PBL Unit

Climate Change Activity

Climate Change Activity

Objective:

Use online resources to determine how Earth's climate is changing and what effects those changes might have on people around the world.

Background:

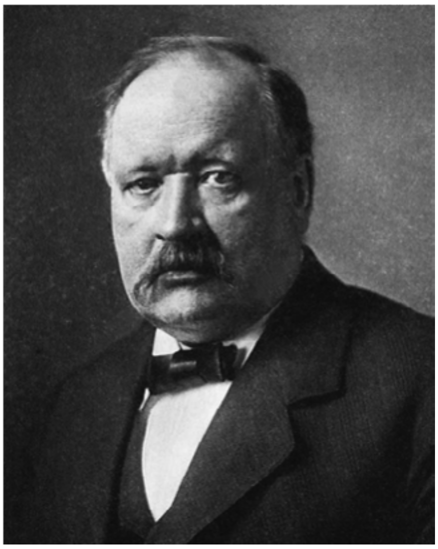
Is our planet getting warmer? Even if it is, does it matter? And how do we know that we're the ones responsible for it? It seems like everyone has an opinion about the idea of climate change, but what do we know for sure? During this activity, we'll be looking at many different sources of information to try and get at the scientific facts behind climate change.

First, what exactly do we mean by "global climate?" Global of course means we're talking about the entire planet Earth. And climate is basically the average of all the weather that happens in a particular part of the world over the course of a year.

Climate should not be confused with weather, which describes the current conditions in a single place. Weather can be different in two places just a short distance apart: it may be raining here even though it's sunny just a mile away, for example.

Since climate is concerned with the average weather over an entire year, these small differences at one moment in time don't matter as much. And since global climate is the average of climates from around the world, local observations don't count as much either. Just because it's raining for us right here doesn't mean the whole planet is getting more rain than usual, after all.

Many people view the idea of global climate change as a recent development. As early as 1896, though, there was an idea that carbon could have a key role to play in changing the Earth's climate. That was the year that a Swedish scientist named Svante Arrhenius calculated that doubling the amount of carbon dioxide in the atmosphere would increase global temperature by 5 to 6°C. At the time, the amount of carbon dioxide humans were producing was very small (most people still got around on horses) so Arrhenius thought that it would take thousands of years.



Svante Arrhenius

Arrhenius would probably be surprised at just how much carbon dioxide we've put into the atmosphere in the century since he warned about the possibilities of global climate change because of carbon dioxide. But how do we know how the Earth's atmosphere is changing? And what's causing it? We'll look at some scientific data to find out.

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Carbon and Climate:

Carbon dioxide (CO_2) is often called a "greenhouse gas," meaning that it's responsible for warming the Earth's climate. But how do we know that? Read this article to find out what makes CO_2 a greenhouse gas and then answer the questions below.

1. According to the article, what don't climate scientists agree on when it comes to global climate change?

2. In your own words (and with a drawing if you want), describe how the greenhouse effect works.

3. Explain in your own words the evidence presented in the article that presents CO2 as being the biggest source of warming among all of the greenhouse gases.

4. Do you think the author presents a good argument for CO2 being responsible for increased global temperatures? Explain your reasoning.

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Carbon Over Time:

How much carbon dioxide was in Earth's atmosphere in the past? And how do we know? Scientists have found many ways to determine what the Earth's atmosphere was like in the past.

1. On this page, click through each of the graphs that are displayed. According to the graphs, what is the highest concentration of ppm of CO_2 in our atmosphere over the last 400,000 years and when did that occur?

2. If you look at the longest timescale and ignore the most modern data (the red and bright blue dots), what would the highest concentration of CO_2 over the last 400,000 years be?

Sources of Carbon:

How does all this carbon get into the atmosphere? To understand the movement of carbon, we need to understand where it's stored on Earth, how it moves from one place to another, and how fast those movements happen.

This diagram shows the fast carbon cycle, the movement of carbon over the course of just one year. The numbers are in billions of tons of carbon per year. You don't need to understand all the processes going on here, but look at the red numbers, which indicate human-generated changes in the carbon cycle.

1. According to the diagram, what processes that move carbon have humans changed and how?

2. According to the diagram, how much carbon is added to the atmosphere annually due to human activity?

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Effects of Fossil Fuels:

1. According to this page, what is the cause of acid rain?

2. According to this page, what are the sources of hazardous air pollutants?

Effects of Increased Atmospheric Carbon:

1. If CO2 is increasing in the atmosphere, what changes we would expect to see in global temperatures and the overall climate?

2. How do you think these changes in temperature and climate would impact humans?

3. Many changes in the world have been blamed on changes in the climate. Use internet searches to estimate what the chances are that the following occurrences are caused by climate change and indicate your results in the table: **(X=most correct, o=acceptable)**

	Not At All	Possible	Likely	Almost Certainly
Rising Sea Levels				
Colony Collapse Disorder				
Extreme Storms and Hurricanes				
Increased Earthquakes				
Increased Animal and Plant Extinctions				
Expansion of Deserts				

Climate Change Activity

4. To summarize what you've learned in the last two sections, what are the effects of burning fossil fuels on the Earth's atmosphere and environment?

Action:

Discuss with your group and write your answers to these questions below.

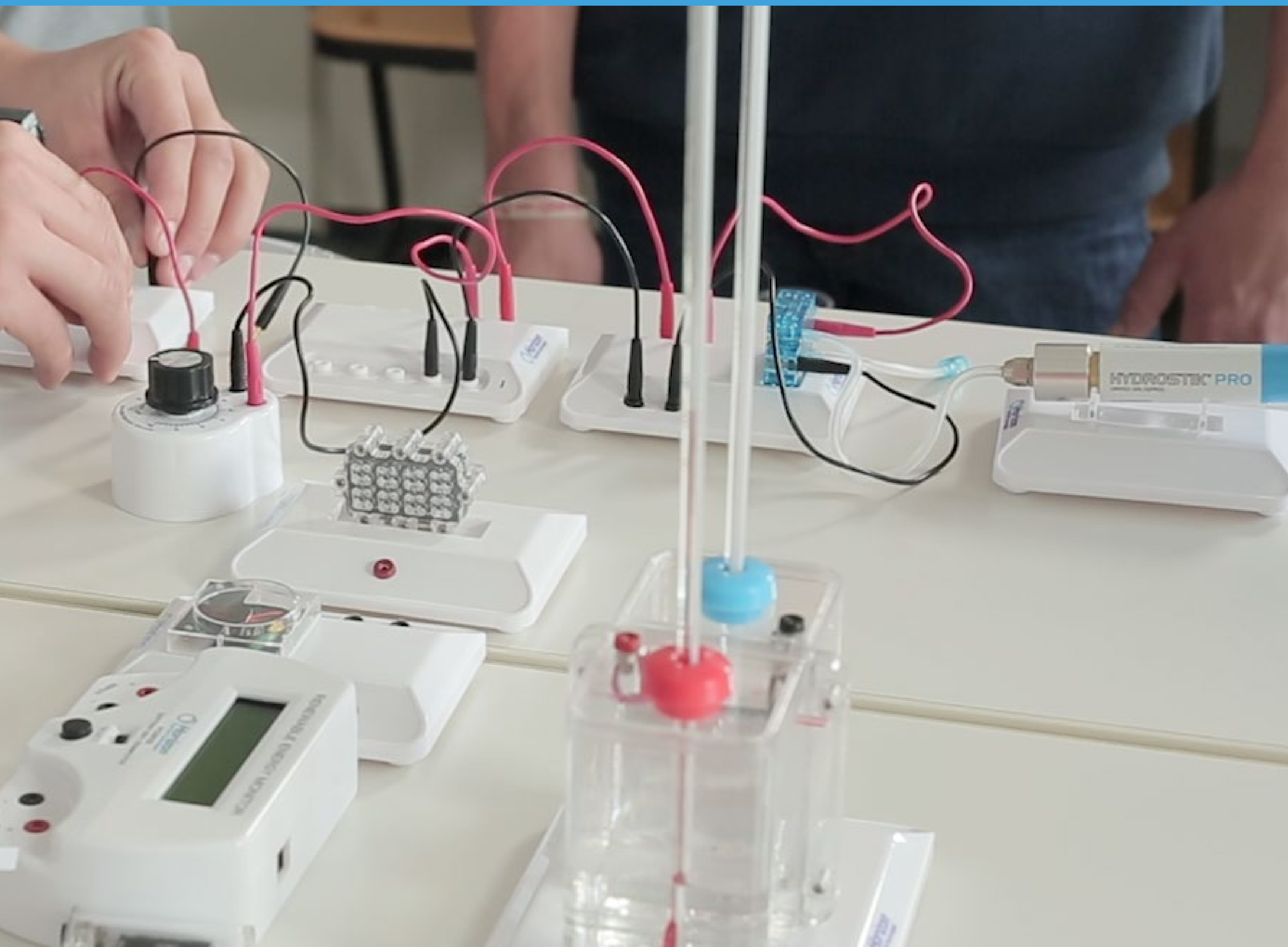
1. Do you think people are doing enough to decrease our use of fossil fuels? Why or why not?

2. If you could encourage people to do one thing to combat global climate change, what would it be?

3. How do you think your community would change if it used more non-polluting sources of energy?

PBL
Unit

Hardware Experiments



Electricity

4. Design an experiment that could test the relationship between the size of the capacitor and the current it produces when discharging. Describe your experiment below:

Conclusions

1. Why did the car eventually stop moving? Construct an explanation of what you observed using what you know about electricity.

2. Could a capacitor be a useful source of electricity for an electric car? Why or why not?

3. Based on your observations, does the capacitor lose its charge over time?

4. Based on your results, do you think fuel cells are a good energy source for cars?

Electric Circuits

Goals

- Build a complete circuit with a solar panel
- Power a motor and electrolyzer with a solar panel
- Measure voltage and amperage in different circuits

Background

Electricity has fundamentally changed the history of humanity. Steam may have powered the industrial age, but electricity has powered every age since. It would be impossible to eat, work, travel, communicate, or create music or art like we do today without electricity.

Electricity is nothing more than the movement of electrons. Within the right materials, called conductors, electrons are no longer attached to single atoms but can move freely between them. Metals are the best conductors, and copper is one of the best conducting metals. Silver is even better, but it's much more expensive, so most electrical wires are made of copper.

For an electric current to move through wires, though, it needs to be pumped. Just like water through a pipe, there must be pressure that pushes the electrons in one direction or the other. We could fill a pipe with water, just as the copper atoms still have their electrons all around them, but without a pressure to move them they won't go anywhere. In electrical circuits, we call this pressure a voltage. Voltage is measured in volts.

When a voltage is applied to an electric circuit, electrons begin to move in one direction. This produces an electric current. We measure current, the amount of moving electrons, in amperes or amps for short. Some electric current moves in just one direction, and we call that direct current (DC). Other currents move back and forth very quickly, many times a second, and we call that alternating current (AC).

There are two ways that two or more devices can be hooked up to an electric current: in series and

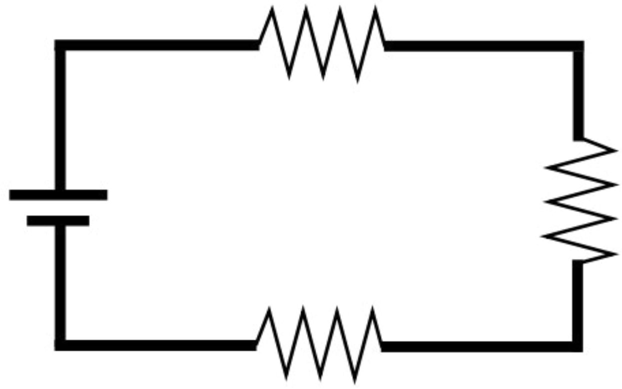


Fig. 1 Series circuit (with 3 resistors)

in parallel. When devices are attached in series, there's only one complete circuit and the devices are attached next to each other like lights on a Christmas tree. (See Fig. 1)

When devices are attached in parallel, the circuit splits current to each individual device and reconnects to the power source. (Fig. 2)

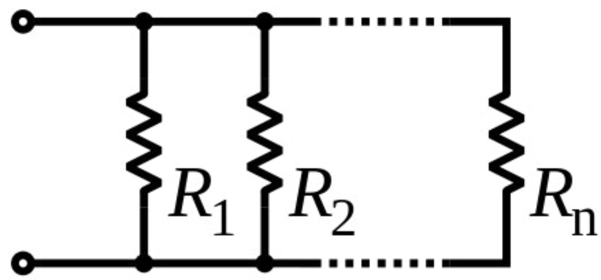


Fig. 2 Parallel circuit (of n resistors)

During this activity, we will use a solar panel to generate DC electricity, see how we can change the amount of current it produces, and attach devices to the circuit in series and in parallel.

Electric Circuits

Conclusions

1. Based on your observations did the electrolyzer and motor get more electric current when they were hooked up in series or in parallel? How do you know?

2. Does hooking up more devices to an electrical circuit in series increase or decrease the electric current in the circuit? Explain your answer.

3. Which is the best way to attach both the motor and electrolyzer with the solar cell at the same time: series or parallel? Explain your answer.