TOUCHTOMORROW

A FESTIVAL OF SCIENCE, TECHNOLOGY, AND ROBOTS

ACTIVITY INFORMATION & INSTRUCTIONS

ACTIVITY NAME: Let's Launch Together –Bottle Rockets

EXPLANATION OF ACTIVITY: From airplanes and spaceships to balloons and frisbees, flight is an important part of today's society. This activity builds and experiments with bottle rockets, the perfect model for investigating what aerospace engineering is all about. After reviewing how to build the bottle rocket, this video details a setup you can use to test what forces, materials, and designs maximize airtime. So at the end of the day, here's the question: how high can you fly?

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GATHER THESE SUPPLIES FOR THE BOTTLE ROCKET

- 2 Empty Soda Bottles (same size)
- Cardboard Sheets
- Scissors
- Permanent Marker
- Cotton Balls
- Tape

TO SET UP AND LAUNCH THE BOTTLE ROCKET

- Bottle Rocket
- Open outdoor space
- An Air/Bicycle Pump
- Water
- A base to keep bottle rocket upright
- A helper (optional)

TO BUILD THE BOTTLE ROCKET

1. Draw a line around the top upper quarter (near the cap but above the label) of one of the soda bottles.
2. Cut the top off by following the line with your scissors. Remove excess plastic as needed.
3. Stuff 2-3 cotton balls into the bottom of the inside of the cap.
4. Tape the cotton balls in place.
5. Remove the label from the second soda bottle.
6. Tape the bottom of the cut top (our nose cone) from the first bottle onto the bottom of the second.
7. Using your bottle rocket as reference, draw a triangle on your cardboard. Its longest side should be as long as the flat part of your bottle rocket.
8. Cut the triangle out.
9. Use this triangle to trace and cut three more identical triangles of the same size and shape.
10. Tape the fin to the rocket, using the longest edges and two pieces of tape on either side to prop it upwards. Rotate the rocket about 90 degrees between every fin.
11. Re-tape any fins whose long edges are not directly touching the rocket's body tube and cut off any excess tape.

CONTINUED ON NEXT PAGE

ACTIVITY NAME: Let's Launch Together –Bottle Rockets (pg 2)

TO SET UP AND LAUNCH THE BOTTLE ROCKET

1. Fill your rocket with water. Leave space within the body tube for air to be pumped in.
2. Secure the water in the bottle.
3. Flip the rocket so the nose cone points upwards and the bottom attaches to your pump and base.
4. Pump air into the rocket until it launches and starts flying. You should see air bottles rise through the water up to the top of the bottle with every pump.

TIPS AND TROUBLESHOOTING

- The plastic may be hard to cut, so you may need someone to help you.
- If the fins are too tough to be cut all at once, cut off a section of the cardboard with the fin in it, then go back and cut off the cardboard surrounding the fin.
- If the nose cone cap does not fit securely onto the bottom of the second bottle, it is best to use another soda bottle to cut a new nose cone.

VOCABULARY - Can you match the words to the proper definitions?

• Lift	• the front-most part of the rocket shaped like a cone to reduce drag and help stability
• Drag	• an upwards force that holds the rocket in the air and is mainly generated by the fins
• Gravity	• the main part of the rocket to which other parts attach and fuel is stored
• Thrust	• a force that opposes thrust and slows the rocket down due to air resistance & friction
• Model	• a downward force that acts on all objects on Earth and pulls the rocket to the ground
• Nose cone	• a forward force that directs the rocket through the air and is generated by the engines
• Fin	• triangular parts placed around the base of the body tube to provide stability & control
• Body tube	• smaller, simpler, and functional representations of a full-sized model

REFLECTION QUESTONS

1. How does the current model decrease drag and the force of gravity while increasing thrust and lift?
2. What could be improved about building the rocket? What would you keep the same in future models?
3. What materials and fuels optimized the time your bottle rocket spent flying?
4. Has your view on rockets and aerodynamics changed after this activity?
5. Why does the rocket fly? What is the science behind it?