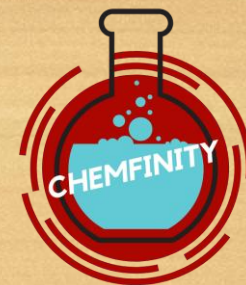


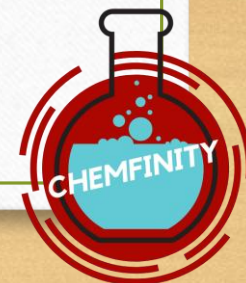
Metals and Non-Metals

Class 10th Chemistry



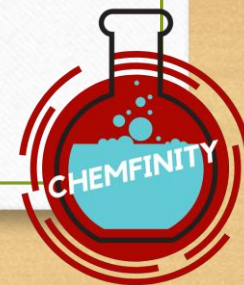
Properties which define Metals

- 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

Periodic Table of the Elements																		18
												VIIIA					8A	
1 1A 1A												13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	2	
1 H Hydrogen 1.008																	2 He Helium 4.003	
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180	
11 Na Sodium 22.99	12 Mg Magnesium 24.305	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 8	10 VIII 8	11 IB 1B	12 IIB 2B	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948	
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.789	
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294	
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018	
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [288]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]	

Lanthanide
Series

Actinide
Series

57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.243	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.500	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.055	71 Lu Lutetium 174.967
89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Alkali
Metal

Alkaline Earth

Transition Metal

Basic Metal

Semin

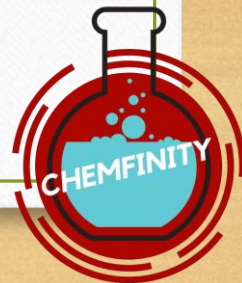
Nonmetal

Halogen

Noble Gas

Lanthanide

Actinide



Chemical Properties of Metals

- Metals burn in air to form metal oxides.
- $\text{Cu} + \text{O}_2 \rightarrow \text{CuO}$
- $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$
- 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 $\text{M}_x(\text{OH})_y$

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

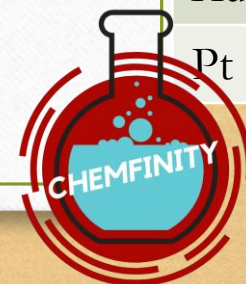
Cu

Hg

Ag

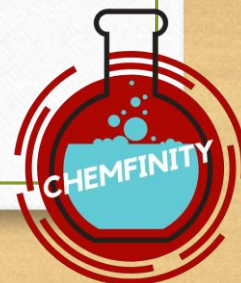
Au

Pt



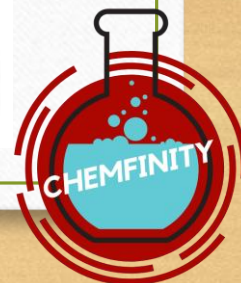
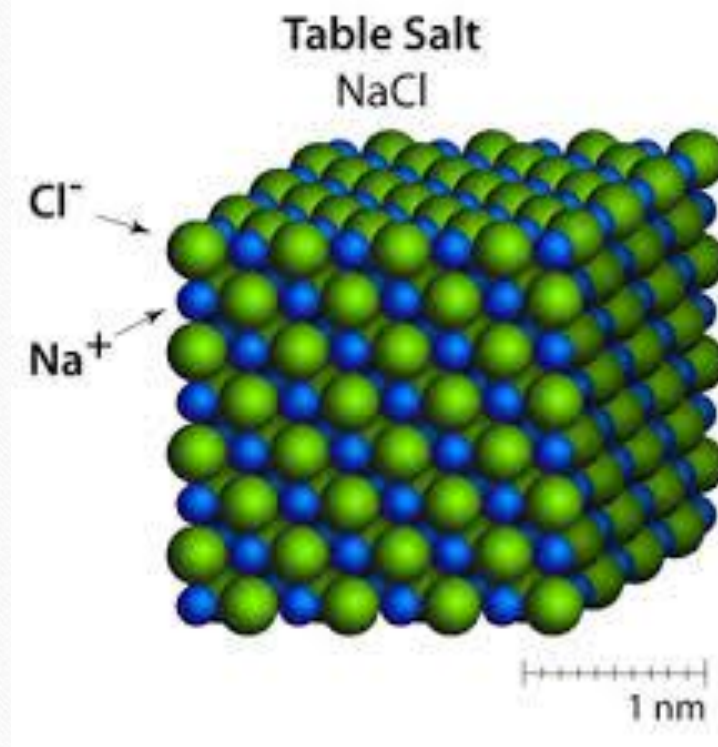
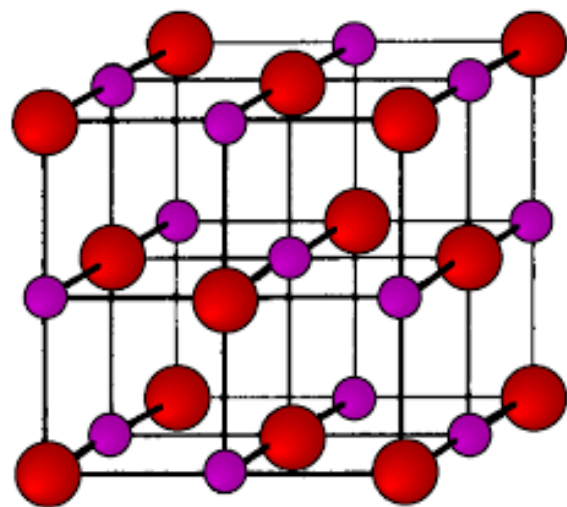
Reaction of a metal and a Non-Metal

- $M \rightarrow \text{metal}; X \rightarrow \text{non metal}; aM + bX \rightarrow M_aX_b$
- ** Noble gases do not react. (Terms and Conditions apply)
- Examples :



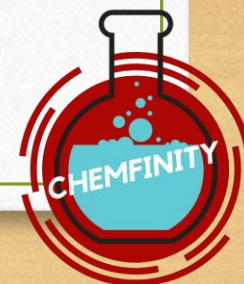
Ionic Compounds

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



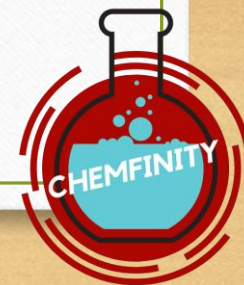
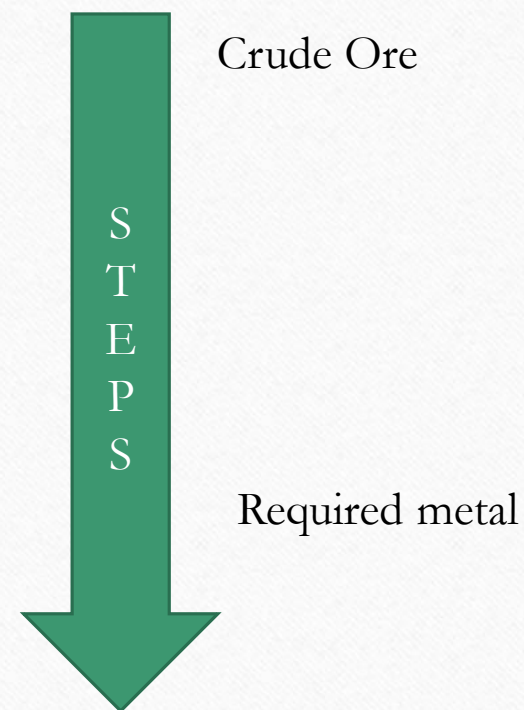
Occurrence and Extraction of Metals

- 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

ZnCO₃

Zincite

ZnO

Chalcocite

Cu₂S

Cinnabar

HgS

Rock Salt

NaCl

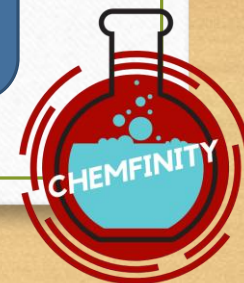
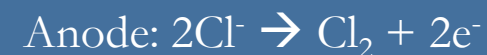
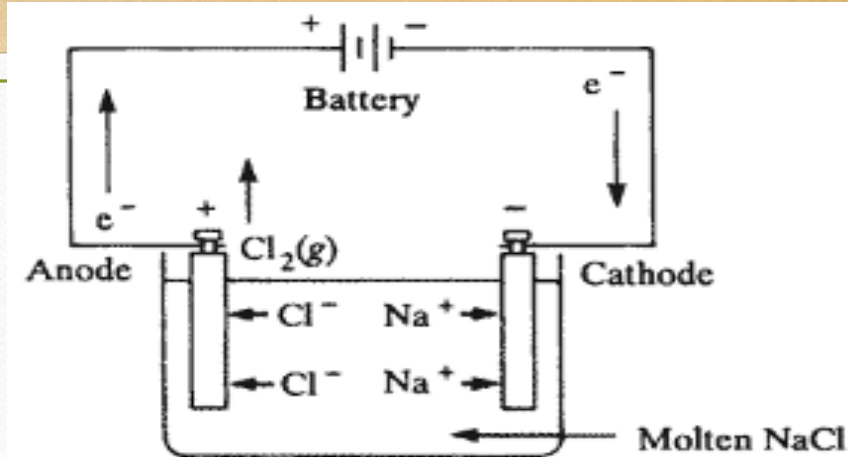
Steps discussed

- 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 O₂.
- Chalcocite → Concentration → Roasting → Self reduction → Blistered Cu → Electrolytic Refining → Pure Copper.
- ZnS → Roasting; ZnCO₃ → Calcination; Calcination vs Roasting.
- Thermit Welding reaction: $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3 + \text{Heat}$ (Displacement rxn.)



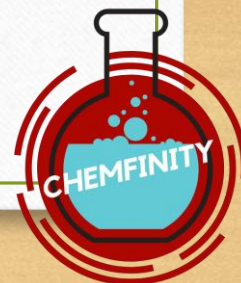
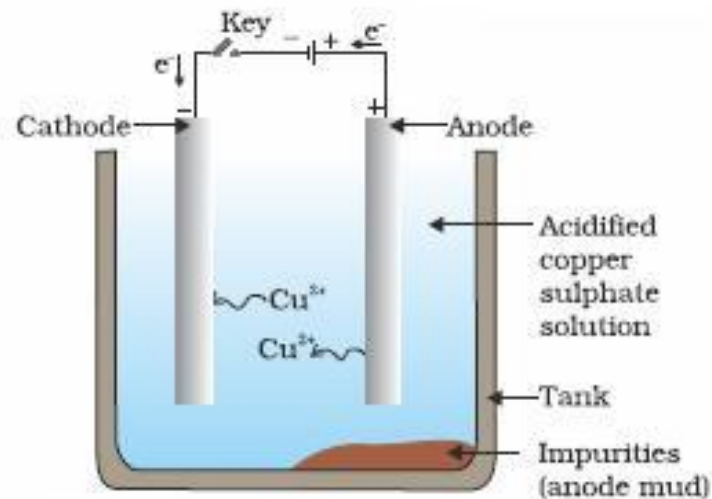
Highly Reactive Metals

- 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

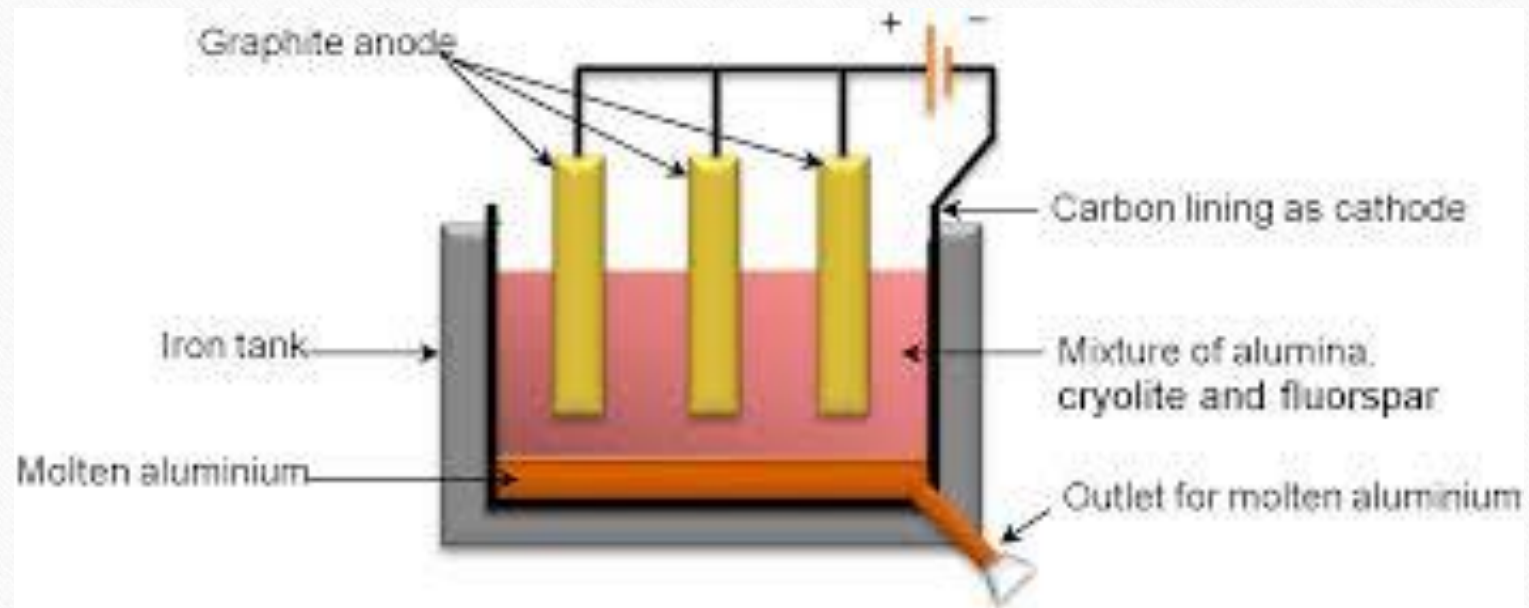


Electrolytic Refining

- 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

