

**WORKSHEET 20****School:** Ba Sangam College**Year:** 11**Subject:** Chemistry**Name:**

<b>Strand</b>	<b>5 – Environmental Chemistry</b>
<b>Sub strand</b>	<b>5.1- Air and Air Pollution</b>
<b>Content Learning Outcome</b>	- Investigate and show how oxygen, carbon dioxide and water vapour are detected. - Describe the extraction, preparation and uses of some gases.

**Air as a Mixture**

Air is a mixture of gases. Most of it – 78% is nitrogen.

**The table below shows the percentage composition of gases in the air.**

Gas	Percentage (%)
Nitrogen	78
Oxygen	21
Argon	1
Carbon dioxide	0.04
Neon, Krypton, Xenon, Water Vapour	Very small amounts

**Detection of Gases****1. Oxygen**

Oxygen is detected by lighting a wooden splint, blowing it out and then placing it into the gas you think might be oxygen. If oxygen is present, the splint will burst into flames again.

**2. Carbon dioxide**

You can test a gas to see if it is carbon dioxide by using limewater. Limewater is a solution of calcium hydroxide in water. When carbon dioxide is mixed with lime water, calcium carbonate (chalk) is formed. This is not soluble in water, so it makes the limewater look cloudy (milky).

**3. Water Vapour**

A cold trap is used to detect water vapour in the air.

A cold trap is a U-tube that is immersed in a container of ice and salt. The salt makes the ice melt at a temperature lower than 0°C. When air

passes through the U-tube it freezes the water vapour in the air and this can be seen.

**Bunsen and Candle Flame**

The table below shows the differences between bunsen and candle flame.

Bunsen Flame	Candle Flame
<ul style="list-style-type: none"> <li>Burns with complete combustion.</li> <li>Produces heat but not much light.</li> <li>Blue flame.</li> </ul>	<ul style="list-style-type: none"> <li>Burns with incomplete combustion.</li> <li>Produces light but not much heat.</li> <li>Yellow flame.</li> </ul>

**Air in Industry**

Vast quantities of air are separated to provide us with pure nitrogen, oxygen, argon etc. The air is first liquefied and then fractionally distilled.

**Note:**

**-Liquefaction** – Is when air is changed to a liquid by compressing it and making it very cold.

**-Fractional distillation** – Separates liquids on the basis of their boiling points.

**The table below shows the boiling points and uses of gases**

Name	Formula	Boiling point (°C)	Uses
Oxygen	O <sub>2</sub>	-183	Hospitals, welding, steel industry
Nitrogen	N <sub>2</sub>	-196	Packaging food, refrigerants
Helium	He	-269	Inflating balloons
Neon	Ne	-246	Filling coloured tube lights
Argon	Ar	-186	In incandescent light globes, welding, radio valves, electrical rectifiers

**Air Pollution**

In densely populated areas and particularly in large cities, often air contains many harmful substances. It is polluted. Air pollution may be due to smoke and/or poisonous gases.

**The table below shows the effect of air pollutants**

Pollutant	Symbol	Source	Effects
<b>Sulphur dioxide</b>	SO <sub>2</sub>	Incineration of garbage, motor vehicles, power plants, metal smelters, petroleum refineries.	Irritant to the eye and respiratory tract, causes acid rain, retards the formation of chlorophyll in plants.
<b>Nitrogen oxides</b>	NO, NO <sub>2</sub> , N <sub>2</sub> O	Motor vehicles, planes	Produces smog, harmful to the respiratory system.
<b>Carbon dioxide</b>	CO <sub>2</sub>	Motor vehicles, industries, deforestation	Contributes to enhanced greenhouse effect
<b>Carbon monoxide</b>	CO	Motor vehicles, wood fires	Causes dizziness and weakness, stops blood from carrying oxygen
<b>Chlorofluoro – carbons</b>	CFCs	Aerosols, air conditioners, and refrigeration systems, fast – food cartons	Destroys ozone layer
<b>Ozone</b>	O <sub>3</sub>	Secondary pollutant from automobiles	Harms lungs, destroys trees
<b>Dust</b>		Industries, motor vehicles	Irritates eyes and lungs

**Note:**

**-Primary pollutant** – Is a pollutant that is directly released into the air e.g. from motor vehicles.

**-Secondary pollutant** – Is a pollutant that forms in the air from chemical reaction between primary pollutants.

**Oxygen**

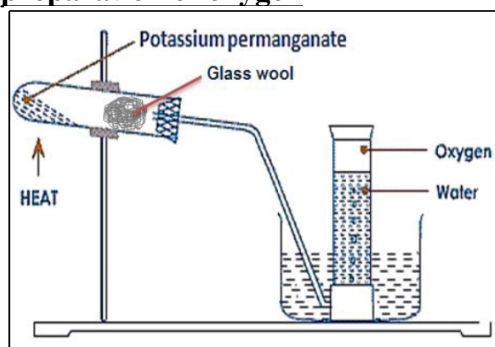
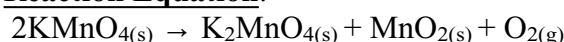
21% of air is made up of oxygen. Oxygen is slightly soluble in water hence able to sustain aquatic life. It also helps things to burn (combustion). Oxygen is a colourless and odourless gas.

**Test for oxygen**

Oxygen re-lights a glowing splint.

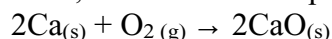
**Laboratory preparation of oxygen**

Oxygen can be prepared in the laboratory by heating potassium permanganate.

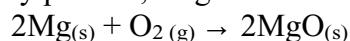
**Experimental set-up for the laboratory preparation of oxygen****Reaction Equation:****Combustion of selected elements**

1. **Calcium** – burns with a bright flame. A white

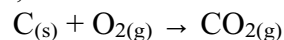
powder, calcium oxide is produced.



2. **Magnesium** – burns with a bright white flame. A grey powder, magnesium oxide is produced.



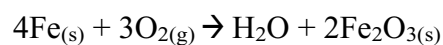
3. **Carbon** – glow red and produces a colourless gas, carbon dioxide.



4. **Wood and Paper** – burns with a yellow flame. A greyish white powder, ash is produced.

**Rusting**

The red-brown deposits on steel and iron is called rust. Rust is iron oxide (Fe<sub>2</sub>O<sub>3</sub>). Oxidation of iron causes rusting; a process where iron combines with oxygen to form rust.



Rust forms when iron is exposed to both water and oxygen and can be prevented by painting, oiling and electroplating.

**Ozone Layer**

The layer of ozone (O<sub>3</sub>) in the stratosphere is very useful. It protects the earth from the harmful ultra-violet light of the sun. Ozone layer is damaged by the substances known as CFC's which are used in refrigerators, air conditioners, foam packaging, spray cans as well as cleaning solvents. Discharge of nitrogen oxide (NO) from planes also destroys the ozone layer. Depletion of ozone layer can lead to cell damage causing mutations and skin cancer and slow growth of crops.

**Exercise**

- Which one of the following air pollutants produces smog?
  - Dust
  - Ozone
  - Carbon dioxide
  - Nitrogen oxide
- State **one** difference between a candle flame and a bunsen flame. **(2 marks)**


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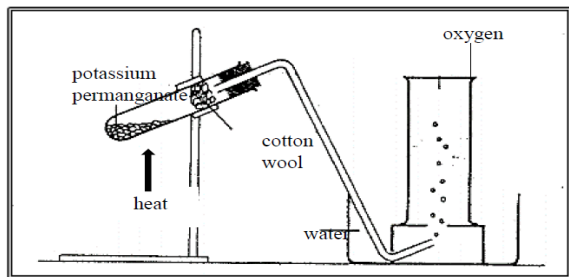
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- State **one** effect of chlorofluorocarbon (CFC) on the ozone layer. **(1 mark)**


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- The diagram given below shows the apparatus which can be used to prepare oxygen gas in the laboratory.

3.



(i) State the purpose of placing the cotton wool in

the test-tube containing potassium permanganate.  
(1 mark)

(ii) State how students would **prove** that the gas  
produced is oxygen.  
(2 marks)