Pop Bottle Rocket

Objective

Build a pop bottle rocket that will stay in the air as long as possible.

The launch and flight of a rocket are governed by Newton's Laws of Motion.

Newton's First Law:

An object at rest will stay at rest. An object in motion will stay in motion in a straight line at the same speed as long as no unbalanced force is applied.

Newton's Second Law:

The acceleration produced by a net force on an object is directly proportional to the net force, is in the same direction as the net force, and is inversely proportional to the mass of the object. Rocket thrust is a type of force.

Newton's Third Law:

For every action there is an equal and opposite reaction.

How do Newton's Laws of Motion apply to rocket flight?

An unbalanced force must be exerted for a rocket to lift off from a launch pad or for a craft in space to change speed or direction (First Law). The amount of thrust (force) produced by a rocket engine will be determined by the rate at which the mass of the rocket fuel burns and the speed of the gas escaping the rocket (Second Law). The reaction, or motion, of the rocket is equal to and in the opposite direction of the action, or thrust, from the engine (Third Law).

Construction

What are the main parts and the materials used to make a 2-liter bottle rocket?

- Nose cone — the nose cone is the leading, tapered or pointed section of the rocket. It helps reduce aerodynamic drag or air friction.

- Body tube (plastic bottle- 2 liter) — the body tube is the central structure of the rocket that becomes pressurized before launch.

- Fins — the fins help guide the rocket and provide a stabilizing force.

Design tips

- Do NOT puncture the 2-liter bottle. This bottle must be pressurized before launch.
- Materials used for the rocket should be relatively light, but strong and durable.
- The various parts should be well secured with tape making the seams smooth to reduce air resistance.
- Fins should be the same shape and equally spaced around the portion of the two liter bottle nearest the nozzle and allow the bottle to rest properly on the launch pad.
- The center of gravity or balance point should between the nose and middle of the rocket.
- For safety reasons, do not use metal or have spikes sticking out of the nose cone of the rocket.

Rocket # _____

Mass (g) _____

Length of Nose Cone (cm) _____

Balance: ***(Tips toward the cone, tips toward the fins, stays balanced)*** _____

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Length of Nose Cone (cm) _____

Balance: ***(Tips toward the cone, tips toward the fins, stays balanced)*** _____

Rocket # _____

	Criteria	Data/ Score
	Mass (g)	
	Balance (Tips toward the cone, tips toward the fins, stays balanced)	
Nose Cone	Length (cm)	
	On a scale of 1-5, how straight is the nose cone? (1= 45^{o}, 5 = perfectly straight)	
	On a scale of 1-5, how smooth are the seams on the nose cone? (1= the seams are ragged and the cone is barely hanging on, 5= the cone is well-secured and the seams are perfectly smooth)	
Fins	Number of fins	
	Size and shape of fins	
	On a scale of 1-5 how symmetrically are the fins placed? (1= looks random, 5= perfectly symmetrical)	
	How smooth are the seams? (1= the seams are ragged and the fins are barely hanging on, 5= the fins are well secured and the seams are perfectly smooth)	
Observations		
Flight	Flight time (s)	
	Flight observations	

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Observations		
Flight	Flight time (s)	
	Flight observations	

Pop Bottle Rocket Name: _____ Per: _____
Integrated Science: Physics/Design

Please staple the class data to the back of this worksheet.

1. How long did your original rocket stay in the air?_____

2. Look over the rocket data for the entire class. What were the characteristics of the rockets that did well?

3. List the changes you are going to make to your rocket and give the rational for the changes.

4. How long did your redesigned rocket stay in the air? _____

5. Write a paragraph describing the differences between your first and final model. How did each modification affect the rocket's performance? Describe unsuccessful as well as successful design changes.

This section is for teacher use only
1. Materials were brought on time_____
2. The rocket was part of the class data _____
3. The class data is stapled to the back of this packet_____