

		
	<p style="text-align: center;"><b>CHANGING FOR CLIMATE CHANGES</b></p>	

8 small experiments to experience the science behind climate changes.

## Experiment 1: Rising sea levels

### 1. INTRODUCTION

Because of global warming, we are getting higher temperatures. This gives consequences on land (greater droughts, melting glaciers, ...). But are there also consequences for our seas and oceans?

### 2. ORIENTATION

What is the influence of the increase of temperature on the sea level? Does it go up, down, or stay still?

### 3. PREPARATION

#### 3.1. Materials:

- 1 glass water bottle
- a small Play-Doh ball
- a straw
- a glass bowl
- a jug of hot water

#### 3.2. Method:

- Fill the bottle with water

- Place a small ball of Play-Doh on the end of the bottle and attach the straw.
- Place the bottle in the bowl into which the boiling water will be poured little by little
- Pay attention to the behaviour of the water at each step and describe what happens

#### 4. RESULTS

**Observations:**

Has the water level changed in any way?

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#### 5. REFLECTION

Can you make the connection between this experiment and the effect of greenhouse gases on the ocean?

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Experiment 2: The greenhouse effect.
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#### 1. INTRODUCTION

In recent years, more and more CO<sub>2</sub> has been emitted (industry, heating, transport, ...). Those emissions have consequences on the climate.

## 2. ORIENTATION

How does carbon dioxide affect the earth's temperature?

## 3. PREPARATION

### 3.1. Materials:

- 2 glass containers with lids
- 2 thermometers (accuracy 0.1 °C)
- 1 lamp with incandescent bulb (more than 100 W)
- Bicarbonate
- Water
- vinegar

### 3.2. Method:

- place a thermometer next to each glass.
- put water in the first and bicarbonate and vinegar in the second and place them under a bowl.
- The second atmosphere must be enclosed as quickly as possible in order to contain the CO<sub>2</sub> produced by the reaction.
- Then place the lamp, i.e. our Sun, over the two bowls in order to heat them up.
- After a few minutes, read the value indicated by the thermometers and find a reason for what happened.

## 4. RESULTS

### Observations:

Two systems are created for comparison: one that reproduces the current condition of the atmosphere, consisting of 'normal' air, and one that hypothesises the state of the future atmosphere with increased levels of CO<sub>2</sub>. How does the temperature change in each of them?

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## 5. REFLECTION

Can you make the connection between this experiment and the effect of greenhouse gases on the atmosphere?

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### Experiment 3: Air quality.

## 1. ORIENTATION

What is the amount of pollution in the air? Check it in different locations (e.g. in the countryside and city center)

## 2. PREPARATION

### 2.1. Materials:

- 2 white cards
- vaseline
- a pen
- adhesive tape
- microscope (in the laboratory)

### 2.2. Method:

- Spread a little Vaseline on the lower half of one side of each card and write a number on the upper half, identifying the locations
- use adhesive tape to affix the card, which will act as a mobile laboratory, to each detection you have identified (the trunk of a tree in the park, the railing of your balcony, the pole supporting the traffic light, etc.).
- After a week, take the cards and we will analyse them in the laboratory

## 3. RESULTS

### Observations:

What was the amount of debris on each piece of paper? What does that mean?

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**4. REFLECTION**

Can you make the connection between this experiment and the effect of pollution in the air?

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Experiment 4: consequence of acidification on sea-shells

**1. INTRODUCTION**

The increase in CO<sub>2</sub> in the oceans resulting from human activities is the cause of ocean acidification. This phenomenon is a danger that should not be underestimated as it attacks very fragile balances within the ecosystem and food chains. Among them the best known is the dissolution of coral reefs for which a point of no return is expected already at the end of this century.

**2. ORIENTATION**

We discuss the phenomenon of ocean acidification by showing a simple experiment in which the dissolution of a shell in vinegar is observed. This will give us an idea of the impact of carbon dioxide emissions on the health of our oceans.

**3. PREPARATION**

**3.1. Materials:**

- 1 sea-shell

- 1 glass
- Some vinegar
- A clock

**3.2. Method:**

- Pour the vinegar into the transparent glass;
- Insert the shell inside the glass and begin to measure the time;
- The experiment will end when the shell has dissolved.

**4. RESULTS**

**Observations:**

When the shell is put in vinegar the reaction begins very quickly. Calcium carbonate comes into contact with acetic acid  $\text{CH}_3\text{COOH}$  (normally present in vinegar with a concentration around 5%) to give the following reaction:

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**5. REFLECTION**

We saw in the previous paragraph that a shell dipped in vinegar dissolves after a few hours. But what conclusion do we want to draw with this experiment of dissolving a shell??

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# Experiment 5: Consequences of more CO<sub>2</sub> on acidification of sea-water

## 1. INTRODUCTION

According to the researchers, more than half of the CO<sub>2</sub> absorbed worldwide ends up in the ocean. Krill, plankton and seaweed play a significant role in this. ... The ocean stores 50 times more CO<sub>2</sub> than the atmosphere and 20 times more than plants on land. But since we produce more and more CO<sub>2</sub> we have to look at the consequences of that on the sea-water and the living organisms in the water.

## 2. ORIENTATION

What are the consequences of more CO<sub>2</sub> on acidification of sea-water?

## 3. PREPARATION

### 3.1. Materials:

- 2 cups
- (distilled) water
- Straw
- pH test strips

### 3.2. Method:

- Fill the cups half way with (distilled) water
- Put in each cup a pH test strip – cup 1 is the reference-cup
- Blow into cup 2 for one minute

## 4. RESULTS

### Observations:

Compare the pH of the 3 cups – is the water acid, basic or neutral?

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## 5. REFLECTION

Can you make the connection between this experiment and the effect of greenhouse gases on the ocean?

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Experiment 6: Consequences on solubility of CO<sub>2</sub> in warmer sea-water

1. INTRODUCTION

According to the researchers, more than half of the CO<sub>2</sub> absorbed worldwide ends up in the ocean. Krill, plankton and seaweed play a significant role in this. The ocean stores 50 times more CO<sub>2</sub> than the atmosphere and 20 times more than plants on land. So oceans have an important role. But can seawater absorb an infinite amount of CO<sub>2</sub> and does it always work as well?

2. ORIENTATION

What are the consequences on solubility of CO<sub>2</sub> in warmer sea-water?

3. PREPARATION

**3.1. Materials:**

- 2 test tubes
- Test tube clamp
- Measuring cup
- Hot water bath
- Sparkling water

**3.2. Method:**

- Fill the measuring cup with sparkling water.
- Heat a test tube in the hot water bath for one minute.
- Place the 2 test tubes (cold and warmed) simultaneously in the measuring cup with sparkling water.



## 4. RESULTS

### Observations:

Observe the gas evolution at the surface of the 2 test tubes

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## 5. REFLECTION

Can you make the connection between this experiment and the effect of greenhouse gases on the ocean? Remember that if you see more gas-bubbles, this means that the gas is less solvable.

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Experiment 7: plants convert carbondioxide into oxygen
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## 1. INTRODUCTION

Forests are considered the lungs of the planet because plants provide the creation of oxygen gas. During photosynthesis, with the help of light, water and CO<sub>2</sub> are converted into sugars and O<sub>2</sub>. And we need that oxygen to live.

## 2. ORIENTATION

A candle needs O<sub>2</sub> to burn. While burning, the candle produces CO<sub>2</sub>. So if we cover the candle, the CO<sub>2</sub> that is generated will extinguish the candle since there is no O<sub>2</sub> enough. Can a plant, covered together with the candle, help the candle to burn longer?

### 3. PREPARATION

#### 3.1. Materials:

- 2 candles or tealights
- 1 plant
- 1 fake plant (or something else), about the same volume as the real plant
- 1 or 2 glass goblets, big enough for the candle and the plant
- chronometer

#### 3.2. Method:

- Burn the candle and put it next to the plant.
- Cover plant and candle with the glass goblet.
- Make sure that no air can enter the goblet.
- Chronometre how long it takes for the candle to be extinguished.
- Repeat this with the fake plant instead of the real one (or if you have 2 goblets, you can do it simultaneously to see the difference)

### 4. RESULTS

#### Observations:

Compare the time needed for the candle to be extinguished.

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### 5. REFLECTION

Can you make the connection between this experiment and the need of more woods combating global warming?

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Experiment 8: Acid rains
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## 1. INTRODUCTION

This activity helps pupils become even more aware of what happens when pollution enters our air, and reinforces their love of the environment, which we all should share.

## 2. ORIENTATION

We have all heard of acid rain. But do we really know what they are and what the long-term consequences can be?

## 3. PREPARATION

### 3.1. Materials:

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|--------------------------------------|----------------------------|
| ➤ 3 1-quart jars with lids           | Measuring cup              |
| ➤ 3 small potted green plants        | Vinegar or lemon juice     |
| ➤ 6 labels or strips of masking tape | Google Doc or Google Sheet |

### 3.2. Method:

- Before you begin the experiment, use your pen and the labels or masking tape to label each jar and each plant. Label the first plant and jar “a little acid”. Label the next plant and jar “a lot of acid”. Finally label the third jar and plant, “plain water.”
- Mix the water for the plant that will get “a little acid” by measuring 1/4 cup of vinegar or lemon juice and placing it into the jar labeled “a little acid” and fill the rest of the jar with tap water.
- For the plant receiving “a lot of acid”, pour 1 cup of the vinegar or lemon juice into the jar and fill the rest with tap water.
- Fill the third jar, labeled “plain water”, just with tap water.
- Start your observation by writing how plants look the first day.

- Every two days continue to water the three plants using the water from the original jars. Be sure to make note of and discuss which plant looks best in your journal (GDoc or GSheets).
- Continue like this for 10 days.

#### 4. RESULTS

**Observations:**

With the help of your journal (GDoc or GSheets), summarize how the plants have changed in these 10 days.

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#### 5. REFLECTION

Can you make the connection between this experiment and the problem of hunger in the world?

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