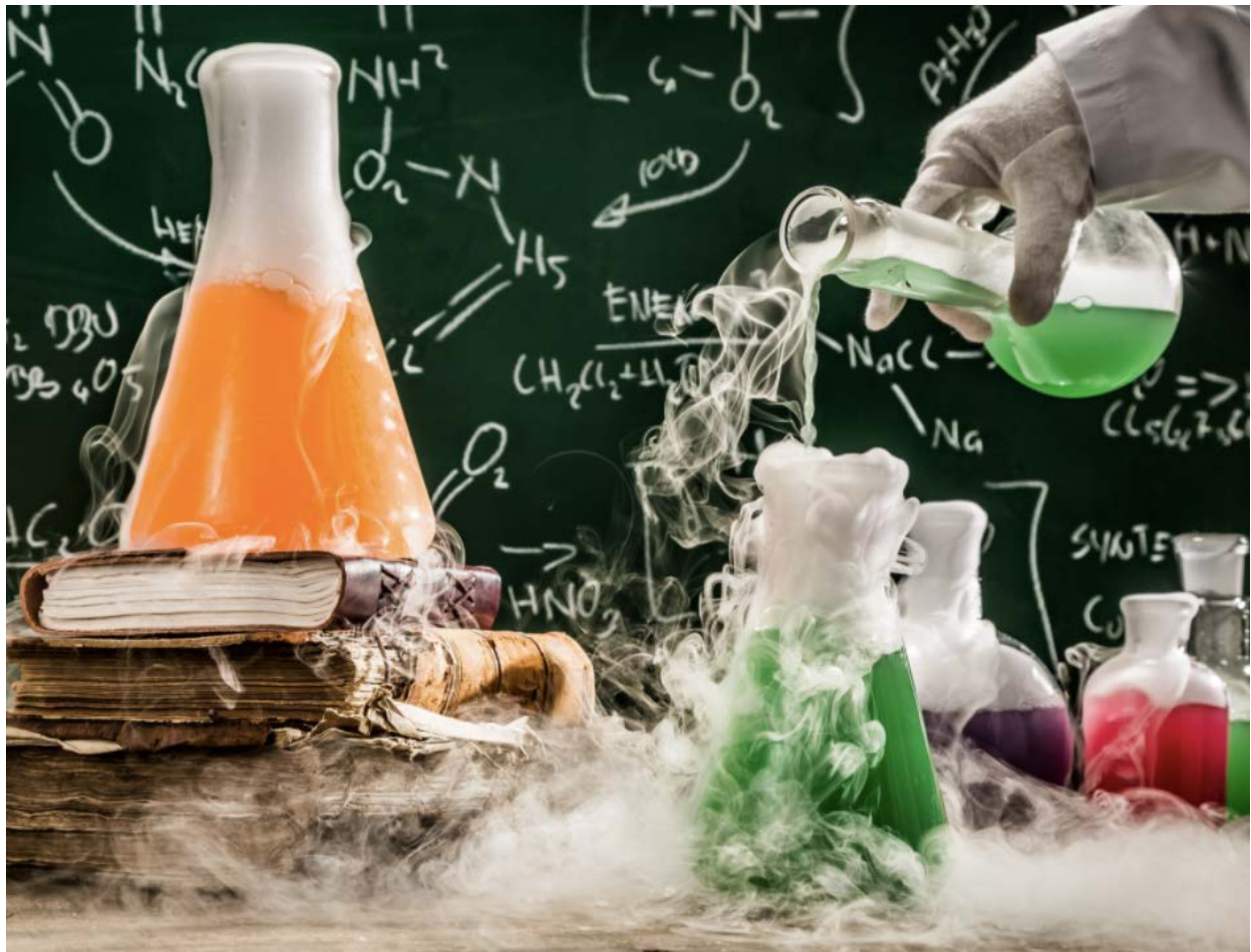


STEM AT HOME ACTIVITY GUIDE: Chemical Reaction Car Experiment



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STEM AT HOME GUIDE: Chemical Reaction Car Experiment Background Knowledge

Aim: Experiment with chemical reactions and engineering to power a car that you design.

Problem & Career Focus: A chemical reaction is a process where a set of substances undergo a chemical change to form a different substance. Chemical reactions occur every day in our lives including every time we eat, to wood burning, and batteries producing electricity. In this experiment you will learn more about how chemical reactions occur. Using the scientific method, your task is to work with your team of scientists: chemical engineers, biochemists and nuclear engineers to explore the effects of chemical reactions.

Educational Standards Correlations: Motion & Energy, Chemistry

Scientific Method: Scientists use the scientific method to guide their experimentation with different materials! With your team: ask questions, discuss what you observe and use your problem-solving skills as you create your potions! Use the scientific method steps to guide your exploration during the Chemical Reaction Car Experiment.

Investigating Questions

- How can you design your car to travel a distance?
- What materials created the chemical reaction?
- How can the distance the car travels be increased?

Materials

- Water bottle
- 1 straw
- 1 bamboo skewer
- Scissors
- 4 plastic caps
- 4 pony beads
- Glue gun or other glue
- Duct tape
- Vinegar
- Baking soda
- Tissue paper

OBSERVE

Make observations

QUESTION

Ask a question or identify a problem

RESEARCH

Search for existing answers or solutions

HYPOTHESIZE

Formulate Hypothesis

EXPERIMENT

Design and perform an experiment

TEST HYPOTHESIS

Accept or reject hypothesis

DRAW CONCLUSIONS

Make conclusions based on hypothesis

REPORT

Share your results

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Vocabulary:

Chemical reaction: process where a set of substances undergo a chemical change to form a different substance.

Base: a chemical that when dissolved in water increase the number of hydrogen ions

Acid: a chemical compound that can react with a base when mixed together; an acid has hydrogen ions in it.

STEM Career Connections:

<p>Chemical Engineer Are scientists that use chemistry, biology, physics, and math to solve problems.</p> <p>They: create solutions in the use of chemicals, fuel, drugs, food, and many other everyday items.</p>	<p>Biochemist Are scientists that study the chemical and physical principles of living things.</p> <p>They: research cell development, growth, heredity, and diseases.</p>	<p>Nuclear Engineer Design or develop nuclear processes and equipment.</p> <p>They: use chemistry principles for industrial, medical and industry materials.</p>
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Literacy Connections:

<p>Everyday Chemistry by Julia Sooy</p>	<p>Radium Girls by Kate Moore</p>	<p>The Dynamic World of Chemical Reactions with Max Axiom, Super Scientist by Agnieszka Jozefina Biskup Barbara Schulz, Tod Smith, Matt Webb, and Cynthia Martin</p>
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Real World Applications

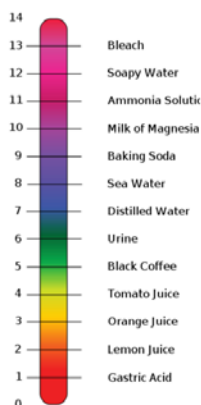
Chemical reactions happen in more than just science labs- you can even see them in your everyday life. Some examples include metal rusting, photosynthesis in plants, washing your hands with soap and water, digesting your food, and baking a cake.

Chemistry for Kids

Bases and acids are two specific kinds of chemicals. Almost all liquids are either an acid or a base. Whether a liquid is an acid, or a base depends on the type of ions in it. If it has a lot of hydrogen ions, then it is known as an acid. If it has a lot of hydroxide ions, then it is a base.

pH Scale

Chemists and scientists use a pH scale to measure how basic or acidic a liquid is. pH is a number that is measured from 0-14. A measurement between 0 to 7 are considered acids, with 0 being the strongest. From 7 to 14 are bases, with 14 being the strongest base.



Acids and Bases in Nature

There are a lot of strong bases and acids in nature. Some are dangerous and used as poison by insects and animals. Some are helpful. Many plants have acids and bases in their leaves, seeds, or even their sap. Citrus fruits like lemons and oranges have citric acid in their juice.

Everyday Science: Acids and Bases

Our bodies produce chemical reactions, just like in nature. Our stomachs use hydrochloric acid to help digest food. This strong acid also kills bacteria and helps us from getting sick. When we exercise our muscles produce lactic acid. Science and technology make good use of acids and bases. From car batteries, household cleaning supplies, and crop fertilizers chemical reactions, acids, and bases are everywhere.



Interesting Facts Acids and Bases:

- Acid turns a special type of paper, called litmus paper, red and bases turn it blue.
- Acids taste sour.
- Bases taste bitter.
- Vitamin C is an acid known as ascorbic acid.
- Strong bases can be slippery and slimy feeling.

Check out these video links!

Top 10 Chemical Reactions

<https://www.youtube.com/watch?v=KNPoBoUt-HM>

Science Max: Chemical Reactions

<https://www.youtube.com/watch?v=G4b6zAypaRw>

The Chemistry of Cookies

<https://www.youtube.com/watch?v=n6wpNhyreDE>

STEM AT HOME GUIDE: Chemical Reaction Car Experiment Activity Directions

Aim: Experiment with chemical reactions and engineering to power a car that you design.

Investigating Questions

- How can you design your car to travel a distance?
- What materials created the chemical reaction?
- How can the distance the car travels be increased?

Materials

Water bottle	1 straw
1 Bamboo skewer	Scissors
Plastic caps	4 pony beads
Glue gun or other glue	Duct tape
Vinegar	Baking soda
Tissue paper	

Instructions

Make sure to perform the experiment as a family team. This activity can get messy, so make sure you have paper towels to clean up messes! Or, if it's a nice day, enjoy the experiment outside. This experiment is structured to allow creativity flow.

- Start by creating a hypothesis with your group about what will happen to your car when the baking soda and vinegar are added.
- Preheat the glue gun- adult supervision is required!
- Gently insert the hot tip of the glue gun into the center of the water bottle lid, melting a hole in it.
- Cut the paper straw in half. Cut the bamboo skewer with scissors into two pieces, 1 inch longer than the straw pieces.
- For each wheel, glue a pony bead into the center of the inside of the wheel.
- Put some glue into the middle of the pony bead and insert one end of the bamboo skewer.
- Insert the bamboo skewer into the paper straw and glue the other end of the bamboo skewer into another wheel. Repeat with the second axle.
- Duct tape the two paper straws to the bottle like axles.
- Test your car to ensure it is able to move without materials falling off.

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- Time to race! Take your car outside- this gets messy.
- Twist open the water bottle and pour 1 cup of vinegar into the water bottle.
- Cut a 5"x4" rectangle of tissue paper and pour in 1 tablespoon of baking soda. Roll up and fold the ends so the baking soda doesn't fall out.
- Place the bottle of the car upright and insert the baking soda package into the cap.
- Shake the bottle and place the car wheels on the ground.
- Let it roll! Draw conclusions and discuss with your team what you observed throughout the experiment.

Extra Challenge:

-Can you design a tool that helps add the baking soda faster?

-Can you redesign your car to make it more aerodynamic and travel further/faster?

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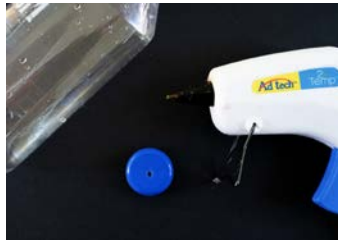
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Photo Guide



Step 1: Gather all materials. Preheat the glue gun. Adult supervision is needed.



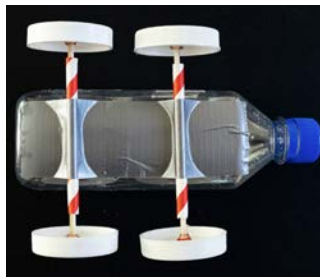
Step 2: Gently insert the hot tip of the glue gun into the center of the water bottle lid, melting a hole in it.



Step 3: Cut the paper straw in half. Cut the bamboo skewer with scissors into two pieces, 1 inch longer than the straw pieces. For each wheel, glue a pony bead into the center of the inside of the wheel.



Step 4: Put some glue into the middle of the pony bead and insert one end of the bamboo skewer. Insert the bamboo skewer into the paper straw and glue the other end of the bamboo skewer into another wheel. Repeat.



Step 5: Duct tape the two paper straws to the bottle like axles. Test your car to ensure it is able to move without materials falling off.



Step 6: Time to race! Take your car outside- this gets messy. Twist open the water bottle and pour 1 cup of vinegar into the water bottle. Add 1 tablespoon of baking soda and close cap. Shake and watch your car race off!

Photo's courtesy of: Left Brain Craft Brain

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STEM AT HOME GUIDE: Chemical Reaction Car Experiment Extension Activity

Fizzy Sherbet

Materials:

Soft icing sugar

Citric acid for baking

Jell-O flavoring

Instructions

An adult should assist with using the materials in this experiment. **WARNING-** this activity can get yummy! In this experiment you will explore how delicious chemical reactions can be.

- Begin by adding 3 teaspoons of soft icing sugar to a medium sized bowl.
- Next add 1 teaspoon of citric acid.
- Pour 2 teaspoons of raw Jell-O flavoring. (For an additional spark of fun- add some Pop Rocks!)
- Stir all ingredients together.
- Enjoy! Serve in cups or a bowl.
- Store in Ziploc bags and refrigerate to enjoy more later.



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