

LESSON NOTES

Year/Level: 11 C/D

week 21

Subject: Chemistry

Strand	4 Materials
Sub Strand	4.1 metals and non-metals
Content Learning Outcome	Discuss the physical and chemical properties and uses of selected non-metals. List the allotropes of sulphur, carbon, phosphorous, oxygen and explain their properties.

NON-METALS

- Hydrogen, Neon gases, Groups 4 – 7 elements are non-metals. These elements are generally, dull, brittle solid and non-conductors of electricity
- Some are solids, others are gases and bromine is a liquid at room temperature.
- Some non-metals may form allotropes. That is, it exists in more than one physical form.

Element	State	m.pt (°C)	b.pt (°C)	Density (gcm ⁻³)	Conductivity
Hydrogen, H ₂	Colourless Gas	- 259.16	- 252.879	0.08988	Non conductor
Oxygen, O ₂	Colourless Gas	-218.4	-183.0	1.429	Non conductor
Nitrogen, N ₂	Colourless Gas	-209.9	-195.8	1.2506	Non conductor
Chlorine, Cl ₂	Green Gas	-100.98	-34.6	3.214	Non conductor
Neon	Gas	-248.6	-246.1	0.901	Non conductor
Bromine, Br ₂	Red Liquid	-7.2	58.78	3.119	Non conductor
Phosphorus	White Solid	44.1	280.0	1.82	Non conductor
Sulphur	Yellow Solid	112.8	444.6	2.07	Non conductor
Carbon (graphite)	Black Solid	3500	4827	2.62	Conductor

Sulphur (S₈)

Uses- making sulphuric acid, vulcanizing rubber, preventing growth of fungus

Industrial preparation- extracted from ground by the Frasch process

Reaction with water- Sulphur is a non-polar solid so it is insoluble in water. Balls of plastic sulphur are readily formed by pouring liquid sulphur into cold water.

Allotropes of Sulphur

1. Rhombic Sulphur

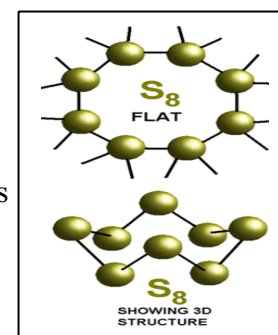
It is the most common form of sulphur. A yellow, odourless, and brittle solid that burns readily in air with a blue flame.

2. Monoclinic Sulphur

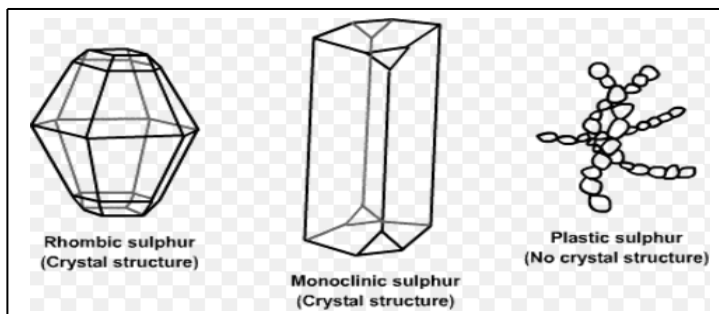
When rhombic sulphur is slowly heated to a temperature above 94.5°C, it will change to needle like allotropes called monoclinic.

3. Plastic Sulphur

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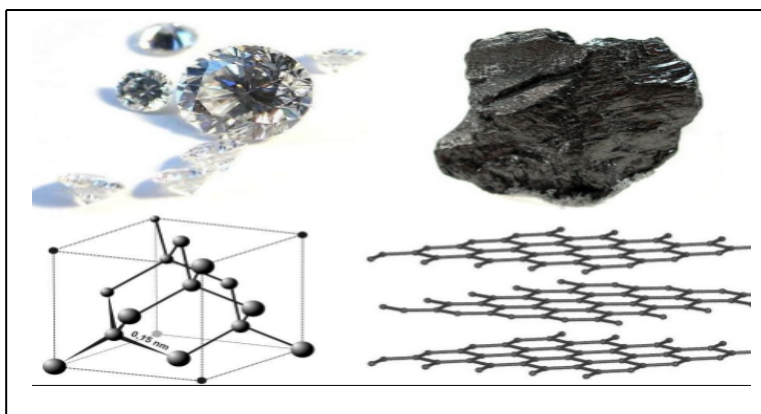


It is a non-crystal form of sulphur formed by pouring liquid sulphur into cold water. It has a texture similar to rubber.



Allotropes of Carbon

	Diamond	Graphite
Formula	C	C
Appearance	Hard, Transparent colorless solid	Soft, black solid
Melting and boiling point	3550/ 4827°C	3720°C
Uses	Jewellery and industrial cutting tools	Lubricant, pencil lead, electrolysis electrodes
Industrial preparation	Heating graphite under high pressure	Incomplete combustion of methane



Common uses of Carbon

- ✓ Is the basis of fuels such as coal and oil since both coal and oil are rich in **carbon**.
- ✓ as graphite is a good lubricant
- ✓ Is a key component of steel


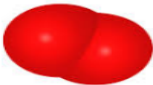
Traditional uses of Carbon

- Used as cook stoves i.e. for cooking
- Paint body in traditional Fijian ceremonies
- Used in jewelleryes (diamond)

Phosphorous (P₄)

- Allotropes- white and red phosphorous (network) is a rusty red solid
- Mpt/bpt: 44°C/ 280°C
- Used for making matches
- Industrial prep- heating phosphate rocks in presence of carbon

Oxygen and Ozone

	Oxygen	Ozone
Formula	O ₂	O ₃
Appearance	Colourless gas	Colourless gas with sharp smell
Melting and boiling point	-219 °C/183 °C	
Uses	Making steel, welding torches, in hospitals for breathing	Killing bacteria in water, ozone in the stratosphere absorbs UV light 
Laboratory preparation	Heating potassium permanganate	
Industrial preparation	Fractional distillation of liquid air 	

Activity

(1) Sulphur is the primary source in the production of sulphuric acid, which is one of the world's most widely used chemical.

- (i) Sulphur has many allotropes. Name any **two** allotropes of sulphur and describe their structures.

- (ii) State **one** use of sulphur in agriculture.

2.The element O, has two allotropes; O₂ and O₃.

i.Name the **two** allotropes.

ii.Which of these allotropes protect the earth from harmful ultraviolet rays from the sun?
