



The Cave of Dogs!

PDQ1 - Catch That Gas!

Grades: 5-8

Time: 5 -15 minutes

Subject: Chemistry

Topics: Properties of Gasses, [Chemical Reactions](#)

Overview

Using simple tools and materials [Carbon Dioxide \(CO₂\)](#) is generated and captured in a spectacular example of a [chemical reaction](#)! Once we know how to generate and capture [CO₂](#) we will put it to work in our grand Cave of Dogs simulation.

Background



Mixing baking soda and vinegar is an exciting demonstration of a [chemical reaction](#) and a great way to see physical and chemical changes. Work with [CO₂](#) to learn how it behaves like a gas, in what ways it can be harmful, how to control it, and how to measure it. Ready for some chemical fun? Let's explore further with databot™!

Objectives

Understand and Recognize:

- Different types of substances can “react” with one another to create a chemical change in the substances.
- [Chemical reactions](#) can cause physical and chemical changes in substances – even creating gas where there was none before.
- [CO₂](#) can be generated through a [chemical reaction](#) of baking soda and vinegar.

What You'll Need

- 2 Liter Plastic Bottle
- 12" Round Balloons (3 or more recommended)
- White Vinegar (Acetic Acid)
- Baking Soda (Sodium Bicarbonate)
- Measuring Cups
- Small funnels to help control the pouring of the **reactants**.
- Small binder clip or paper clip to pinch off the balloon.

Important Terms

Carbon Dioxide (CO₂): A colorless, odorless gas naturally present in the air you breathe and is absorbed by plants in photosynthesis. *There would be no animal life or green plants without carbon dioxide. Green plants use energy from the sun plus carbon dioxide and water to produce carbohydrates and oxygen.*

Volume: The amount of space a substance takes up.

Chemical Reaction: This occurs when substances combine to produce one or more new substances.

Reactant: The starting substance that enters into a **chemical reaction**.

Product: The substance created in a **chemical reaction**.

Prep (5 mins)

- Use the QR code to Watch the Cave of Dogs PDQ1 video:
- Organize your **reactants** and materials for quick and easy access.
- Be aware that you don't want to accidentally combine your **reactants** before you are ready, so keep the baking soda (sodium bicarbonate) and vinegar (acetic acid) separate!
- Think about the order of your procedure in advance so you are prepared to execute smoothly!
- Be tidy and keep your workspace clean.



PDQ 1 (10 mins)

- Pour 1 cup of acetic acid (vinegar) into your 2 liter bottle using a funnel (Metric: use 250 ml of vinegar).
- Add 1/4 cup of sodium bicarbonate to your balloon (Metric: use 50 ml of baking soda). Use a separate funnel or carefully clean the one used for the vinegar to prevent an early reaction. ___
- Fix the balloon around the opening of your bottle.
- Carefully shake the sodium bicarbonate into the bottle and watch the reaction take place!
- Your balloon will fill with CO₂. If you are planning on doing PDQ 2 in the same session, use your small binder clips from that activity to pinch off the balloon opening and preserve the CO₂ for what's coming next!

Now that you know how to generate and capture CO₂ in this fashion, additional experiments can be done!

Great Work!

PDQ 2 coming up! Ready. Set. Go.

Another PDQ!

Educator Resources

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NGSS

- 5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Misconceptions

Gases such as air and **CO₂** are invisible and as such, pose an interesting challenge for students to develop understanding. Activities in the Cave of Dogs module provide clear demonstrations about gases such as air and **CO₂** that will help students form a deeper understanding of the characteristics of gases.

- Air is weightless and floats.
- All gases are weightless

Guiding Questions

The following questions may or may not be appropriate for the age group you are working with so use your discretion.

- What are the states of matter?
- What states of matter do we see in our experiment here?
- What are the **reactants** in our experiment?
- What is the **product**?
- Is this a physical change or a chemical change?
- Does it appear we have created new substances in our experiment?
- How could we get our baking soda and vinegar back to normal?
- Do you suppose this experiment could be dangerous if we were careless? How?

Additional Resources:

[How should the reaction between vinegar and baking soda be classified?](https://antoine.frostburg.edu/chem/senese/101/reactions/faq/classify-vinegar-bakingsoda.shtml)

<https://antoine.frostburg.edu/chem/senese/101/reactions/faq/classify-vinegar-bakingsoda.shtml>

[Misconceptions about science](http://modeling.asu.edu/modeling/KindVanessaBarkerchem.pdf)

<http://modeling.asu.edu/modeling/KindVanessaBarkerchem.pdf>

[Why Does Vinegar and Baking Soda React?](https://www.stemmayhem.com/why-does-vinegar-baking-soda-react/)

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