JSR IAS ACADEMY

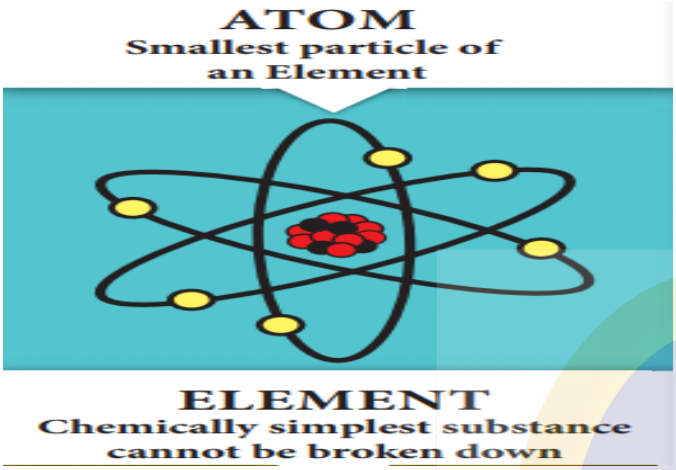
GENERAL SCIENCE

CHEMISTRY

Elements

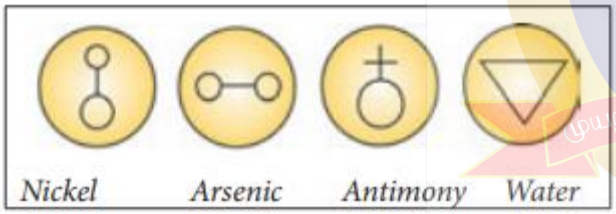
Atom:

An atom is the smallest particle of an element, which exhibits all the properties of that element. It may or may not exist independently but takes part in every chemical reaction.



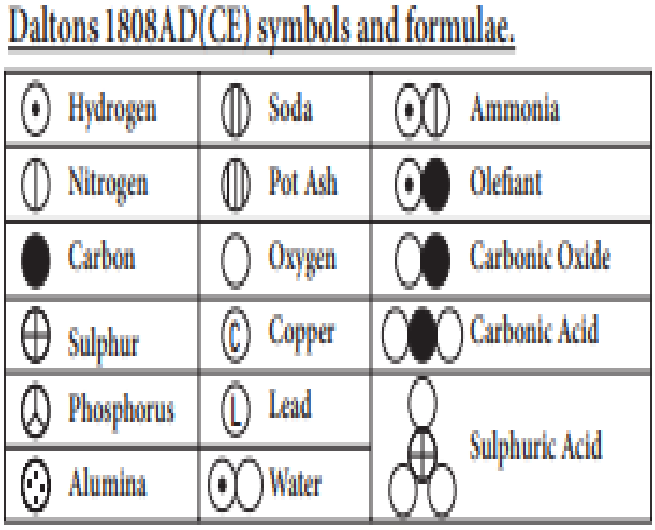
Alchemist symbol

they try to change less valuable metal into gold. The process was called alchemy and the men who did this work were known as alchemists.



Dalton symbols

In 1808, John Dalton, English scientist tried to name the various elements based on these pictorial symbols. These symbols are difficult to draw and hence they are not used. It is only of historical importance



Berzelius symbols

In 1813, Jon Jakob Berzelius devised a system using letters of alphabet rather than signs.,. The modified version of Berzelius system follows under the heading 'System for Determining Symbols of the Elements' Present System for Determining Symbols of the Elements

1. The symbols of the most common elements, mainly non-metals, use the **first letter of their English name.**

Element	Symbol	Element	Symbol
Boron	B	Oxygen	O
Carbon	C	Phosphorus	P
Fluorine	F	Sulphur	S
Hydrogen	H	Vanadium	V
Iodine	I	Uranium	U
Nitrogen	N	Yttrium	Y

2. If the name of the element has the same initial letter as another element, then symbol uses the first and second letters of their Element name. **First letter in upper case and the second letter is in lower case.**

Element	Symbol	Element	Symbol
Aluminium	Al	Gallium	Ga
Barium	Ba	Helium	He
Beryllium	Be	Lithium	Li
Bismuth	Bi	Neon	Ne
Bromine	Br	Silicon	Si
Cobalt	Co	Argon	Ar

3. If the first two letters of the names of elements are the same, then the symbol consists of first letter and second or third letter of English name that they do not have in common.

Element	Symbol	Element	Symbol
Argon	Ar	Calcium	Ca
Arsenic	As	Cadmium	Cd
Chlorine	Cl	Magnesium	Mg
Chromium	Cr	Manganese	Mn
Bromine	Br	Silicon	Si
Cobalt	Co		

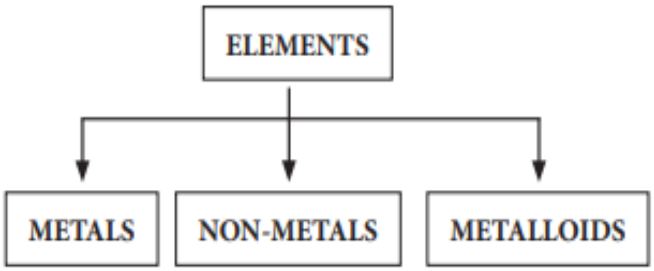
4. Some symbols are used on the basis of their old names or Latin name of an element. There are eleven elements.

Name of element	Latin Name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Iron	Ferrum	Fe

Name of element	Latin Name	Symbol
Copper	Cupurum	Cu
Silver	Argentum	Ag
Gold	Aurum	Au
Mercury	Hydrargyrum	Hg
Lead	Plumbum	Pb
Tin	Stannum	Sn
Antimony	Stibium	Sb
Tungsten	Wolfram	W

5. Some elements are named using name of country/scientist/colour/mythological character/planet.

Name	Symbol	Name Derived from
Americium	Am	**Am**erica (country)
Europium	Eu	**Eu**rope (country)
Nobelium	No	Alfred **No**bel (scientist)
Iodine	I	Violet (colour, Greek)
Mercury	Hg	God Mercury (mythologic character)
Plutonium	Pu	Pluto (planet)
Neptunium	Np	Neptune (Planet)
Uranium	U	Uranus (planet)



Property	Metal	Non Metal
Physical state at room Temperature	Usually Solid (Occasionaly liquid)	Solid, liquid or gas
Malleablity	Good	Poor-usually soft or brittle
Ductility	Good	Poor-usually soft or brittle
Melting point	Usually high	Usually low
Boiling point	Usually high	Usually low
Density	Usually high	Usually low
Conductivity (Thermal and electrical)	Good	Very poor

Physical properties of metals

1. **Physical state:**
Elements **cesium (Cs), rubidium (Rb), Francium (Fr) and Gallium (Ga)** become liquid at or just above room temperature.

2. **Hardness:**
Exception here is **sodium and potassium**, **Osmium** is so hard that it can scratch glass.

3. **Lustre:**
All metals are shiny
An exception is calcium.

4. **Density:**
Sodium and potassium have exceptionally low density.

5. **Melting point and boiling point:**
Sodium,potassium,mercury and gallium are exceptions.

6. **Tensile strength:**
Metals have the capacity to withstand strain without breaking.
Zinc, arsenic and antimony are exceptions.

7. **Malleability:**
Metals can be hammered into very thin sheets.

8. **Ductility:**
Metals can be drawn into thin wires.
Example: copper wires.

9. **Conductivity:**
Metals are good conductors of heat and electricity.
Silver and copper are very good conductors of electricity.
However, **bismuth and tungsten** are poor conductors.

10. **Sonorous:**
On being hit, metals produce a typical sound.

PHYSICAL PROPERTIES OF NON-METALS

1. **Physical state:**
liquids or gases at normal temperature;
for example sulphur, phosphorus occurs in solid state while bromine occurs in liquid state.

2. **Hardness:**
Non-metals are generally not hard except diamond.(a form of carbon)

3. **LUSTRE:**
Graphite and iodine are exceptions as they are shiny and lustrous.

4. **Density:**
NonMetals are generally soft and have low densities.
The exception here is diamond (a form of carbon)

5. **Melting point and boiling point**:
Nonmetals have low melting point and boiling point.
carbon, silicon and boron are exceptions.

6. **Tensile strength:**
Non-metals do not have tensile strength.
carbon fibre (a form of carbon) is as tensile as steel.

7. **Malleability:**
Non-metals are nonmalleable. If hammered, they form a powdery mass.

8. **Ductility:**
Non-metals are not ductile.
Carbon fibre is highly ductile.

9. **Conductivity:**
Non-Metals are generally bad conductor of electricity.
Graphite (a form of carbon) is exception.

10. **Sonorous:**
Non-Metals do not produce sound(non-sonorous) when hit

Uses of Metals

Mercury is used in thermometers and barometers because of its high density and uniform expansion at different temperature.
Aluminium is used in electrical wires, cables and in aerospace industries.
Lead is used in automobile batteries, X-ray machines.

Uses of Non-Metals

Sulphur is used in the manufacturing of gun powder and vulcanization of rubber.
Phosphorus is used in matches, rat poison etc.
Nitrogen is used for manufacturing ammonia.
Chlorine is used as a bleaching agent and in sterilizing water.
Hydrogen is used as a rocket fuel and hydrogen flame is used for cutting and welding purposes, as well as a reducing agent

Metalloids

The elements which exhibit the properties of metals as well as non-metals are called metalloids.

Examples: **boron, silicon, arsenic, germanium, antimony, tellurium and polonium.**

Physical properties of metalloids

Metalloids are all solid at room temperature.
1. They can form **alloys with other metals**

2. Some metalloids, such as **silicon and germanium, can act as electrical conductors** under the specific conditions, thus they are called semiconductors.

3. **Silicon** for example appears lustrous, but is not malleable nor ductile (it is brittle - a characteristic of some non metals). It is a much poorer conductor of heat and electricity than the metals

Uses of metalloids

1. **Silicon** is used in electronic devices .
2. **Boron** is used in fireworks and as a fuel for ignition in rocket.

USES OF ELEMENTS

Magnesium and Phosphorus used for making crackers.
Sulphur is used as manure in agriculture.
Gallium is used for making mobile phones
silicon is used for making computer chips.