Carbon capture & storage

Mitigating environmental impact

Key questions: How can we capture CO_2 gas and cycle it naturally on Earth? What impacts could that have on Earth and to humans/wildlife?

Initial Ideas

1. What do you think chemical weathering means?

2. What is basalt, and where does it form?

Materials

- Flask
- 200 mL of distilled water
- 2 small water bottles
- 2 bags of basalt rocks per group
- 5 g (1 teaspoon) of baking soda
- 60 mL (¼ cup) of vinegar
- Balloon

Procedures

1. Gather two plastic water bottles.
2. Pour 200 mL of distilled water into each of the two plastic water bottles. Label them "control" and "experiment".
3. Pour 1 bag of basalt into each of the water bottles. Swirl to mix.
4. In a separate flask, put ~1 teaspoon of baking soda.
5. Have someone in your group prepare to stretch a balloon over the top of the flask.
6. Over a sink or tray, pour ~60 mL vinegar into the flask with the baking soda and immediately stretch/secure the balloon over the mouth of the flask. Swirl the bottle to keep the reaction going until complete. The reaction (baking soda + vinegar) makes CO_2 and inflates the balloon.
7. When bubbling stops and the balloon is well inflated, pinch the balloon opening closed so the gas doesn't escape.

8. Take the pinched balloon to the "experiment" bottle. Secure the end of the balloon over the mouth of the bottle and release the pinch. Allow the CO_2 to be released into the bottle. This will happen because CO_2 is more dense than air, so it will fall and displace the air.
9. Close the carbonated experimental bottle and shake. The walls will shrink as CO_2 dissolves in the water.
10. Make sure both bottles are fully closed and leave them out for 3 days.

Predict

What do you think will happen in the "experiment" bottle vs. the "control" bottle? What kind of changes do you think will take place?

Results

Record observations of your bottles every day. Notice changes in color of solution, appearance of basalt rocks, appearance of bottles, etc.

In each box, draw what you see inside the bottle. Look for:

- **The air:** Is the bottle tight/inflated or flexible to the touch?
- **The water:** Is it clear, cloudy, or bubbly?
- **The rock:** Do you notice any changes in the color or texture of the rock?

Day 1	Day 2	Day 3
Bottle Feel: [ ] Firm [ ] Soft Water Color: _____	Bottle Feel: [ ] Firm [ ] Soft Water Color: _____	Bottle Feel: [ ] Firm [ ] Soft Water Color: _____

Discussion and conclusion

1. Relate your observations back to their hypothesis. Were you right or wrong?
    a. If you were right, explain what caused the observed changes in the CO_2 bottle.
    b. If the results did not follow your hypothesis, was your hypothesis wrong or were there errors in the experiment that could be improved on in the next run?

2. **The invisible change:** Why did the bottle get softer even though no gas was let out?

3. **The new rock:** Look at the white grains mixed with the black basalt dust. What are these called?

4. The law of conservation of matter says that matter cannot be created or destroyed. If the CO_2 gas is no longer in the bottle, what do you think happened to it?

Linking to the real world

5. What produces basalt rock? Could this already be happening all around us?

6. What other carbon capture processes are happening around us?

7. Can we do basalt carbon capture on a large scale? If we spread basalt dust on a giant farm, what impact would that have on the farm?

8. How can you engineer a solution to take more CO_2 out of the atmosphere, and what effect do you think this would have on climate?