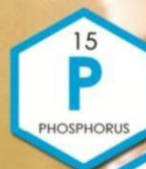


ELEMENTARY BOOK ON

REPRESENTATIVE

ELEMENTS



SYEDAH NOOR UL SABAH ANDRABI

Elementary Book on
Representative Elements

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Elementary Book on Representative Elements

Syedah Noor Ul Sabah Andrabi

*Dedicated to
my children*

Toiba

Amber

Waheed

Acknowledgements

First of all I would like to thank Almighty for letting me go through .I am highly thankful to my husband who is always there in the corner pushing me when I am ready to give up. I would also like to thank my worthy colleagues Dr.Nuzhat Gull and Mrs. Rukhsana who helped me at each and every moment.

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01

HYDROGEN

Classification	Hydrogen is a considered as a non-metal.
Colour	Colourless
Atomic Number	1
Atomic Weight	1.0089 amu
State	Gas
Melting Point	-259.14 °C, 14.01 K
Boiling Point	-252.87 °C, 20.28 K
No of protons	1
No of electrons	1
Electronic configuration	1s ¹
No of neutrons	0
Density@20°C	0.0000899 g/cm ³

Harmful effects

Hydrogen as such isn't harmful however being highly inflammable and with almost invisible flame it can lead to accidental burns.

Characteristics

Hydrogen is the first and the lightest of all the elements of the periodic table. It's the most abundant element in the universe. The most common isotope of hydrogen consists of one proton, one electron and no neutrons. It is the only element in the periodic table that can exist without neutrons.

At standard temperature and pressure, hydrogen exists as diatomic molecule (H₂), odourless and colourless gas.

Occurrence

Hydrogen is present on the earth's surface mostly in the form of water. There is little amount of free hydrogen on Earth because hydrogen is so light that it is not held by the planet's gravity. Any hydrogen that forms eventually escapes from the atmosphere into space.

Hydrogen can be liquefied by applying high pressures on it.

Uses of Hydrogen

- Hydrogen is used in large quantities for the preparation of ammonia {Haber's process}
- Hydrogen is used for hydrogenation of fats and oils, production of methanol, hydro cracking and hydrodesulphurization*
- Refining of metal can be done by using hydrogen.
- Liquid hydrogen is used as rocket fuel.
- Heavier isotopes of hydrogen (deuterium and tritium) are used in nuclear fusion.
- Hydrogen can be used as a substitute for hydrocarbon energy (oil, gas and coal). This is because of the fact that combustion of hydrogen with oxygen produces energy and the only by product formed during this process is water making it more eco friendly source.

(*Hydro-de-sulfurization: Is defined as a catalytic chemical process which is widely used to remove sulphur compounds from refined petroleum products such as gasoline or petrol, jet fuel, diesel fuel and fuel oils.)

Source

Preparation of hydrogen on commercial scale is done by reacting superheated steam with methane or carbon. Lab preparation of hydrogen can be done by the action of acids on metals such as Zn or Mg or by the electrolysis of water.

Isotopes

There are 3 isotopes of hydrogen.

1. Protium H^1
2. Deuterium H^2
3. Tritium H^3

Out of the three isotopes of hydrogen the most abundant isotope is Protium and the least abundant is tritium. Tritium is the most unstable isotope with a half life of about 12 years and 4 months. Deuterium and tritium are used for nuclear fusion.

* * * * *

02

HELIUM

Classification:	Helium is the first member of 18 th group.
Color:	colorless
Atomic number	2
Atomic weight:	4.00260 amu
State:	gas
Melting point:	-272.2 °C, 0.95 K at 25 atm pressure. Helium doesn't solidify at normal atmospheric pressure.
Boiling point:	-268.9 °C, 4.2 K
Electrons:	2
Protons:	2
Neutrons in most abundant isotope:	2
Electronic distribution	2
Electron configuration:	1s ²
Density @ 20°C:	0.0001787 g/cm ³

Harmful effects

Helium being inert isn't considered to be toxic.

Characteristics

Helium is considered to be monatomic inert gas. It is light, colourless and odourless. At temperatures close to absolute zero helium can form diatomic molecules. Helium doesn't exist as solid under normal

conditions however at elevated atmospheric pressures ~ 25 atm it can solidify. Melting point of solid helium is very low.

Unlike any other element, helium does not solidify but remains a liquid down to absolute zero (0 K) under ordinary pressures.

The voice of someone who has inhaled helium temporarily sounds high-pitched.

Uses of Helium

- Helium is used to cool super conducting magnets of MRI scanner.
- Helium is used to increase the pressure of liquid fuel in rockets.
- Divers and the people working under high pressure use mixture of helium and oxygen for breathing.
- In order to prevent the reaction of hot metal welds with atmospheric oxygen during welding process, helium is used as an inert barrier.
- During the growth of silicon and germanium crystals, helium is used to provide inert atmosphere in semiconductor industries.
- Helium is used as a carrier gas in gas chromatography.

Source

Helium is present in trace amounts on earth's crust. It is the second most abundant element in the universe after hydrogen. Main source of helium on earth's crust is the radioactive decay of uranium and thorium. On large scale helium is obtained by carrying the fractional distillation of natural gas which contains about 7% helium.

Isotopes

Helium has 8 isotopes with known half lives. Their mass numbers range between 3 and 10. Naturally occurring helium is a mixture of its two stable isotopes:

He (3)	0.0001%
and He (4)	99.999%

* * * * *

03

LITHIUM

Classification	Lithium is the first member of group first of the periodic table.
Colour	Silvery white
Atomic No	3
Atomic weight	6.941 amu
State	Solid
Melting point	180.54° C 453.69 K
Boiling Point	1347° C 1615 K
Electrons	3
Protons	3
Neutrons in most abundant isotope	4
Electron Configuration	$1s^2 2s^1$
Density @20° C	0.53g/cm ³

Harmful effects

Lithium metal is considered as corrosive metal. It may cause skin burns due to the formation of lithium hydroxide. Lithium may cause birth defects i.e why women who are taking lithium carbonate for the treatment of bipolar disorder are advised to minimize their dose during pregnancy.

Characteristics

Lithium is considered as the least dense metal. It is soft and silvery white in colour. Lithium doesn't occur freely in nature because of its

high reactivity. Freshly cut surfaces of lithium get tarnished because of its oxidation with air leading to the formation of black oxide. It reacts with nitrogen at room temperature to form lithium nitride. Specific heat capacity of lithium is very high and as such it exists as a liquid over a wide range of temperatures. It burns with a crimson flame which turns white when the metal burns completely.

Uses of Lithium

- Lithium metal is used in rechargeable lithium ion batteries in its pure form.
- An alloy of lithium with aluminium, copper, manganese and cadmium is used to make high performance aircraft parts.
- It is used as a coolant in nuclear breeder reactors.
- It acts a source of tritium. Lithium when bombarded with neutrons produces tritium.
- Carbonate of lithium is used as a mood-stabilizing drug.
- Chloride and bromide of lithium are used as desiccants.

Source

Lithium being highly reactive doesn't occur free in nature, however it occurs in the form of salts in minerals and in small amounts in ores from igneous rocks. Pure lithium can be obtained by carrying the electrolysis of fused LiCl & KCl.

Isotopes

It has been found that lithium has 7 isotopes with known half lives. The mass numbers of these isotopes range between 5 and 11. In its native form lithium is considered to be comprised of two isotopes with natural abundances of :

Li-7	92.4%
Li-6	7.6%

* * * * *

ELEMENTARY BOOK ON REPRESENTATIVE ELEMENTS

This Book Gives A Peep Into The

1. Physical Characteristics
2. Harmful Effects.
3. Applications/Uses
4. Abundance
5. Isotopes

of Representative Elements of Periodic Table.



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