

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

## Chemistry of Gases Guided Notes - Student Edition

### The Nature of Gases

The particles in a gas move around \_\_\_\_\_ and at \_\_\_\_\_. These particles are spread out which makes gases light with no fixed \_\_\_\_\_ or \_\_\_\_\_. Gas particles can exist as independent atoms e.g., \_\_\_\_\_ and argon or as molecules, which are \_\_\_\_\_ of atoms chemically bonded together, e.g., \_\_\_\_\_ gas. There are three main gases that you will learn about in this lesson:

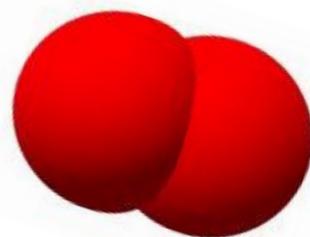
1. Oxygen gas
2. Hydrogen gas
3. Carbon dioxide gas

### Oxygen Gas

Oxygen is a clear, \_\_\_\_\_ gas which is essential to almost all living things. It is used by cells for aerobic respiration – the breakdown of \_\_\_\_\_ to release energy. Oxygen gas is found in our \_\_\_\_\_ and is produced by plants through \_\_\_\_\_. It exists as molecules of \_\_\_\_\_ oxygen atoms bonded together (\_\_\_\_\_).

#### Properties of Oxygen Gas

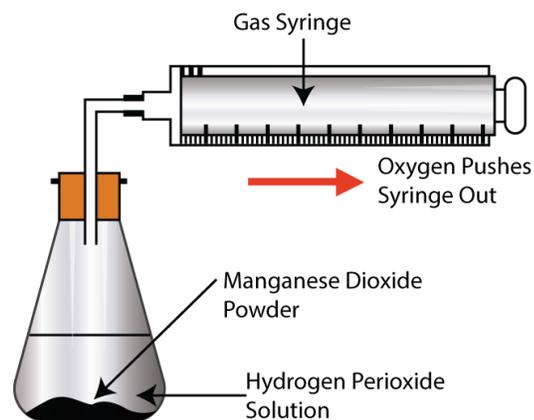
<b>Color:</b>	Transparent/ colorless
<b>Smell:</b>	Odorless
<b>Density:</b>	1.15 g cm <sup>-3</sup>
<b>Boiling point:</b>	-183°C
<b>Melting point:</b>	-218°C
<b>% in atmosphere:</b>	21%
<b>Solubility in water:</b>	Slightly soluble



*Oxygen (O<sub>2</sub>) molecule*

### Making Oxygen Gas

Oxygen can be made in the lab by breaking down the compound hydrogen \_\_\_\_\_ (found in bleach products) into oxygen and water. This requires the catalyst manganese dioxide to \_\_\_\_\_ the reaction. The equipment setup for this reaction is shown in the diagram to the right.

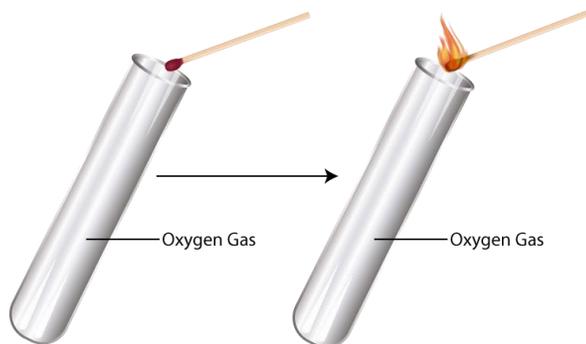


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### Testing for Oxygen Gas

The presence of oxygen gas can be detected using the \_\_\_\_\_ test.

1. Light a splint and then blow it out carefully so that it is \_\_\_\_\_ (not completely extinguished).
2. Place the splint over the \_\_\_\_\_ of the test tube that the gas has been collected in.
3. If the splint relights, it confirms that \_\_\_\_\_ gas is present.



### Hydrogen Gas

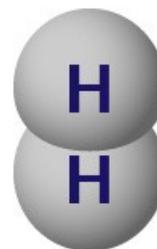
Hydrogen gas is the \_\_\_\_\_ gas on the periodic table. It is odorless and colorless. Like oxygen, it exists as a molecule of \_\_\_\_\_ atoms (\_\_\_\_\_). Hydrogen is highly combustible (\_\_\_\_\_ ) and can even be explosive in some situations. The Hindenburg (pictured right) is one such example, filled with 7 million cubic feet of hydrogen gas, it is thought to have exploded due to a gas leak and an atmospheric electrical discharge. Hydrogen can also react with \_\_\_\_\_ to produce a large amount of heat and \_\_\_\_\_ vapor.



*Zeppelin the Hindenburg on fire at the mooring mast of Lakehurst, USA - 6 May 1937.*

#### Properties of Hydrogen Gas

<b>Color:</b>	Transparent/ colorless
<b>Smell:</b>	Odorless
<b>Density:</b>	0.07 g cm <sup>-3</sup>
<b>Boiling point:</b>	-252°C
<b>Melting point:</b>	-259°C
<b>% in atmosphere:</b>	0.000005%
<b>Solubility in water:</b>	Insoluble



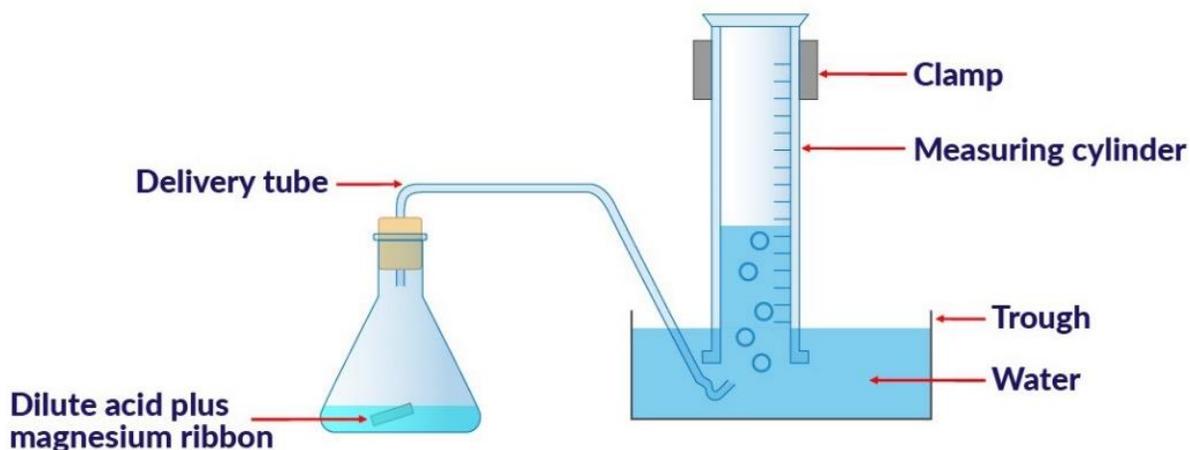
*Hydrogen (H<sub>2</sub>) molecule*

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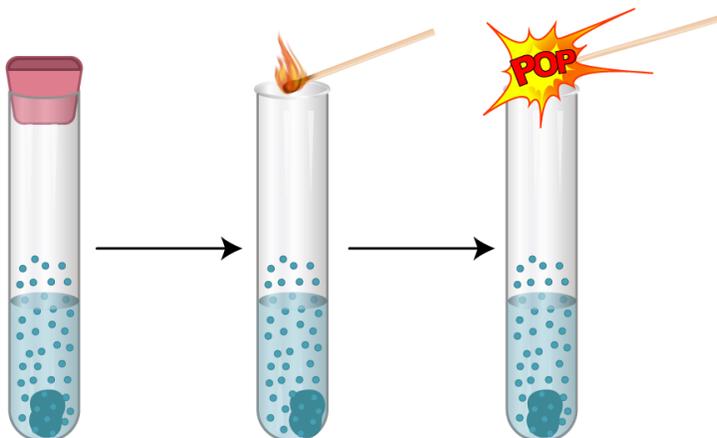
### Making Hydrogen Gas

Hydrogen can be made in the lab when dilute \_\_\_\_\_ acid is added to a reactive metal such as \_\_\_\_\_ or zinc. The fizzing that is observed are \_\_\_\_\_ gas bubbles.



### Testing for Hydrogen

The presence of hydrogen gas can be detected by placing a \_\_\_\_\_ splint into the mouth of a test tube containing hydrogen. If hydrogen gas is present a loud squeaky \_\_\_\_\_ sound will be heard.



### Carbon Dioxide Gas

Carbon dioxide is also colorless and odorless. Unlike oxygen and hydrogen however, this gas does not support burning which is why it is used in \_\_\_\_\_. Carbon dioxide exists as molecules of two \_\_\_\_\_ atoms bonded to a single \_\_\_\_\_ atom ( $\text{CO}_2$ ). Carbon dioxide

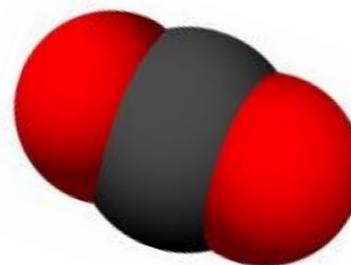
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is produced by all living things as a \_\_\_\_\_ product of cellular respiration. It is also produced when fuels such as oil, gas and wood are burnt. This is known as a \_\_\_\_\_ reaction.

### Properties of Carbon Dioxide Gas

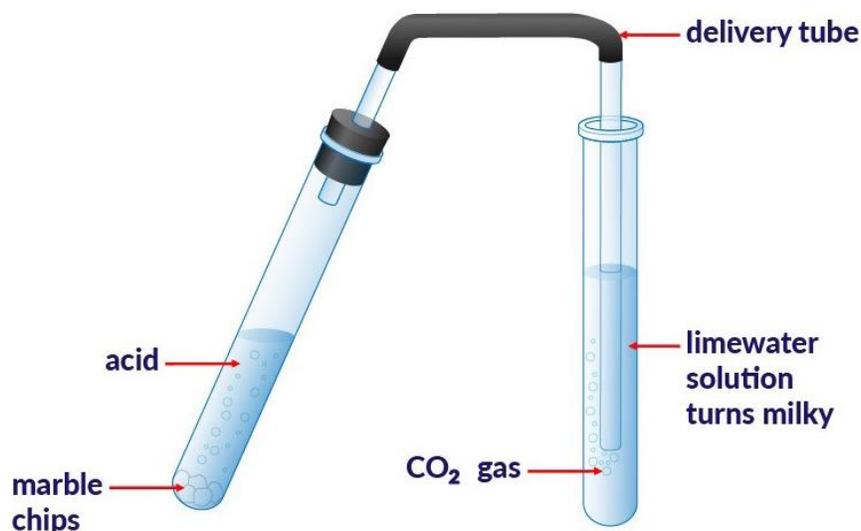
<b>Color:</b>	Transparent/ colorless
<b>Smell:</b>	Odorless
<b>Density:</b>	$1.55 \text{ g cm}^{-3}$
<b>Boiling point:</b>	Sublimes
<b>Sublimation point:</b>	$-79^\circ\text{C}$
<b>% in atmosphere:</b>	0.035%
<b>Solubility in water:</b>	Moderately soluble



*Carbon dioxide (CO<sub>2</sub>)  
molecule*

### Making and Testing for Carbon Dioxide Gas

The test for carbon dioxide is known as the \_\_\_\_\_ and is shown below:



Calcium carbonate (marble) chips are added to \_\_\_\_\_ hydrochloric acid. These react to release carbon dioxide gas which, when collected and bubbled into limewater solution, turns it from \_\_\_\_\_ to \_\_\_\_\_ white.