STEM Sims™

Water Rockets

STEM Sims™

Water Rockets

Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start learning right now about water rocket propulsion. Take the following brief quiz to see how much you already know about water rockets. See the bottom of page 4 to check your answers.

1. The highest altitude a water rocket has been launched on record is:
   a. 500 feet.
   b. 1000 feet.
   c. 1500 feet.
   d. over 2000 feet.

2. What is the current record for the highest number of water rockets launched simultaneously?
   a. 57
   b. 96
   c. 213
   d. 324

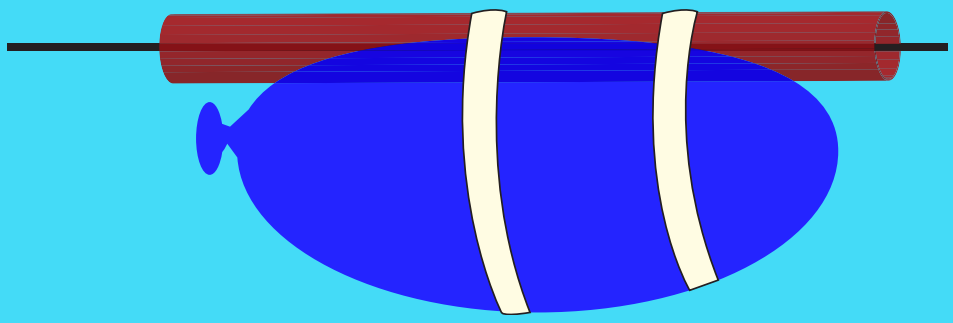
3. Where and when were the first steam-powered rockets invented?
   a. in the region of Southern Italy in 300 B.C.
   b. at a Chinese festival in 1045
   c. in the Netherlands in 1720
   d. in Russia in 1898

4. What is the maximum air speed of a typical bottle rocket?
   a. 100 km/hr
   b. 200 km/hr
   c. 300 km/hr
   d. faster than the speed of light

5. Sir Isaac Newton's book that established the three laws of motion is:
   a. *Method of Fluxions.*
   b. *Philosophiæ Naturalis Principia Mathematica.*
   c. *Arithmetica Universalis.*
   d. *Theoria Motus Corporum Solidorum Seu Rigidorum.*

Rocketeers

There are multiple ways that you can demonstrate Newton's third law of motion: that every action has an equal and opposite reaction.



Supplies Needed:
- a long string
- a variety of balloons
- tape
- a plastic straw
- a stopwatch
- measuring tape

Instructions:
1. The string will provide your track, so tape or tie one end of the string to a sturdy object (i.e., a chair, a desk, a doorknob).
2. Next thread the other end of the string through the straw.
3. Then, blow up the balloon and hold the end without tying it.
4. Holding the end of the balloon, tape it to the straw and drag the straw and balloon to one end of the track.
5. Have a partner hold the other end of the string taut so that the track is parallel with the ground.
6. Finally, start the stopwatch at the same time as you let go of the balloon and stop the stopwatch when the balloon stops moving. Record the time in seconds below.
7. Measure the distance traveled by the balloon with measuring tape and record it in centimeters below.
8. Experiment with variables such as number of breaths and balloon type.

Trials	# of Breaths	Balloon Description	Distance Traveled (cm)	Time (s)
1				
2				
3				

Questions:

1. What is the greatest distance that the balloon traveled?

2. What is the fastest speed at which the balloon traveled?

3. What effect does the number of breaths have on the distance traveled? Please explain your response.

Water Rockets

Rocket Facts

In do-it-yourself experiments, rockets can be propelled by either chemical or physical changes. Examples of rocket experiments that rely on chemical reactions would include the Mentos® in a diet cola bottle and the baking soda and vinegar bottle rockets. Both produce foams that expand beyond their original containers, causing thrust that propels the bottle. Typical water bottle rockets, however, rely on physical reactions to propel the rocket.

Water rockets require both water and air: the water gives more force to the bottle, but the pressurized air acts as the catalyst, pushing the water down. In a water rocket, the water provides the reaction mass, meaning the fuel required for propulsion. Experiments are required to determine the perfect ratio of water to air to get maximum launch height. Even though the water is required to provide the force, more water makes the rocket heavier, and therefore institutes drag on the water rocket. Drag is a resistance between a solid and a fluid based on velocity, and it must be overcome to get more height.

There are many things you can do to reduce drag or make it work to your advantage. The shape of the rocket has a large effect on the flow. A conical nose helps reduce the drag because it alters the air's pattern less. Fins are also a helpful addition to your water rocket. Not only do they add stability, but if placed properly, they can lower the center of pressure, decreasing the likelihood of the rocket flipping over in the air.

Working with rockets can be dangerous, so it is important to always use protective eyewear and have attentive adult supervision if you intend to try one of these experiments at home (outside). Be prepared for a long cleanup too because some of them can get really messy!

Please visit our site for more helpful information:

STEMsims.com

Answers: Page 2 Answers: 1) d. 2) c. 3) a. 4) b. 5) b. **Page 3 Answers**: 1) Answers will vary. 2) Answers will vary. 3) Sample Response: The more breaths supplied to the balloon, the more distance the balloon travelled because the breaths expel from the back of the balloon, propelling the balloon forward. Number of breaths, distance traveled, and speed are all directly proportional.

The Green Engineering Magnet (GEM) project was funded in part under the National Science Foundation grant contract #IIP-1127544. Its contents are solely the responsibilities of the authors and do not necessarily represent the official views of the National Science Foundation.