THE GREENHOUSE EFFECT
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Aim

To observe and compare the absorption of thermal radiation by two greenhouse gasses, CO₂ and water vapor, and the effect that greenhouse gasses create when they prevent the emission of the outcoming radiation to space.

Materials

- Three glass jars with lid. The lid has to have a hole to introduce the temperature sensor or the thermometer.
- Plasticine
- Temperature sensors or thermometers
- Two beakers Water
- Yeast and sugar (glucose), or, vinegar and sodium hydrogen carbonate, which will provide CO₂
- Spoon
- Light

The activity

1. Prepare the CO₂.
   There are two ways to do this:
   Mix vinegar and sodium hydrogen carbonate (for example, 5 g of hydrogen carbonate and 75 cm³ of vinegar.) or add sugar to a mixture of warm water and yeast.

2. Fill a beaker with water (75 cm³ or the same quantity you have used for the CO₂ formation). This will produce your water vapour.

3. Put a beaker with the mixture producing CO₂ in a glass jar. Put the beaker with water in another glass jar. You also need an empty glass jar.
4. Put the three jars in the sun with the sensors or the thermometers inside. We need an extra sensor or thermometer to measure the outside temperature (control). Be careful to put it in a place that has only contact with the air.

5. Measure the initial temperature and the temperature changes every 5 minutes for 15 minutes if we are using thermometers. If you are using sensors you can take continuous data. In each case note the temperature changes every 5 minutes.

**DATA**

<table>
<thead>
<tr>
<th></th>
<th>Outside Temperature (°C)</th>
<th>Vinegar + hydrogen carbonate Temperature (°C)</th>
<th>Water vapour Temperature (°C)</th>
<th>Empty jar Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Temperature (°C)</strong></td>
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<td>5 minutes later</td>
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<td>15 minutes later</td>
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Questions

1. What does each treatment simulate?

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2. Write the conclusions to your experiment.

What do you think happens due to the rise of anthropogenic CO$_2$ emissions?
Results obtained using temperature sensors

Treatments

Sensor 1: Sodium hydrogencarbonate and vinegar
    Initial temperature: 25,5º C – Final temperature: 44,8º C.

Sensor 2: Water
    Initial temperature: 25,5º C - Final temperature: 40,1º C.

Sensor 3: Glass jar.
    Initial temperature: 25,5º C-Final temperature: 37,5º C.

Sensor 4: Outside temperature.
    Initial temperature: 25,6º C -Final temperature 34,2º C.

Developed for CarboSchools by Roser Nebot, IES Manuel Blancafort, Spain. Mail: mrnebot@gmail.com (last change: 12-Oct-09). Pictures and graphic by Marina Passarell.

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