

BORON FAMILY



ELECTRONIC CONFIGURATION



ns^2np^1
Valence
electrons = 3

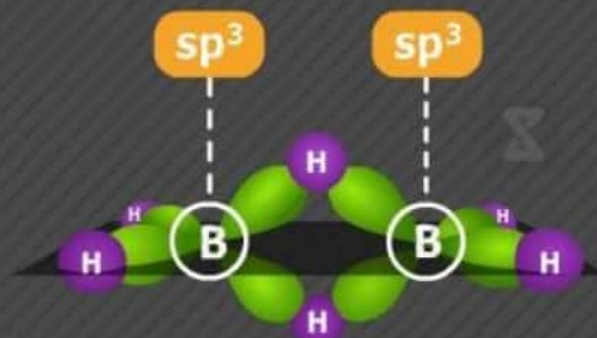
PHYSICAL STATE

Boron is a non metal.
Aluminium, Indium,
Gallium are metalloids.



Gallium has the **second lowest melting point** after mercury. It remains in liquid phase even at high temperatures.

DIBORANE (B_2H_6)



BH_3 is an electron deficient molecule. It has six electrons and a vacant orbital. So, it is used as an electrophile in organic reactions.

AMPHOTERIC


$Al(OH)_3$ is amphoteric



Strength between Al - O
and O - H is same.



Bond strength Al - O = Bond strength O - H



Aluminium is used in tins, aeroplanes and even in Iphone

Borax ($Na_2B_4O_7$) is used
for cleaning and washing
purposes.



Aluminium was classified as precious metal during 19th century. **Napoleon III** gave aluminium cutlery to his most valuable guests, all other guests had to eat with gold cutlery.



Indium is used in display
screens of television
and mobiles.



Thallium is used as rat
poison.



CARBON



Part-1

6 C 12.0107	14 Si 28.09	32 Ge 72.81	50 Sn 118.71	82 Pb 207.2
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FAMILY

**DO
you?
know?**

- Carbon is a non-metal
- Silicon and germanium are metalloid
- Lead and tin are metal

Carbon has three main solid state allotropes: **Graphite**, **Diamond** and **Fullerenes** (the most commonly known of which, **buckminsterfullerene**, is also known as a "bucky-ball").

Germanium



Germanium is a rare element used in the manufacturing of **semi-conductor** devices. The physical and chemical properties of germanium are very similar to those of silicon. Germanium is **grey-white** in color and forms crystal structures.

Silicon



Silicon is the second most common element in the earth's crust (after oxygen) and it is the backbone of the mineral world. Silicon is used extensively as a semiconductor in **solid-state** devices in the computer and microelectronics industries.

Tin



Tin is **malleable**, **ductile**, and **crystalline**. It is a superconductor at low temperatures. Tin reacts with bases, acid salts and strong acids. Tin chlorides are good reducing agents and often used to reduce iron ores. Tin fluoride is often the anticavity "**fluoride**" additive in toothpastes.

Lead



It is a soft, malleable metal with a low **melting point**. Lead is toxic to humans, especially children. Even low levels of exposure can cause nervous system damage and can prevent proper production of **haemoglobin**. Its oxides have many industrial uses as oxidizing agents, such as cathodes in lead-acid storage cells.

Point to Remember

Carbon has the highest melting/sublimation point of the elements. The melting point of diamond is **3550°C**, with the sublimation point of carbon is around **3800°C**



CARBON FAMILY

6
C
Carbon

14
Si
Silicon

32
Ge
Germanium

50
Sn
Tin

82
Pb
Lead

ELECTRONIC CONFIGURATION



Valence Electrons = 4

REACTIVITY

The carbon family elements tend to be fairly unreactive. The elements tend to form covalent compounds, though tin and lead also form ionic compounds.

CARBIDES

Carbon combines with other elements and forms carbides Al_4C_3 , Be_2C , SiC and B_4C are considered as the hardest compounds.



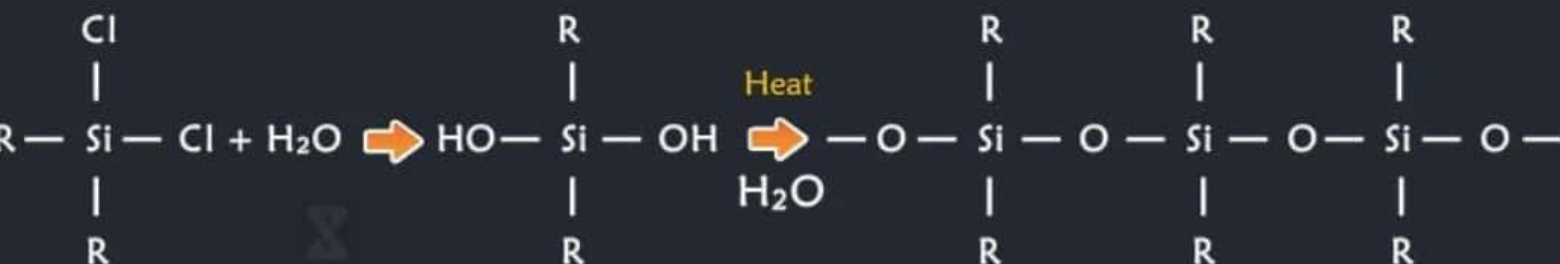
DON'T STORE JUICES IN TIN CONTAINERS

Generally juices have metallic taste if we store them in tin containers. Juices are mostly acidic and they react with tin. Tin reduces the acid by absorbing oxygen.



SILICONES

Silicones are organo silicon polymers and are formed by hydrolysis of R_2SiCl_2



Linear Silicones

CARBON-GODLY ELEMENT

Every human being and everything around us consists of carbon.



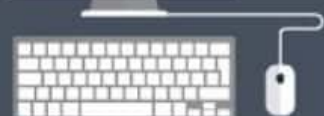
TIN-CANS

Initially we used Tin in making cans, later it was replaced by Aluminium.



SILICON

Silicon is used in semiconductor devices, which are used in modern day computers.



LEAD PENCILS

Lead Pencils which we use do not contain Lead. It contains Graphite (an allotrope of carbon).



NON STICK PAN

Nonstick pan has a Teflon layer on its surface. Teflon ($-\text{CF}_2-\text{CF}_2-$)



NITROGEN FAMILY

7
N
Nitrogen

15
P
Phosphorus

33
As
Arsenic

51
Sb
Antimony

83
Bi
Bismuth

ELECTRONIC CONFIGURATION



Valence Electron = 5

BORAZONE

Borazone (cBN) has graphite like structure and it is harder than diamond. So, it is used for cutting the diamond.



Half life of Bismuth is very high. If 100 gm of Bismuth had been present at the beginning of universe, 14 billion years ago. About 99.9999 gm would be left today.

INERT NATURE OF N_2 ($N \equiv N$)

Triple bond exists between Nitrogen, which is very hard to break. It reacts only when suitable conditions are met for reaction.

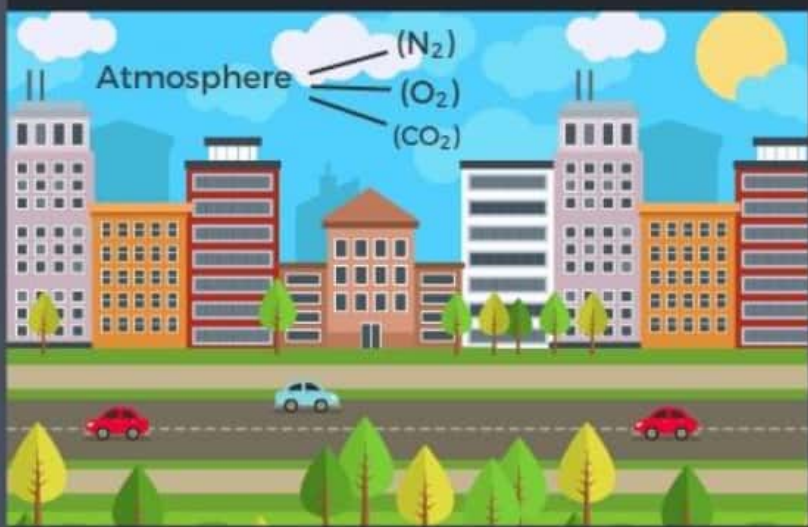


TEST OF PROTIENS

Nitric acid attacks the protien and forms Xanthoprotien which is yellow in colour.

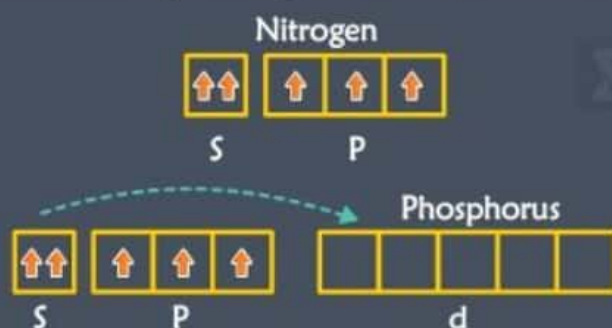


EARTH ATMOSPHERE CONTAINS 71% NITROGEN



PENTAHALIDES

Nitrogen does not show pentahalides because of the absence of d-orbitals. Phosphorous shows pentahalides by exciting s electrons into d-orbitals.



USES



TNT

Tri Nitro Toulene is used in explosives.



Arsenic is a poisonous gas therefore, it is used as pesticides for trees.

Red phosphorus is used in matchbox.



P_2O_5 is used as a drying agent, but it is corrosive to use outside the labs.



CHALCOGENS

8
O
Oxygen

16
S
Sulphur

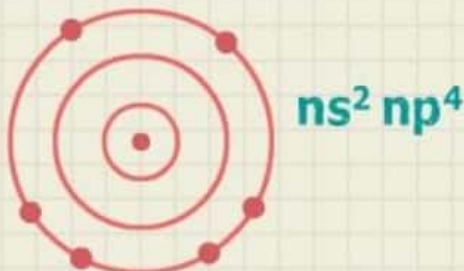
34
Se
Selenium

52
Te
Tellurium

84
Po
Polonium

116
Lv
Livermorium

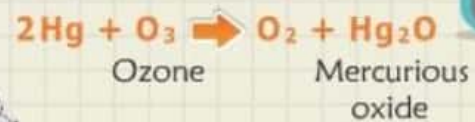
ELECTRONIC CONFIGURATION



Valence Electrons = 6

TAILING OF MERCURY

Mercury loses its meniscus and sticks to the glass due to formation of mercurous oxide.



OZONE LAYER (O₃)



Ozone layer is filled with ozone molecules.

Ozone is the **BEST OXIDISING AGENT**

REACTION WITH HYDROGEN

Hydrogen with Oxygen forms water (H₂O)

Hydrogen with sulphur forms H₂S which gives foul smell.



POLONIUM

Radioactive and deadly. It is rumoured that **Yasar Arafat** died due to poisoning of Polonium.

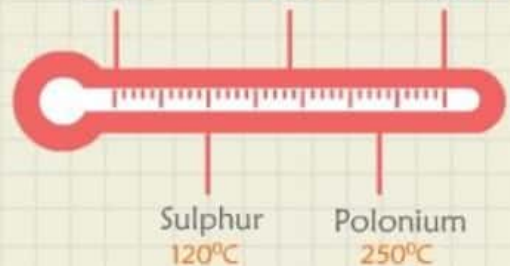
CAREFUL WITH H₂SO₄

H₂SO₄ is the strongest and most corrosive acid. It can cause serious burns on the skin.



MELTING POINT

Oxygen	Selenium	Tellurium
-219°C	221°C	450°C



SULPHUR

Sulphur is used in making Gun powder.



TELLURIUM

Tellurium is used in CD's and Blue-ray discs.



SELENIUM

Selenium is used in Glass making.



OXYGEN

Liquid oxygen is used as Rocket fuel.

HALOGENS

1 Physical State



3 REACTIVITY

Reactivity decreases down the group as it is harder to add electrons.

F is the most reactive



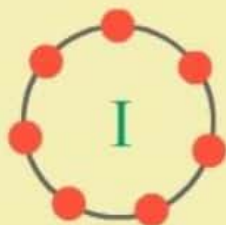
5 INTER HALOGEN

Halogens combine with each other to form series of compounds like



Large molecules can accommodate more halogens like in IF_7

Small fluorine can't accommodate many halogens like in FCl_3



7 VARIABLE OXIDATION STATES

Halogens exhibit variable oxidation states, starting from -1 to 7 .

Fluorine can't show positive oxidation state.

9 USES

Fluorine is used in Tooth Paste



Chlorine is used as a Bleaching Agent



Iodine is used in Disinfectants



Bromine is used for developing Photographic films



2 ELECTRONIC CONFIGURATION



They have **seven** valence electrons

GENERAL CONFIGURATION
 $ns^2 np^5$

4 ACIDITY



Acidity decreases down the group

HF is the strongest acid which can dissolve glass also.

6 CHLORINE IN WAR FARE

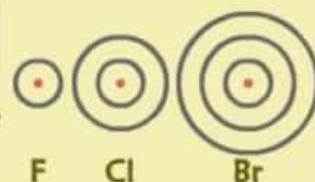


Germany used chlorine in world war-I against France.

Chlorine gas **destroys** respiratory organs.

8 ELECTRONEGATIVITY

Atomic size increases down the group, therefore electronegativity decreases down the group.



NOBLE GASES



Also known as **inert gases** as their atoms don't combine with other atoms in chemical reaction



First Noble Gas Compound - Xenon

Bartlett surprised every one by synthesising **XePtF₆**

Atomic Size

Size increases as you go down the group.



He Xe Kr



Helium

Helium is used in **ballons**. Initially hydrogen was used which is much lighter than Helium but due to its **flammability**, we shifted to **Helium**.



Electronic Configuration

These elements have **8 electrons** in valence orbital which is considered stable.

Exception : Helium has two valence **electrons**

General electronic configuration



Krypton

Light bulb containing **krypton gas** can produce a bright white light useful for photography and runaway **lights**.

Neon Light

Neon Lights which we use in our streets are produced by **ionising inert gas** by applying voltage.



Argon

Do you know?

There are 22 known isotopes of argon ranging from **argon-31** to **argon-51** and **argon-53**.

Reactivity of Xenon

1 Xenon acts as fluorinating agent



2 Xenon acts as fluoride acceptor



3 Xenon acts as fluorine donar



Radon

Radon is radioactive and can enter homes through basements after **radioactive** decay of rocks below the **earth**.