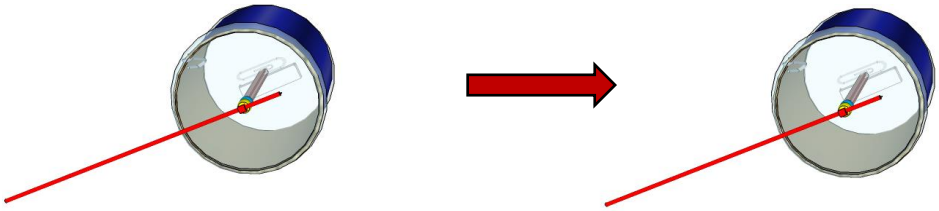
ROLLER RACER

Exploring energy conversion with a twist!



Enjoy the hands-on experience of building and using the Roller Racer, a modern variation of an old favorite. Explore the application of simple machines and energy conversion and investigate how changes in the amount of stored energy can affect the distance in which this device can roll!

Curriculum topics

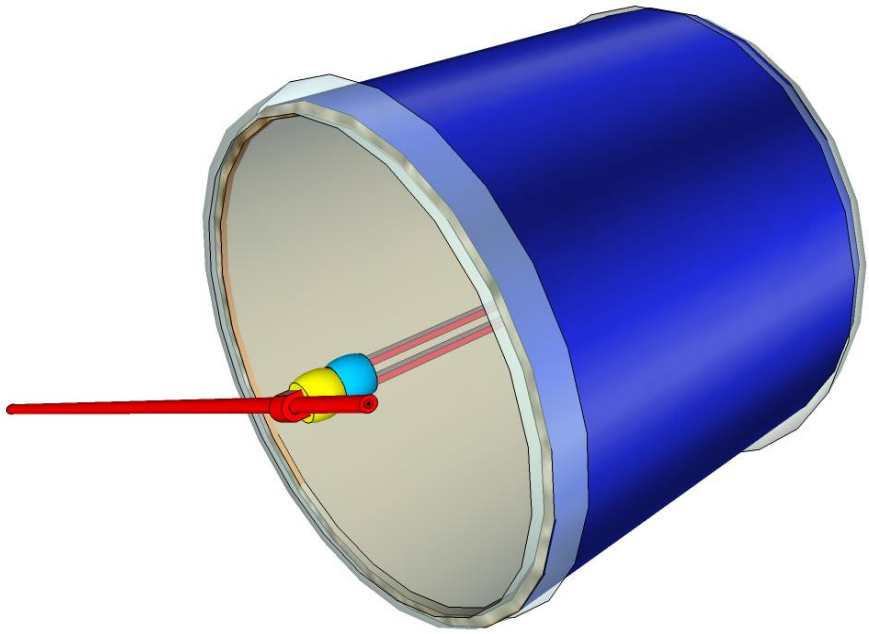
- Air Pressure
- Friction
- Motion
- Inertia
- Engineering/Design

Subjects

- Engineering
- Physical Science

Grade range: 3 – 8

Who we are: Resource Area for Teaching (RAFT) helps transform the learning experience by inspiring joy through hands-on learning.



Share Your feedback!
http://bit.ly/RAFTkitsurvey

Materials

Materials in the kit may vary but generally, this kit contains the following:

- Plastic lids, circular, 3-6” diameter (2)
- Corrugated cardboard sheet, flutes parallel to the short side (1)
- Rubber bands (2)
- Pony beads, regular (2)
- Thin straw or coffee stirrer, 7” (1)
- Adhesive foam block (1)
- Paper clips (2)

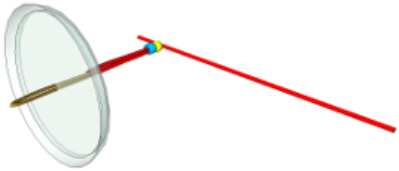
WARNING: Rubber bands contain natural rubber latex which can cause allergic reactions.

To Do and Notice

1 Interlock the two rubber bands as shown below. Insert the end of one rubber band through both pony beads until a small rubber loop sticks out.

2 Insert the thin straw through the small loop in the rubber band. Pull on the other end of the rubber band to tighten the loop around the straw.

3 Insert the free end of the rubber bands into the hole in the first lid starting from the top side of the lid (groove is on the bottom side). Pull the rubber band through until the beads are snug against the lid (see right).



4 Place the lid on a flat surface with groove facing upward. Insert the long edge of the corrugated cardboard sheet into the groove of the lid, shaping the sheet to form a cylinder. Overlap the ends and secure with a paperclip (see below, left).

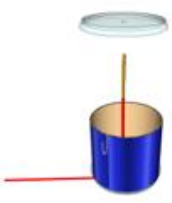
5 Pull the end of the rubber band up and out of the cardboard cylinder and through the second lid (groove side facing downward). Fit the cardboard edge into the lid (see below, right). Hold the lid in place while pulling the rubber band up until the knot between the rubber bands comes through the lid. Insert a paperclip into the loop between the knot and the lid.

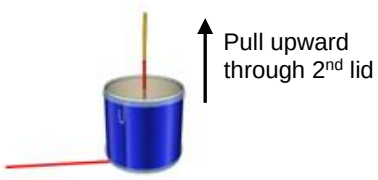
6 Remove the release paper from the piece of adhesive foam. Adhere the foam on the lid next to the paperclip. The foam prevents the paperclip from rotating.

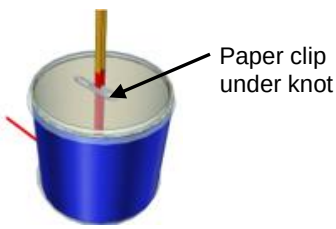
7 Hold the Roller Racer in both hands. Rotate (twist) the straw around the pivot point a set number of times (for example, 10 to 20 times). This winds the rubber band.

8 Set the Roller Racer on a smooth surface. If the 2 beads have become tilted, move the straw so that the beads are at a right angle to the lid. Aim the Roller Racer in a direction clear of obstacles and let go! Note the direction, time, and distance of travel. Repeat by changing the number of twists in the rubber band.

9 **Share** student learning with RAFT! Submit photos/video via email at education@raft.net or on social media (Facebook, Twitter, Instagram).







Core Content Skills:

Science & Engineering (NGSS)

Developing and Using Models, Planning and Conducting Investigations, Generating and Comparing Design Solutions, Properties of Matter, Forces and Motion, Definitions of Energy, Conservation of Energy, Types of Interactions, Cause and Effect, Systems

Social Emotional Learning

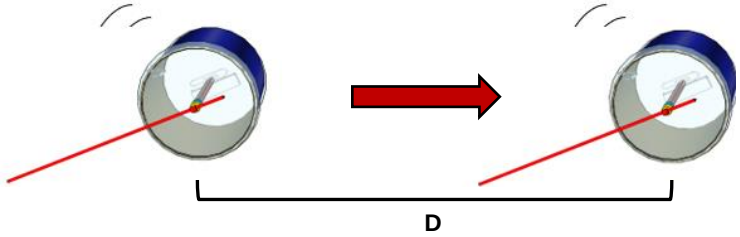
- Self-awareness
- Self-management
- Responsible decision-making

The Content Behind the Activity

Turning the straw, which acts as a lever, will wind up the rubber band and store elastic potential energy. This energy is the result of the mechanical work done by a moving finger as it applies a force over a certain distance. When the rubber band is allowed to unwind, the **potential energy** (stored energy) is converted into **kinetic energy** (energy of motion), and a small amount of heat that is generated by the friction of the Roller Racer with the surface it touches, as well as the air it moves through. The more twists in the rubber band, the more potential energy is stored, resulting in more kinetic energy being available to move the Roller Racer through a greater distance.

If distance and time data are measured, these data can be graphed to reveal patterns in relation to the number of twists in the rubber band. For example, a simple graph can be made with the number of twists along the x-axis (independent variable) and the distance traveled along the y-axis (dependent variable). Similarly, one can graph the time of each traveled distance vs the number of twists. In addition to this graphical analysis, it is possible to calculate the average speed of the Roller Racer by taking the average distance traveled and dividing that value by the average time measured for each number of twists in the rubber band (see Resources below).

Roller Racer travels a distance **D** in a certain amount of time **t** for **X** number of twists



Reuse

This kit uses 100% reusable materials designed for other uses. To continue making a positive impact in reducing waste, reuse these materials in other projects. Additionally, any unused materials can be collected and delivered back to RAFT.

Feedback

Please comment on this kit by taking this short survey: http://bit.ly/RAFTkitsurvey. Let us know of any material concerns (missing, broken, or poorly fitting parts) as well as any suggestions for improvement.

Visit https://raft.net to view related activities!

Car on a Roll
Racing Cups
Rollback Can
Retractor Car

Resources

- Difference between potential and kinetic energy – https://bit.ly/3Cm7kfo
- Relations between speed, distance, & time - https://bit.ly/30tX8o9