



WORKSHEET 17

School: Ba Sangam CollegeYear: 11Subject: Chemistry

Name: _____

Strand	4 - Materials
Sub strand	4.2 Oxides of Metals and Non-Metals
Content Learning Outcome	-State the sources and properties of the oxides found in the atmosphere. -Conduct an experiment to prepare and test a sample of oxide gas. -Describe the effect of carbon monoxide on human beings.

Sources of carbon dioxide

Carbon dioxide gas (CO₂) is produced from:

1. Naturally by decomposition of dead plants and animals, respiration in all living organisms and volcanic eruption.
2. Combustion or burning of fossil fuels in cooking, vehicles and other machines, forest fire and any other fire, fermentation from microorganisms and brewery factories, and industrial processes like cement making.

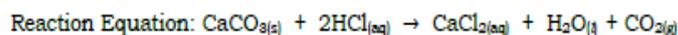
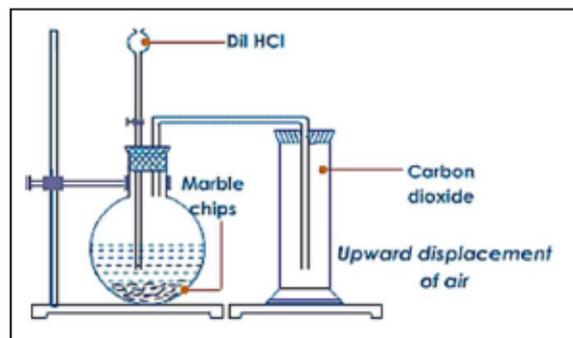
Effect of CO₂ gas on the Environment

- Carbon dioxide gas is used up by plants for photosynthesis. Too much of it is not good for the environment as it accumulates in the atmosphere and forms a layer.
- This shields the atmosphere and it reflects the heat back to earth. This increases the earth's temperature and causes the ice in the polar regions to melt.
- The sea level rise threatens the livelihood of coastal island people. This is called the Green House Effect.

Preparation of carbon dioxide

-Carbon dioxide gas can be prepared by adding dilute hydrochloric acid to calcium carbonate or marble chips.

Note: Instead of calcium carbonate, other metal carbonates can also be used.

Laboratory preparation of carbon dioxide gasSources of sulphur dioxide

Sulphur dioxide gas (SO₂) is produced from:

1. Industrial activity that processes materials that contain sulphur. For example, the generation of electricity from coal, oil or gas that contains sulphur.
2. Mineral ores also contain sulphur such as pyrite (Fe₂S) and galena (PbS) and sulphur dioxide is released when they are processed.
3. Industrial activities that burn fossil fuels containing sulphur can be important sources of sulphur dioxide.
4. Motor vehicle emissions contain sulphur dioxide as the result of fuel combustion.

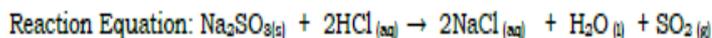
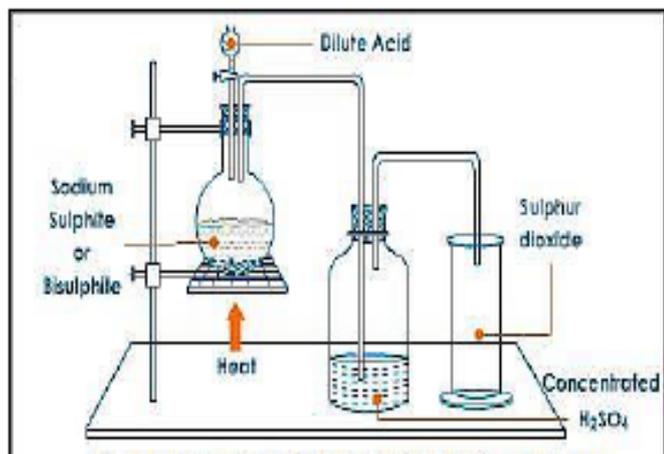
Effect of SO₂ gas on the environment

- Sulphur dioxide gas reacts with water vapour in the atmosphere to form sulphurous acid.
- This acid falls with rain as acid rain and is harmful to the plant growth and animal survival.

Preparation of Sulphur dioxide

Sulphur dioxide can be prepared by adding dilute acid to sodium sulphite or Bisulphite.

Laboratory preparation of sulphur dioxide



Comparison of CO₂ and SO₂

Properties	Carbon dioxide	Sulphur dioxide
Colour	Colourless	Colourless
State	Gas	Gas
Density	1.97 kgm ⁻³	1.43 kgm ⁻³
Reaction with water	Heavier than air ($\rho = 1.29 \text{ kgm}^{-3}$) so can be collected by upward displacement of air. $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$	Heavier than air so can be collected by upward displacement of air. $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$
Reaction with sodium hydroxide	$2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$	$2\text{NaOH} + \text{SO}_2 \rightarrow \text{Na}_2\text{SO}_3 + \text{H}_2\text{O}$
Effects on wet litmus paper	Turns damp blue litmus paper red showing acidic property.	Turns damp blue litmus paper red showing acidic property.
Test	Bubble CO ₂ gas in limewater, it turns milky.	Freshly made orange potassium dichromate solution turns green.
Uses	In carbonated beverages. Fire Extinguishers	Sulphur dioxide is a reducing agent and is used for bleaching and as a fumigant and food preservative.

Carbon monoxide (CO)

-Carbon monoxide is produced by the incomplete combustion of fuel.

-It is harmful to the body as it causes blood poisoning.

-This happens when the blood carries carbon monoxide gas instead of the oxygen needed by the body cells for the energy releasing process (respiration).

Poisonous nature of CO

-CO binds very strongly to the iron in haemoglobin (red blood pigment that carries oxygen).

-Once carbon monoxide attaches, it is very difficult to be released.

-If one breathes in carbon monoxide, it sticks to the haemoglobin and takes up all of the oxygen binding sites.

-As a result, the blood loses all of its ability to transport oxygen, hence a person suffocates.

-Prolonged exposure to fresh air (or pure oxygen) is required for the CO-tainted haemoglobin (carboxy-haemoglobin) to clear.

-Since CO binds to haemoglobin so strongly, a person can be poisoned by carbon monoxide

even at very low concentrations if exposed for a long period of time.

-Carbon monoxide is produced by cars, gas appliances, wood stoves and cigarettes.

Exercise

1. Write an equation to show how these gases can be produced in the laboratory using the reagents given. Also give one way in which you can test for the presence of these gases.

i. Carbon dioxide - from CaCO_3 and HCl

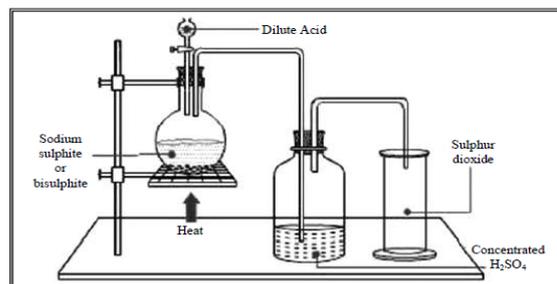
(1 mark)

ii. Sulphur dioxide - from Na_2SO_3 and HCl

(1 mark)

2. Describe the effect of carbon monoxide on human beings. (2 marks)

3. Sulphur dioxide can be produced in the laboratory by the action of dilute acid on sodium sulphites or bisulphites, as illustrated in the figure below. Answer the questions that follow.



(i) Describe the method that is used to collect sulphur dioxide in this experiment. (1 mark)

(ii) Describe a test for sulphur dioxide in the above experiment. (1 mark)

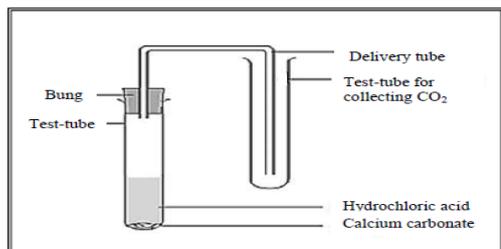
4. Carbon monoxide is colourless, odourless, tasteless, yet a highly poisonous gas.

(i) Describe the most common source of carbon monoxide in the environment. (1 mark)

(ii) Explain how carbon monoxide poisoning is caused in human beings. (1 mark)

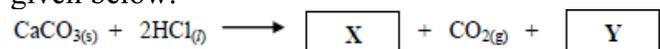
5. The diagram given below shows the set-up for the preparation of carbon dioxide gas.

Use this diagram to answer the questions that follow.



(i) Why is carbon dioxide gas collected by upward displacement of air? **(1 mark)**

(ii) Identify the products **X** and **Y** in the equation given below:



(1 mark)