LESSON 2:
ROCKET SCIENCE

SUPPLIES

HANDOUTS FOLDER

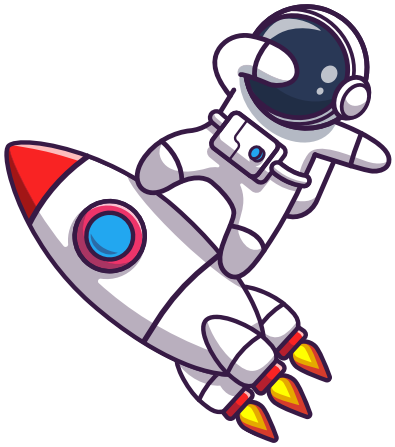
- Rocket Templates - 5

MAIN BIN (ZIP LOCK)

- Straws - 25

PENCIL BOX

- Clear Tape - 2
- Pencils - 20
- Markers - 15
- Scissors - 15
- Tape Measure



OBJECTIVES

- [x] How does force affect the distance a rocket can travel?
- [x] How does trajectory affect the distance a rocket can travel?

HOOK

3-5 min

- How do rockets launch into space?
- What factors affect how fast and how far a rocket can travel?

INTRODUCTION

3-5 min

Blasting off into space is like a science fiction dream come true, fueled by cool stuff like Newton's Third Law and some serious brainpower from physics and engineering whizzes. From classic chemical rockets to fancy thrusters and nuclear thermal rockets, there are all sorts of ways for the modern rocket to exist. Mix in a pinch of thermodynamics, fluid dynamics, and materials science, and you've got a rocket recipe for interstellar success!

Once a rocket is built, a very important step comes next, the Launch! Today we will be acting as the thrusters trying to get our rockets into space.

PREP FOR STUDENTS

3-5 min

Have these materials out and ready for use for the students to use:

- Pencils - 15
- Rocket Templates
  - Helps to cut each template into 3 parts following the **dotted lines**
- Clear Tape - 2 Rolls
  - Helps to pre-cut lots of pieces for the students
- Markers for decorating their templates
- The should be the last part of process
  - Pass these out at the end so that students are not shooting rockets unsupervised

ROCKET SCIENCE

ACTIVITY SET-UP

20-30 min

1. To start the experiment, give each student the rocket template and let them color it in.
   - Cut out the rectangle and the Fin Template
     - Split the fins in the middle where the line is

2. The rectangle is the body, wrap it around the pencil and secure it with tape against itself on the middle and bottom portions.
   - Leave the top un-taped for now

3. Attach the fins. Align the bottom of the rectangle that extends between the fins with the bottom of the rocket body, and tape the fin to the body tube.
   - Do the same thing for the other fin on the opposite side, making a "fin sandwich."

4. Bend the fins. Bend the fins on each fin unit 90 degrees so that they are each at a right angle to each other. When you look along the back of the rocket, the fins should form a "+" mark.

5. For the nose cone, move the cylinder up the pencil so that the top is lined up with the nose pencil tip.

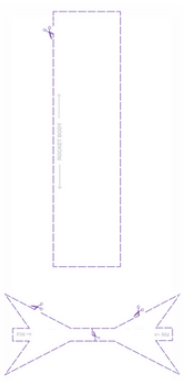
6. Twist the top of the body tube into a nose cone around the sharpened end of your pencil.

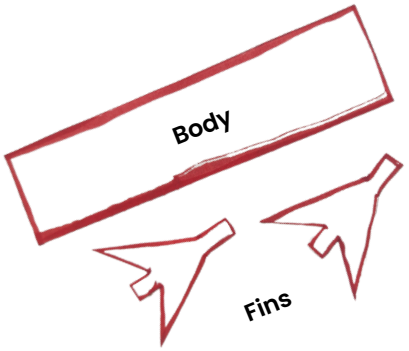
HYPOTHESIS

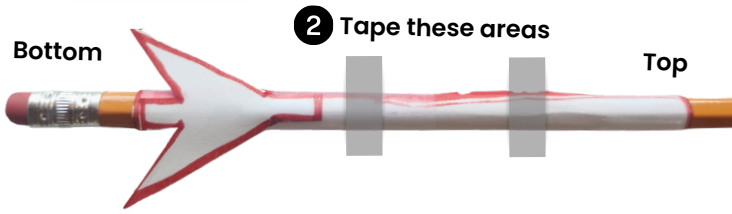
3-5 min

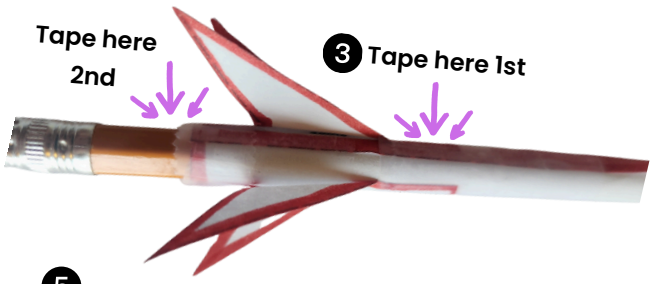
Using their paper and pencil, have students write their predictions:

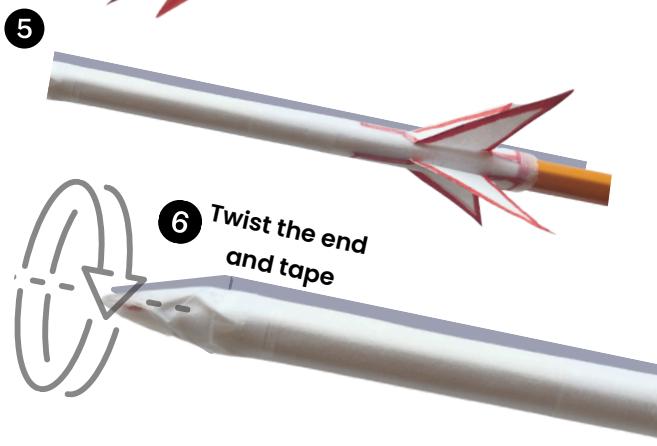
- How far do you think the straw rocket can travel?
- What angle of release will make the rocket travel the furthest?
- How much force (air blown) will make the rocket travel the furthest?



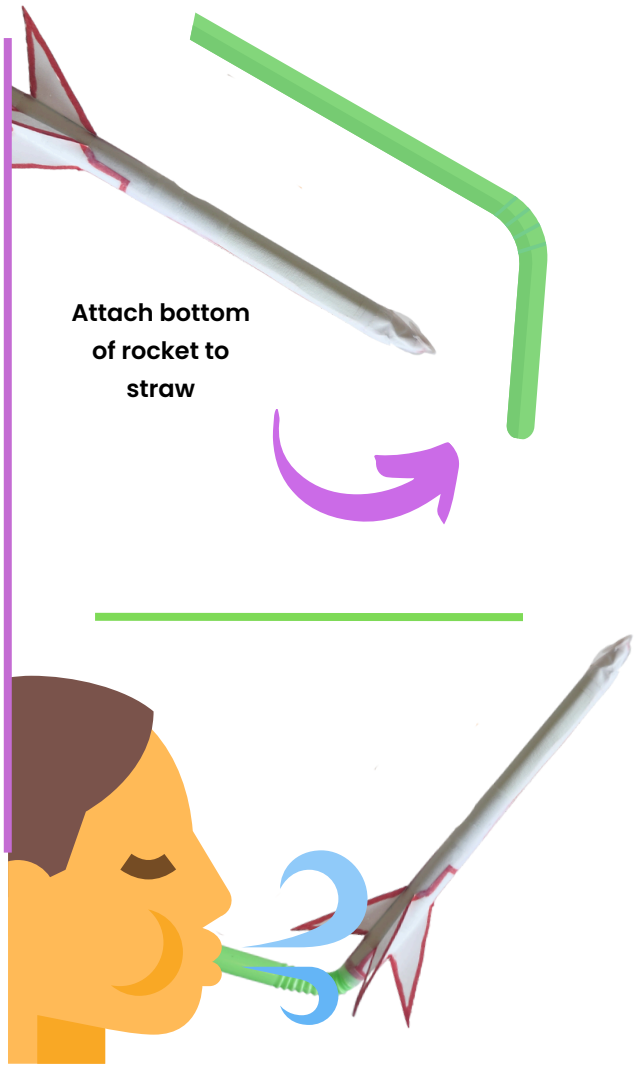








ROCKET SCIENCE



ACTIVITY LAUNCH

20-30 min

1. Prepare to launch! Remove the pencil and replace it with a soda straw.
    - Be sure your launch area is clear of people and hazards.

2. Blow into the straw to launch your rocket! Record the distance the rocket travels on your data log.

3. To measure how far it travels, you can either set up a launching station in the classroom, with distances marked out, or give students a tape measure and have them measure their launches.
    - Launches should be recorded on the scientist's worksheet.

4. Let each child launch their rocket 3-5 times, depending on how much time you have.

5. Remind children that as they launch their rocket each time, to record the force they blow with and the angle that they keep the straw.

CONCLUSION AND OBSERVATIONS

Ask children to review the space rocket activity:

- How much force did you use when you blew into the straw?
- What angle did you use to start the launch?
    - Was the rocket horizontal, at 45-degree angle or closer to a 90-degree angle?
- How far did the rocket travel?
- Did force and angle affect the rockets travelled distance?

ROCKET SCIENCE

EXPLANATION

3-5 min

The rocket traveled further when children blew harder into the straw because of kinetic energy and acceleration. The more air blown into the straw, the more kinetic energy the rocket had. This increased its acceleration and force with which it travelled. The more kinetic energy, force, and acceleration an object has, the further it can travel.
Energy cannot be destroyed, but rather changed from one form to another. As the rocket flew, the more kinetic energy it had from blowing it, the more energy needed to be converted to another form.

Air resistance is the friction that air applies to an object. As the rocket travelled through the air, air resistance applied friction and converted kinetic energy into heat energy, causing the rocket to slow and stop traveling. The more kinetic energy the rocket had (the more air blown into the straw), the longer the air resistance took to convert the energy and slow the rocket down. Therefore, the further it travelled.

The trajectory of the rocket also affected the distance it travelled. Trajectory includes both horizontal and vertical motion. As the rocket was launched, gravity was working to pull the object to the ground, limiting how far it could travel. If the rocket is released at 90 degrees, it will travel up on a vertical plane and will not travel horizontally to achieve a distance. If the rocket is released on a horizontal plane (0 degrees) then it will begin to move horizontally but gravity will quickly pull it down to the ground. The ideal point of release and trajectory is 45 degrees because it is the middle point between vertical and horizontal releases. The rocket gains enough vertical height to combat gravity while also maintaining a horizontal trajectory that allows it to gain distance in its flight.

CLEAN UP

Make sure all the materials are picked up, thrown away, or kept.
Students can take their projects with them.

Make sure all the tape and cut pieces of paper are picked up and thrown away or recycled

ROCKET SCIENCE