

# Help your friend who is a teacher

Your initial thoughts?

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## Analogies

Angle = amount of CO<sub>2</sub>

Volume = equilibrium temperature

Time to reach constant flow = heating time

Water = input radiation

## Differential equations

Teach basics of differential equations

## Derive equation

Derive equation for volume (heat) versus angle (CO<sub>2</sub> amount) ideally in combination with the corresponding experimental plot (suggested below)

## Measure the amount of outflow over time

The students then also see that it will take some delay to fill the cup before it overflows

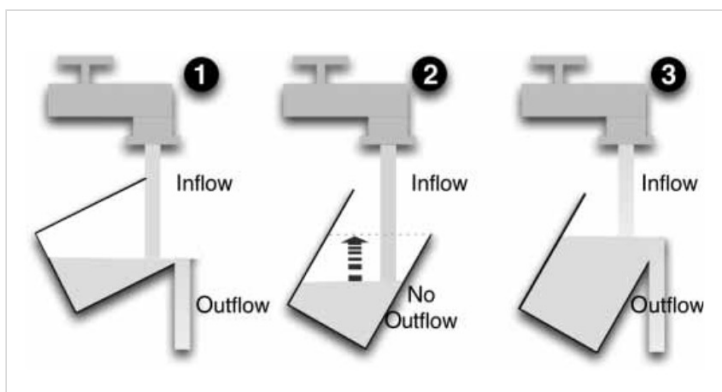
## Plot a graph.

Measure the volume vs angle?

## Help the teacher

The teacher wants students to couple this to a mathematical representation.

Which ideas can we provide for the teacher?



## Visit or create a small greenhouse

There is no ozone involved.

## Do a lesson on Ozone Depletion Substances

Make sure you point out the difference between greenhouse gases and ODS

## Observation: The connections between the mechanisms in play are missing

The students seem to remember certain aspects (e.g. that there seems to be an ozone layer and CO<sub>2</sub> is somehow involved) but do not make connections how these pieces of information are related. Maybe a graphic detailing cause and effect could help out...

## Ozone layer

Explain difference between greenhouse gases and effect of ozone layer. (Greenhouse gases reflect infrared radiation back to Earth; ozone layer reflects ultraviolet radiation out into space)

## What students wrote

Student 1: Greenhouse gases send the longwave radiation back to Earth while letting shortwave radiation pass. This means that the greenhouse gases let light pass, but hold on to the infrared rays, and that is a huge problem for the Earth because it gets heated.

Student 2: CO<sub>2</sub> destroys the ozone layer. Radiation comes from the sun, which passes into the atmosphere through the layer and warms the earth. The hole in the ozone layer is getting bigger because companies are producing more CO<sub>2</sub>.

Student 3: The sun's rays are absorbed by the earth's surface. [...] The heat is released again, but a layer of greenhouse gases prevents the heat from getting back into the room. So the heat remains in the atmosphere.

