

Earth's thermostat

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What are we doing here?

- We will learn...

...the effect of CO₂ on temperature

...how scientists find out what the temperature and CO₂ concentration were, a long time ago!



(Industrial machinery chugging frantically)

The Greenhouse Effect Experiment

- Get together in groups of 2 or 3
- Each group will have:
 - 4 Jars
 - Mailing labels
 - A sharpie
 - A set of measuring cups and spoons
 - Vinegar
 - Baking soda
 - Elastic bands
 - A thermometer
 - Plastic wrap

The Greenhouse Effect Experiment

1. Label the jars:

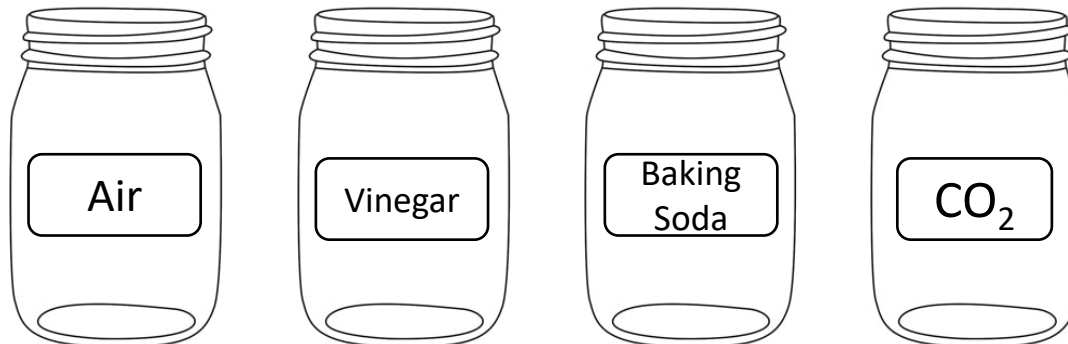
- Air (control)
- Vinegar (control)
- Baking soda (control)
- CO₂

What are controls?

Controls are conditions that are known and kept constant during an experiment



They will be an important point of reference when collecting and comparing our data!



The Greenhouse Effect Experiment

2. Cut 4 pieces of plastic wrap (big enough to cover the mouth of the jar with a bit of extra down the sides)
3. Place plastic wrap on the air jar and secure it with an elastic band
4. Add 1/4 cup of vinegar to the vinegar jar, then cover with plastic wrap and secure with an elastic
5. Add 1 tablespoon of baking soda to the baking soda jar, cover with plastic wrap and secure with elastic

The Greenhouse Effect Experiment

6. For the CO₂, one person gets ready with the plastic wrap and elastic;

Another other person will add 1 tablespoon of baking soda to the jar, then add 1/4 cup of vinegar → the reaction will form CO₂!

VERY QUICKLY place the plastic wrap over the mouth of the jar and secure it with an elastic band

The Greenhouse Effect Experiment

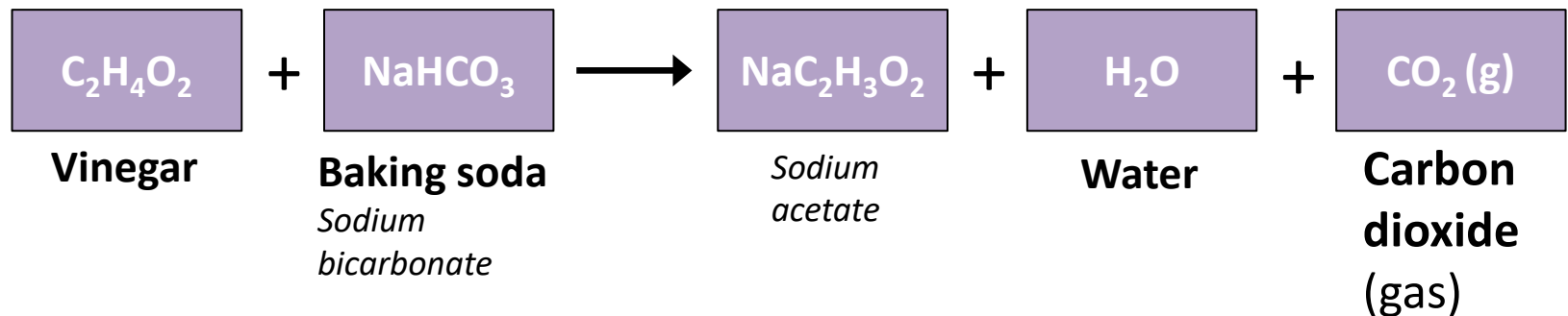
7. Place the jars in front of the heaters
8. Allow the jars to heat for 5-10 minutes

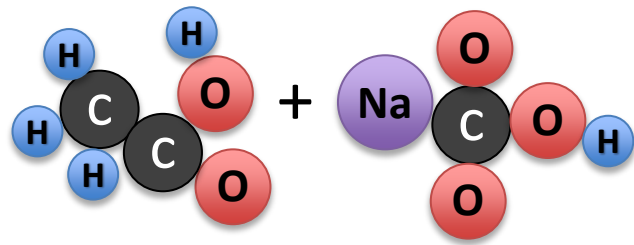
Meanwhile...



The Greenhouse Effect Experiment

- What happens when we mix vinegar and baking soda?
- Chemical reaction!





Vinegar

Baking soda
Sodium

Carbonic Acid

+

+

Sodium acetate

Water

Carbon dioxide (gas)

The Greenhouse Effect Experiment

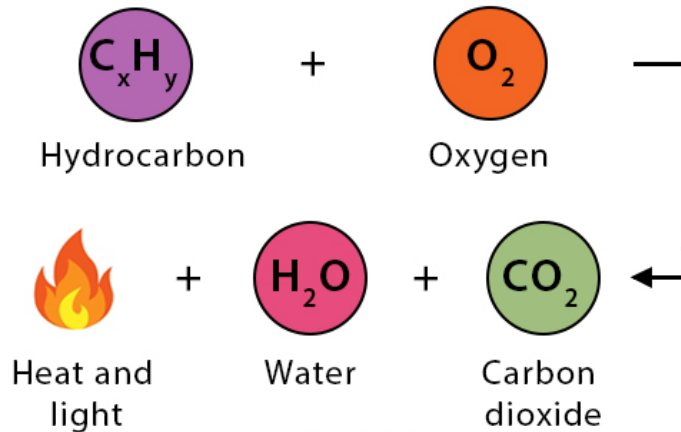
9. Use the thermometer to measure the temperature from each jar (aim it straight down)
10. Record your results
11. What do you notice about the temperature readings?



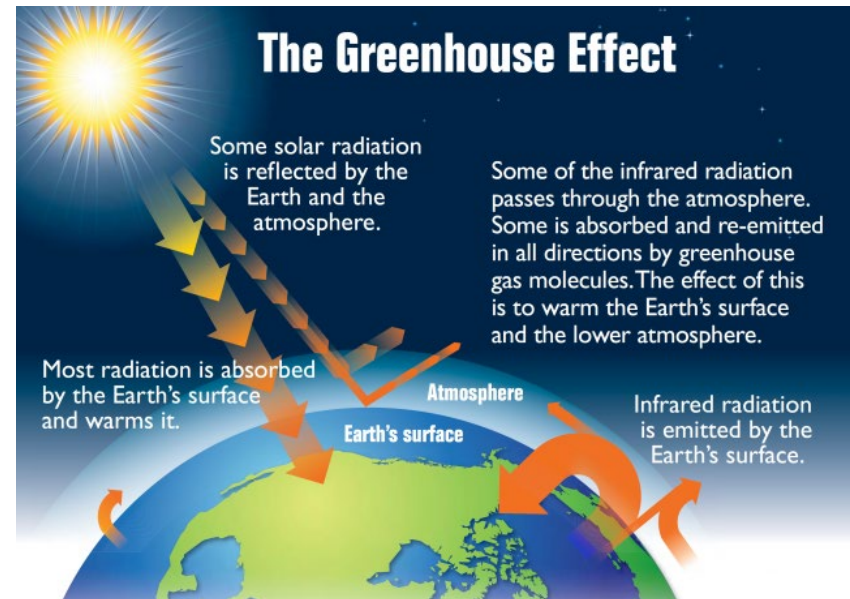
How do fossil fuels relate to CO₂?

- Burning (combustion) produces CO₂
- CO₂ traps heat → greenhouse effect

Combustion Reaction



ChemistryLearner.com

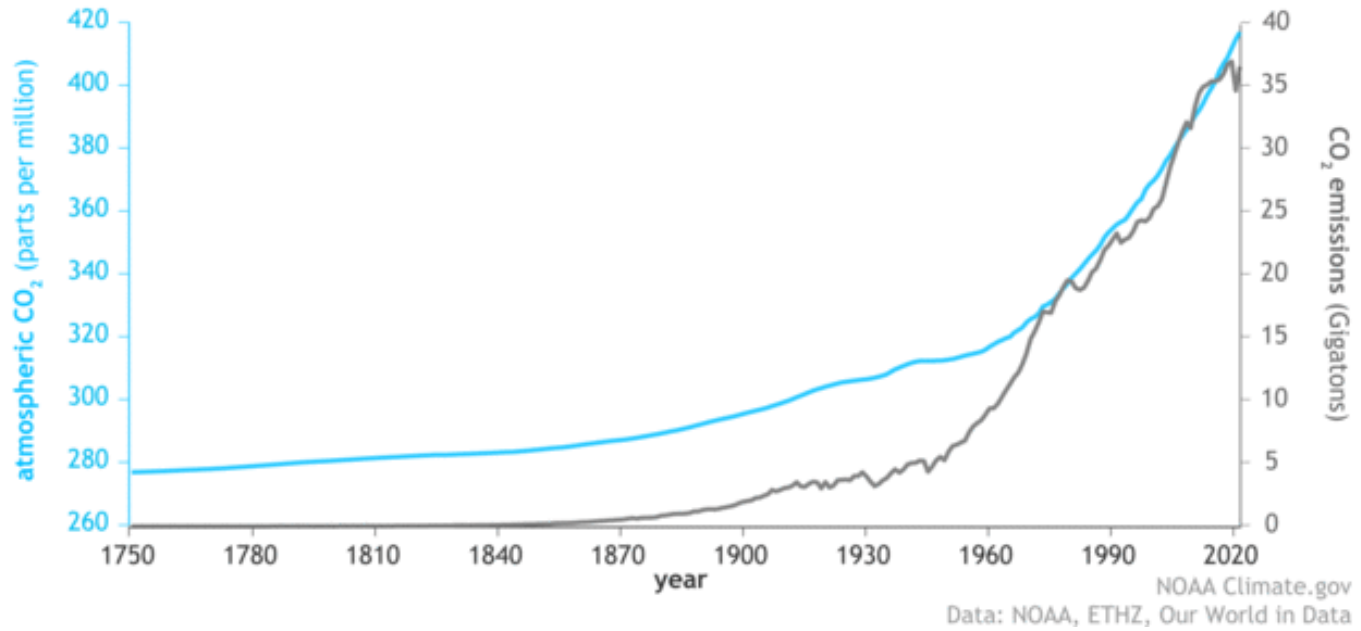


<https://www.epa.gov/climatechange-science/basics-climate-change>

How do fossil fuels relate to CO₂?

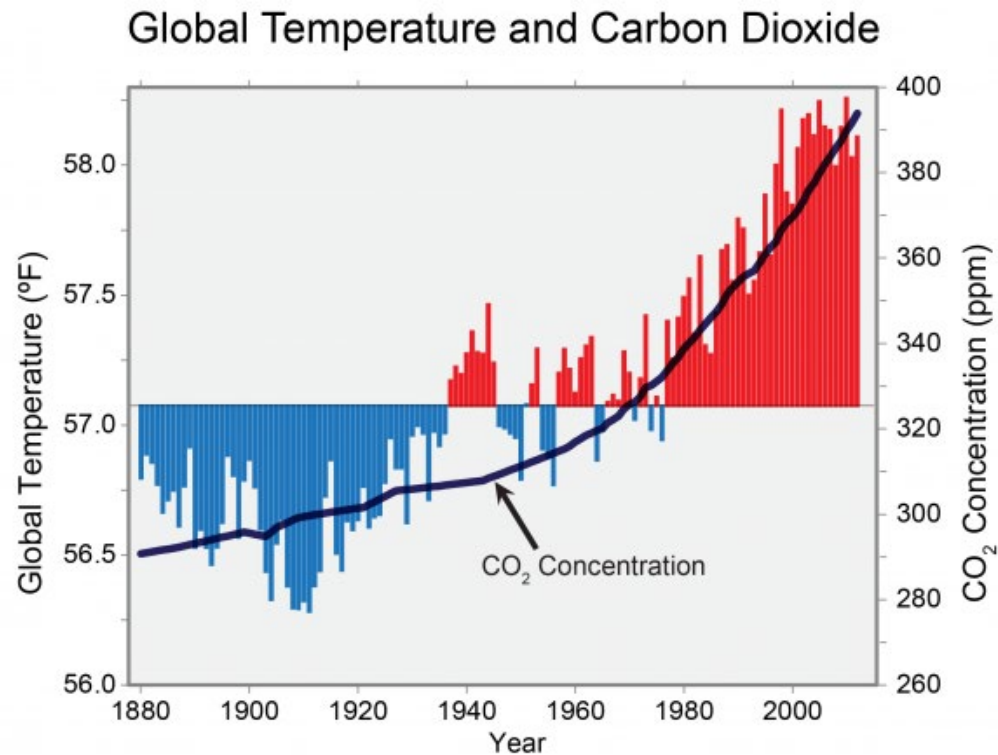
- The more we burn, the more CO₂ we generate!

Atmospheric carbon dioxide amounts and annual emissions (1750-2021)



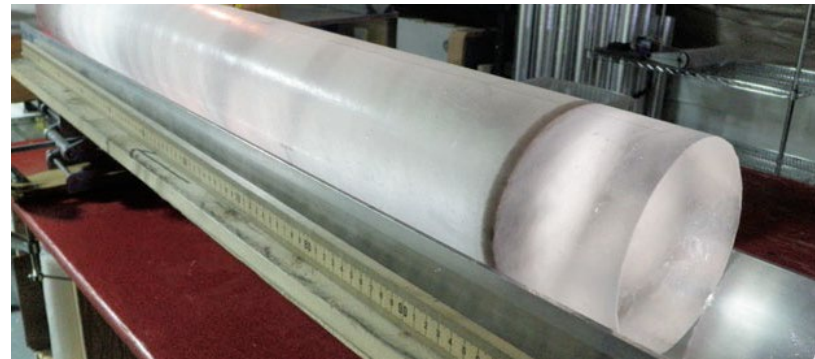
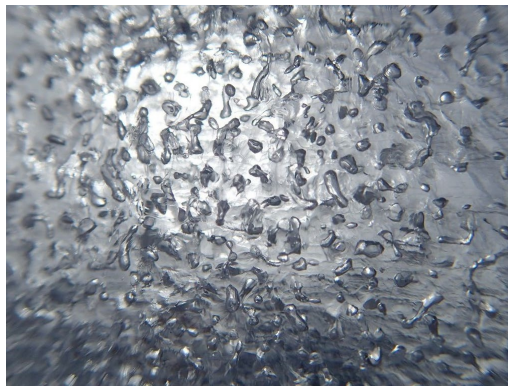
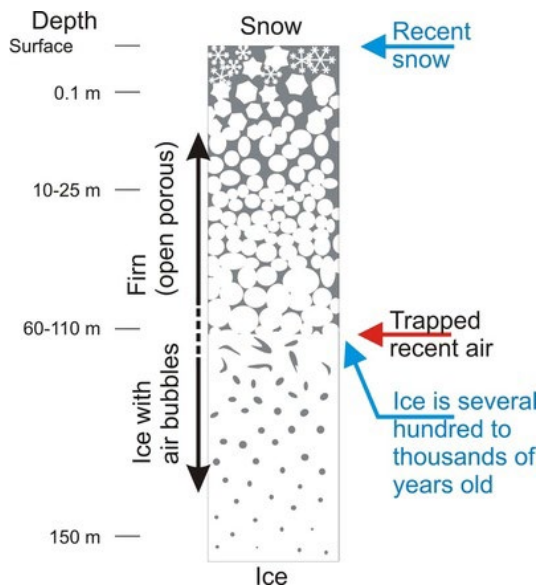
How does CO₂ in the atmosphere impact global temperature?

- The more CO₂, the more heat is trapped, the hotter our Earth gets!

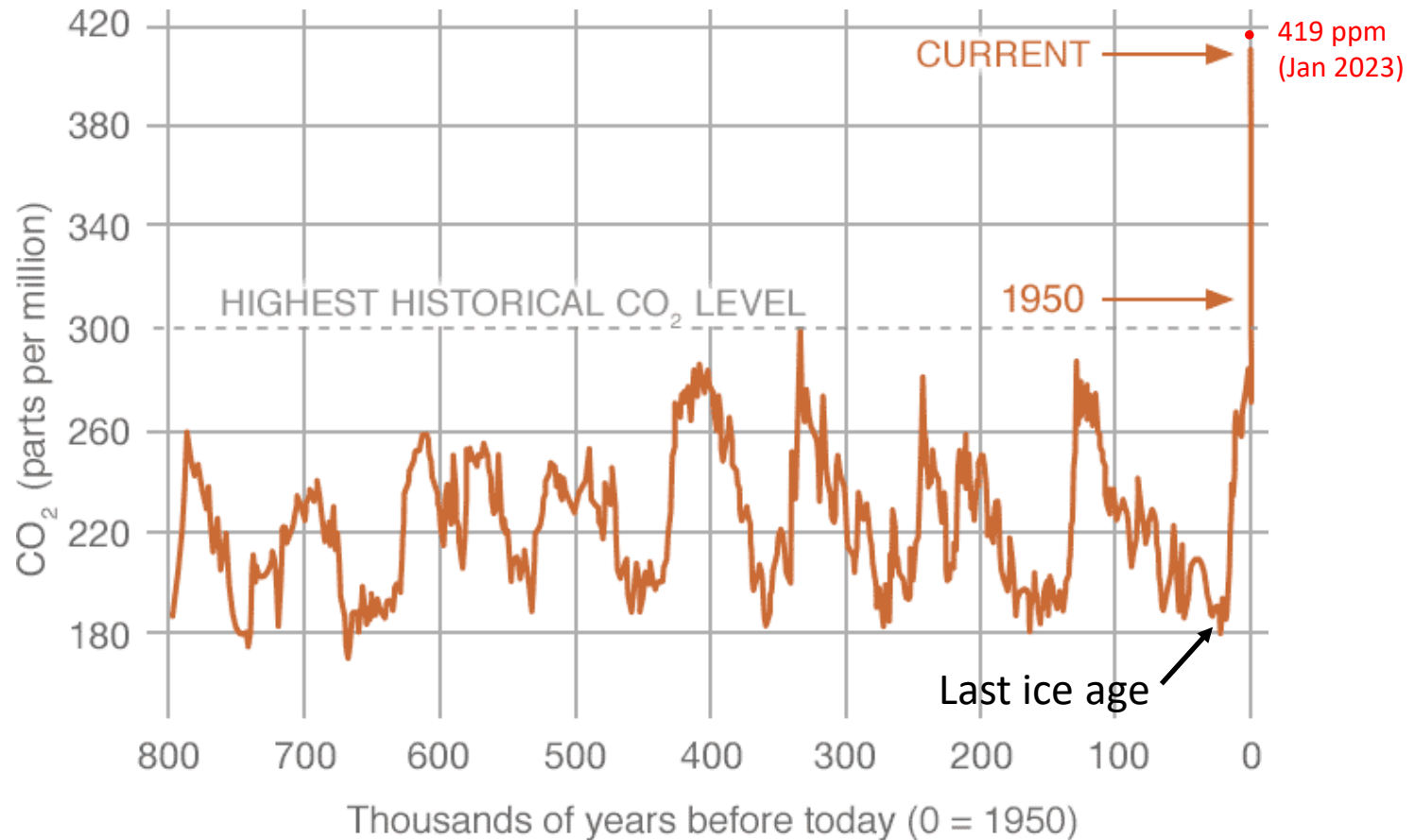


How do we know CO₂ levels long, long time ago?

- Gas bubbles in ice cores (wait... what?!?)



How do we know CO₂ levels long, long time ago?



Reducing greenhouse gas emissions

Kansas Pollution Prevention Program Implemented Results



21,197,000
POUNDS OF
SOLID WASTE
REDUCED



210,531,600
GALLONS OF
WATER REDUCED



22,819,200
DOLLARS SAVED



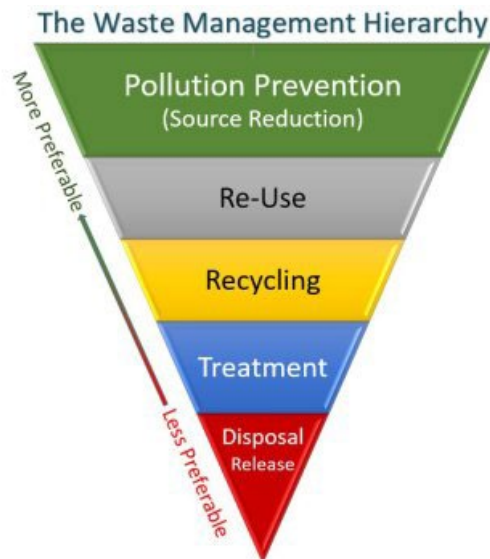
959,700 POUNDS
OF HAZARDOUS
MATERIALS
REDUCED



58,209,400
POUNDS OF AIR
EMISSIONS
REDUCED



33,557
MTCO2E
REDUCED



Pollution
Prevention
Institute

We can all do our part to our planet happy and healthy!

PROTECTING OUR PLANET STARTS WITH YOU



**BIKE MORE
DRIVE LESS**



**reduce
REUSE
recycle**

Cut down on what you throw away. Follow the three "R's" to conserve natural resources and landfill space.

choose sustainable



Learn how to make smart seafood choices at www.FishWatch.gov.

Trees provide food and oxygen. They help save energy, clean the air, and help combat climate change.



**PLANT
A TREE**



EDUCATE

When you further your own education, you can help others understand the importance and value of our natural resources.

CONSERVE WATER



The less water you use, the less runoff and wastewater that eventually end up in the ocean.



Buy less plastic and bring a reusable shopping bag.



Don't send chemicals into our waterways.

Choose nontoxic chemicals in the home and office.



Volunteer!

Volunteer for cleanups in your community. You can get involved in protecting your watershed too!



**Long-lasting light bulbs
- ARE A -
BRIGHT IDEA**

Energy efficient light bulbs reduce greenhouse gas emissions. Also flip the light switch off when you leave the room!



oceanservice.noaa.gov