

Fizzy Rockets

Teacher Copy

Lesson Focus

This lesson focuses on the concept of physical change versus chemical change. It also touches on three of the four forces of flight (thrust, drag, and gravity) and how changes in design can affect performance.

This lesson also covers Newton's third law of motion, which states that for every action (force), there is an equal and opposite reaction.

[The history of rockets](#), National Geographic
[Alka-Seltzer commercial](#)

Grade Levels

6-8

Objectives

During this lesson students will:

- Build their own rocket (may be done with partners)
- Record observations
- Adjust design
- Communicate results

Materials

(Materials for a group of 20 students working)

1. 10 canisters
2. Tape
3. Scissors
4. Template sheet for nose cone, fins, and canister cover
5. Markers or crayons to decorate rocket (optional)
6. Pencils or pens
7. Water
8. 15 tablets of sodium bicarbonate (one-and-a-half per group)
9. Safety goggles

Pre-Lab Questions: Please use complete sentences with correct punctuation.

1. What are Newton's three laws of motion? Write them down or look them up.

First: Objects at rest or in motion tend to stay at rest or in motion until acted upon by an outside force.

Second: Describes how mass, acceleration, and force are related. $f = ma$

Third: Every action has an equal and opposite reaction.

2. Read over the lab. Which law do you think applies and why? *Third — the thrust of the air pushing down and out from the canister is what propels it upward.*
3. Why should you wear goggles for this lab? *It is a chemical reaction, and the rockets can lift off at fairly high speeds.*
4. What is the difference between a chemical and physical change? *A chemical change causes a change in the substance; a physical change only causes a change in state of matter or size.*
5. What factors influence the rate of reactions? *Temperature, surface area, concentration, solvent, catalysts.*
6. What are we changing in this experiment? *Concentration.*
7. What are the four forces of flight and their definitions?

Thrust: *The force that moves an aircraft through the air.*

Drag: *The force that resists movement through the air, air resistance.*

Lift: *The force that directly opposes the weight of an airplane and holds the airplane in the air.*

Gravity: *The force that holds all objects to the Earth.*

Procedure

1. Measure paper to cover the body of your film canister.



2. Use the template to create a nose cone. Attach the nose cone to the bottom of the canister.
3. Design your fins or use the template. Decide on the number of fins for your rocket.
4. Tape the paper body, nose cone, and fins onto the canister. Do not block the base or extend fins past the base. The canister lid has to be able to detach from the canister.



5. Hold the rocket upside-down and fill halfway with water.
6. Drop the tablet into the water and quickly snap on the lid.
7. Set the rocket on its base and step away.

Independent variable: the variable that is changed. _____

Dependent variable: the variable being measured due to the independent variable. _____

Teacher note: You can set up this experiment in many ways. Below is one example.

Hypothesis: I think the canister will go (higher or lower) with (one or half) of a tablet because _____

Data

Sample Data Table

Alternative: Measure height with an analog altitude calculator and graph results.

Number of trials can be for group or individual, depending on number of tablets available.

Trial	Full tablet	Half tablet
1		
2		
3		
4		
5		

Present your conclusion to your peers. Was your hypothesis supported? How did your data support that conclusion? How could you change this experiment in the future?

Questions

1. Is this lab based on a chemical or physical change? Why? *This lab shows a chemical change because the substances that we are starting with are different from the substances we end with.*
2. How could you increase the height of the flight? *Answers will vary — increase the reactants, use a lighter canister, adjust the fin shape, etc.*
3. What provides the thrust for this rocket? *The chemical reaction.*

Extension

Look at the evolution of rockets. Use a variety of sources, including print and digital. Highlight design changes that improved the performance.

Alignment to Curriculum Frameworks

NGSS Engineering Practices

- MS-PS2-2. Plan an investigation individually and collaboratively, and in the design: Identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data is needed to support a claim.
- MS-PS2-5. Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Common Core—ELA

- RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Assessment

1. An altitude calculator measures
 - a. **Height**
 - b. Weight
 - c. Mass
 - d. Velocity
2. Is this experiment part of a larger system?
 - a. **Yes**
 - b. No
 - c. Depends on the temperature
 - d. Depends on the mass
3. What is the dependent variable in this experiment?
 - a. Fins
 - b. Rocket body
 - c. Canister
 - d. **None of the above**
4. What is an independent variable?
 - a. **The one that we change**
 - b. The one that happens as a result of our change
 - c. Something that stays the same
 - d. None of the above
5. What are the four forces of flight?
 - a. Drag, gravity, mass, height
 - b. Drag, gravity, thrust, mass
 - c. Drag, gravity, mass, lift
 - d. **Drag, gravity, lift, thrust**
6. What is a constant?
 - a. The one the we change
 - b. The one that happens as a result of our change
 - c. **Something that stays the same**
 - d. None of the above

7. Newton's third law of motion is:
 - a. Force = mass x acceleration
 - b. For every action, there is an opposite and equal reaction**
 - c. All particles are in motion
 - d. Every object in a state of uniform motion will remain in that state of motion unless an external force acts on it
8. What type of ignition did your rocket use?
 - a. Electric
 - b. Fire ignition
 - c. Physical
 - d. Chemical**
9. Which of your rockets went higher and why?