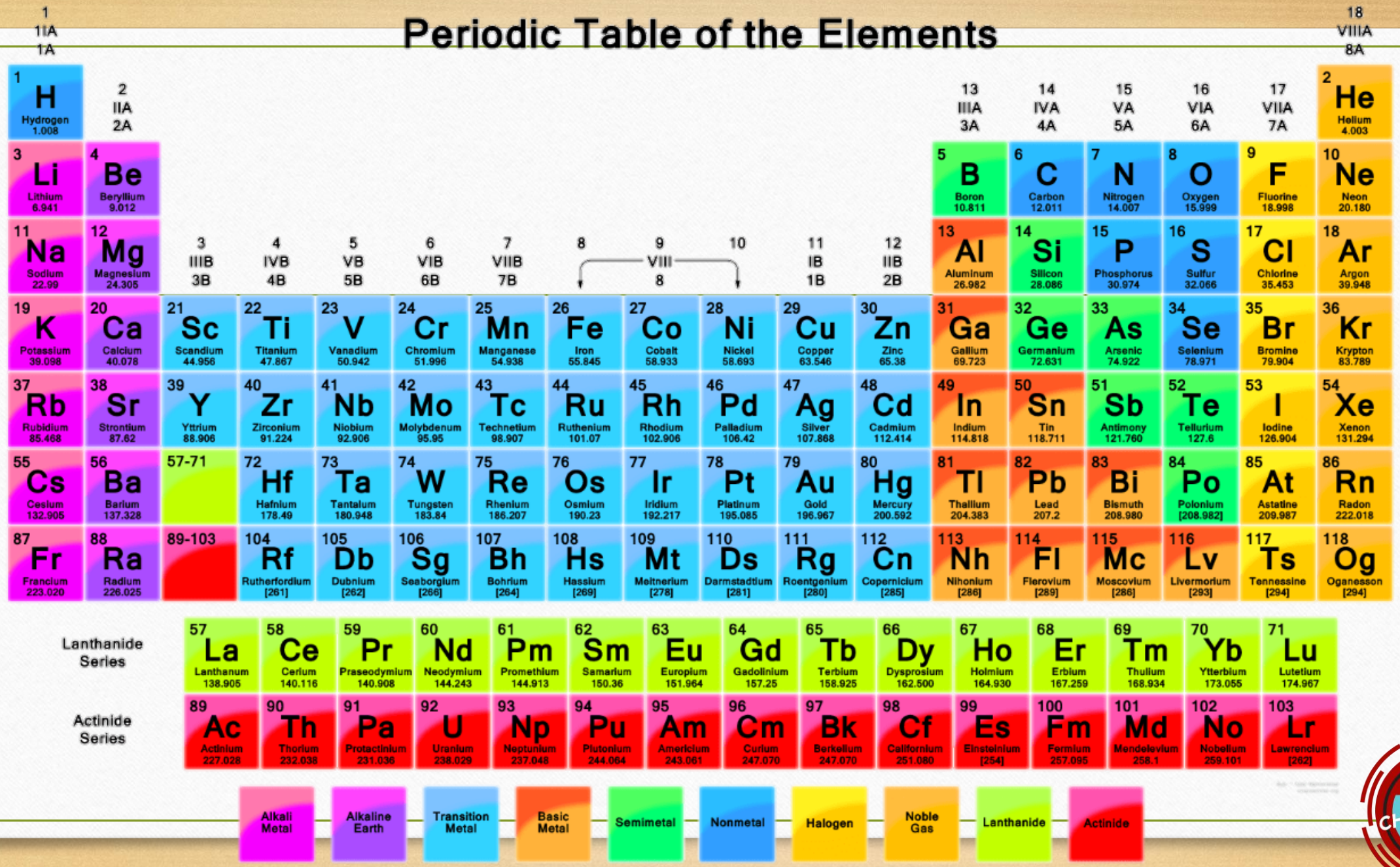
Properties which define Metals

- Metallic lustre
- Hardness
- Malleability (Gold and Silver are the most malleable metals)
- Ductility (Gold is the most ductile metal)
- Good conductors of heat and electricity
- High MPs and BPs.

Properties that define Non-Metals

- Opposite of that of metals.
- Absence of Lustre
- Generally Soft
- Non malleable
- Non ductile
- Poor conductors of heat and electricity
- Low MPs and BPs.

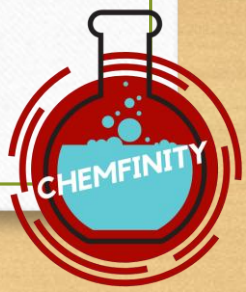
Periodic Table of the Elements



Chemical Properties of Metals

- Metals burn in air to form metal oxides.
- $Cu + O_2 \rightarrow CuO$
- $Mg + O_2 \rightarrow MgO$
- Metals react with acids to form corresponding salts.
- Chlorides, Sulphates and Nitrates or Nitrites.
- G1 metal oxides dissolve in water to form basic hydroxides.
- K and Na are so reactive so…
- Metals react with water to give metal oxide and liberate hydrogen.
- More reactive ones readily give $M_x(OH)_y$

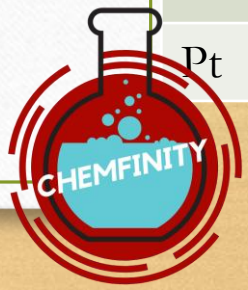
Li
K
Na
Mg
Al
Zn
Fe
Ni
Pb
H
Cu
Hg
Ag
Au
Pt



- On reacting with acids, they yield metal salt and H_2
- However in case of reaction with HNO_3, H_2 is not evolved as HNO_3 is a powerful oxidising agent that oxidises the H_2 liberated into water(H_2O) and itself gets reduced to a nitrogen oxide (N_xO_y).

- Cu does not react with dil. HCl.
- Aqua regia == Royal Water; Corrosive fuming liquid.
- Reactivity series decides who displaces who: Displacement reaction.
- Reactivity series is a list of metals arranged in the order of their decreasing activities in accordance with their standard electrode potentials.

Li
K
Na
Ca
Mg
Al
Zn
Fe
Ni
Pb
H
Cu
Hg
Ag
Au
Pt

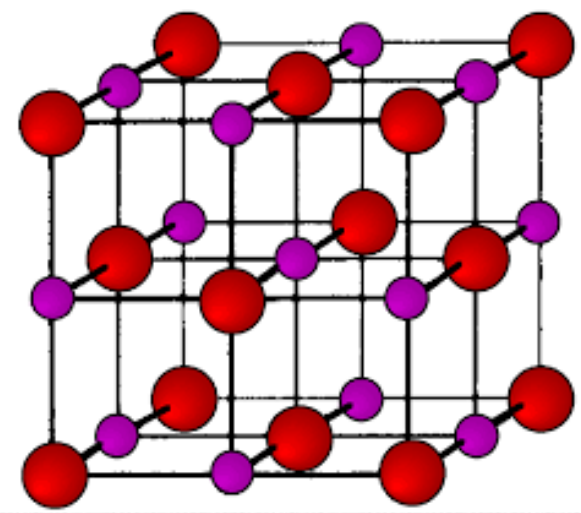


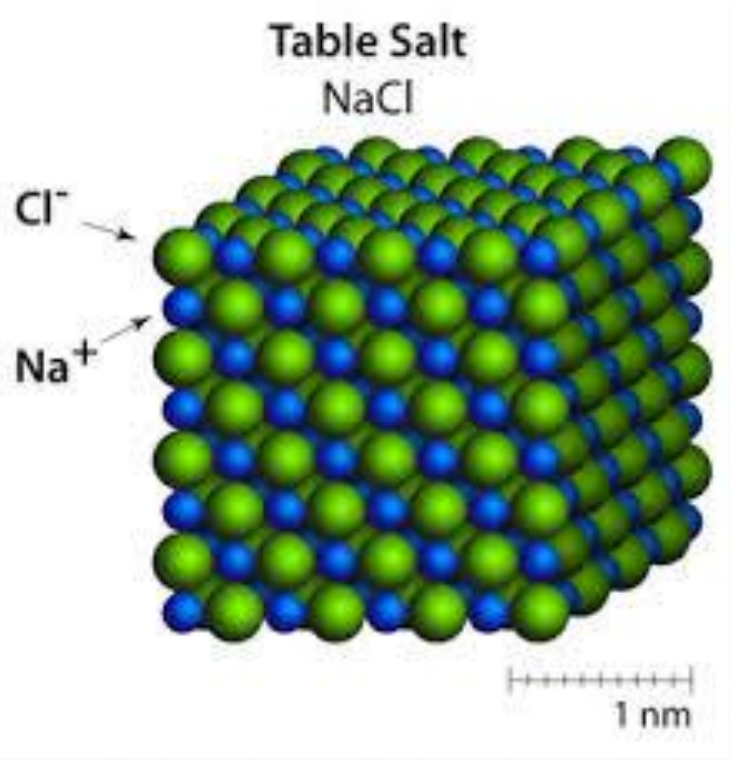
Reaction of a metal and a Non-Metal

- M→ metal; X→ non metal ; aM + bX → M_aX_b
- ** Noble gases do not react. (Terms and Conditions apply)
- Examples :

Ionic Compounds

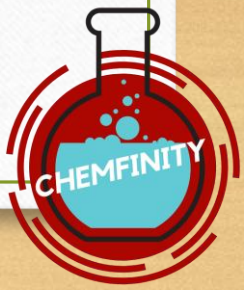
- Physical state
- MPs and BPs
- Solubility
- Electrical Conductivity





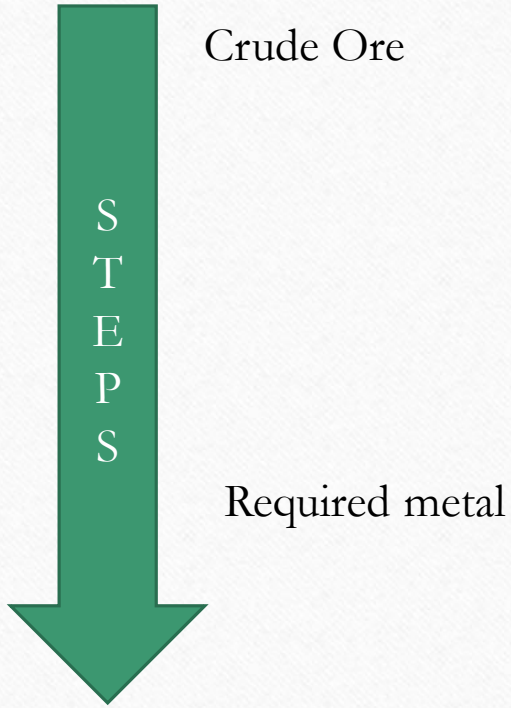
Occurrence and Extraction of Metals

- Ores vs Minerals : All ores are minerals but not all minerals are ores.
- Minerals: The elements or compounds that occur naturally in earth crust.
- Ores: Minerals that contain high percentage of particular metal from which it can be profitably extracted.
- Highly reactive metals == Electrolytic Reduction of ores
- Normally reactive metals == Carbon reduction of ores
- Least reactive metals == Found in native state; Refining required.



Steps to obtain a metal from its ore (Exceptions: Highly Reactive metals)

- Obtain the crude metal/ ore.
- Concentration of ore.
- Extraction of metal from the ore in form of oxides.
- Reduction of oxides.
- Refining/Purification of metal so obtained.



Galena	PbS

Sphalerite	ZnS

Calamine	$ZnCO_3$

Zincite	ZnO

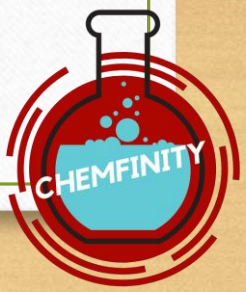
Chalcocite	Cu_2S

Steps discussed

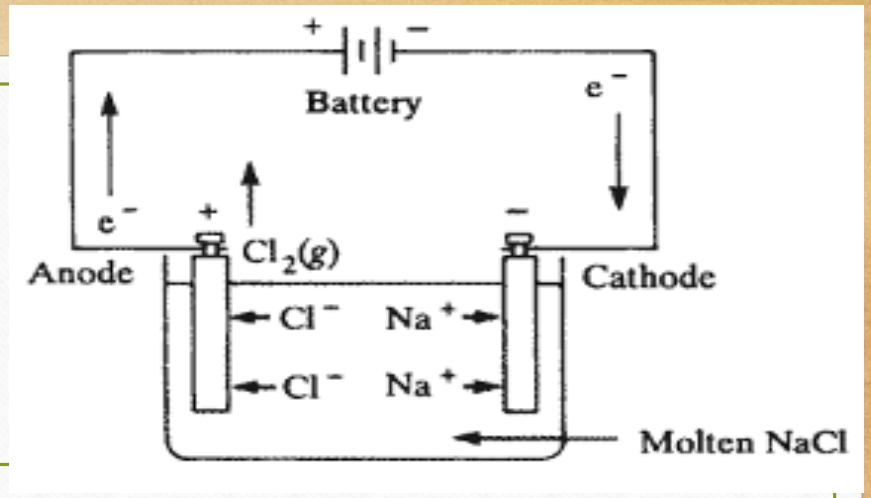
Cinnabar	HgS

Rock Salt	NaCl

- Gangue: The contaminants that are present in large quantities in mined ores.
- After concentration, HgS is roasted to give HgO which is heated to get decomposed into Hg and O_2 .
- Chalcocite → Concentration → Roasting → Self reduction → Blistered Cu → Electrolytic Refining → Pure Copper.
- ZnS → Roasting; $ZnCO_3$ → Calcination; Calcination vs Roasting.
- Thermit Welding reaction: $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3 + Heat$ (Displacement rxn.)



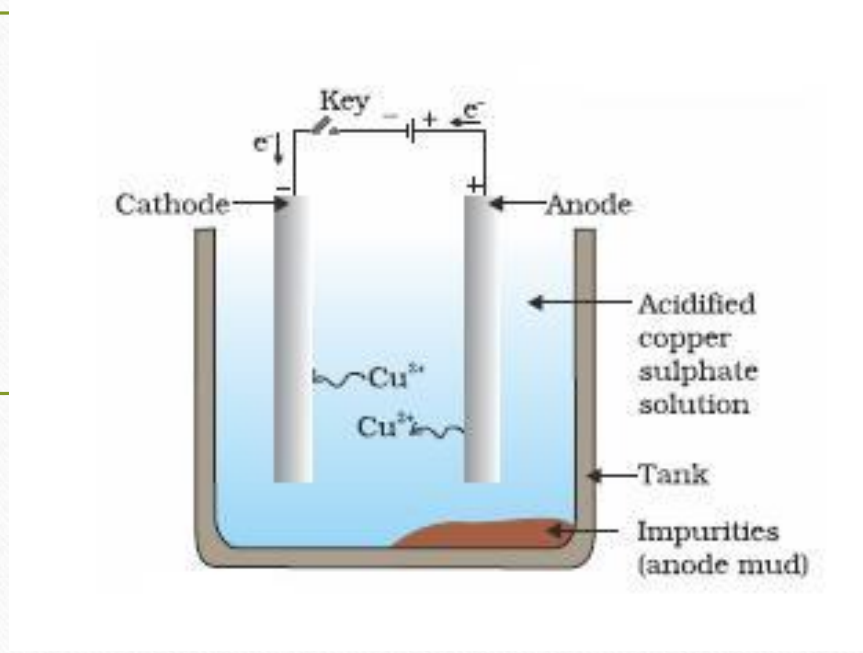
Highly Reactive Metals



- Cannot be reduced using carbon or other reactive metals as they are the most reactive ones. Carbon can't reduce them because they have more affinity for oxygen than that of Carbon.
- The only possible viable means to obtain them is electrolytic reduction of their ores.
- Metal gets deposited at cathode whereas the by-product, usually a gas is obtained at anode.
- For electrolysis, Cathode == Negative Electrode
- Anode == Positive Electrode

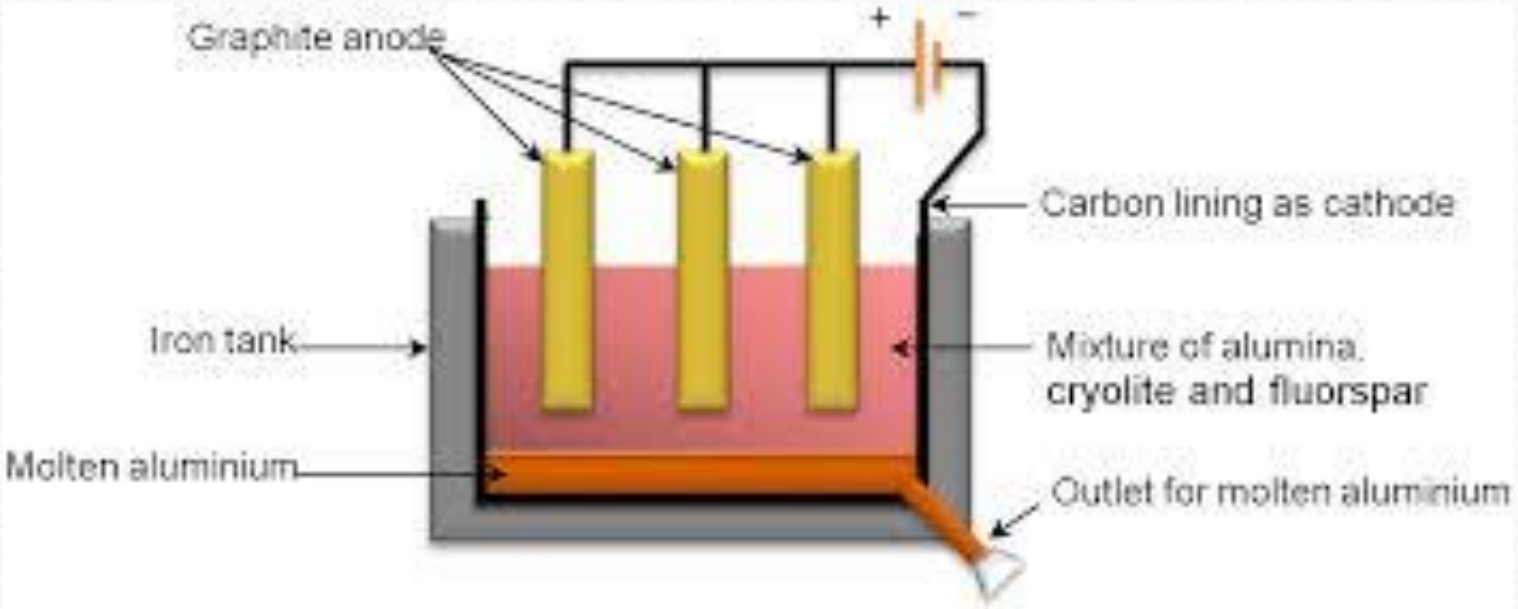
Cathode: $Na^+ + e^- \rightarrow Na$
Anode: $2Cl^- \rightarrow Cl_2 + 2e^-$

Electrolytic Refining



- Impure metal is made anode.
- Pure metal is made cathode.
- There is something called “Electrolytic Solution”.
- On passage of current, the pure metal from anode dissolves into the electrolyte. An equivalent amount of metal ions are reduced and deposited on cathode as pure metal.
- Insoluble impurities == Anode mUd.

ER of Aluminium



Corrosion and its Prevention

- Painting
- Oiling
- Greasing
- Galvanising
- Chrome Plating
- Anodising
- Alloying

An alloy is a homogenous mixture of two or more metals or a metal with a non-metal.

Pure Gold

Pure Iron

Brass = Cu + Zn
Bronze = Cu + Sn
Solder = Pb + Sn