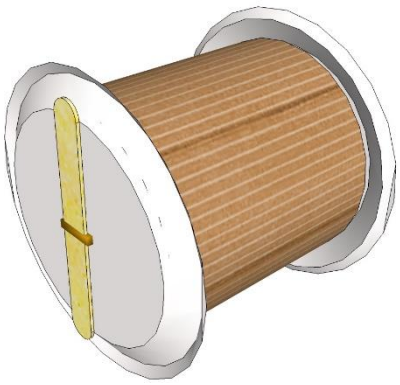
ROLLBACK CAN

Investigate energy and motion with this intriguing cylinder!



Curriculum topics

- Energy
- Forces & Motion
- Engineering/Design

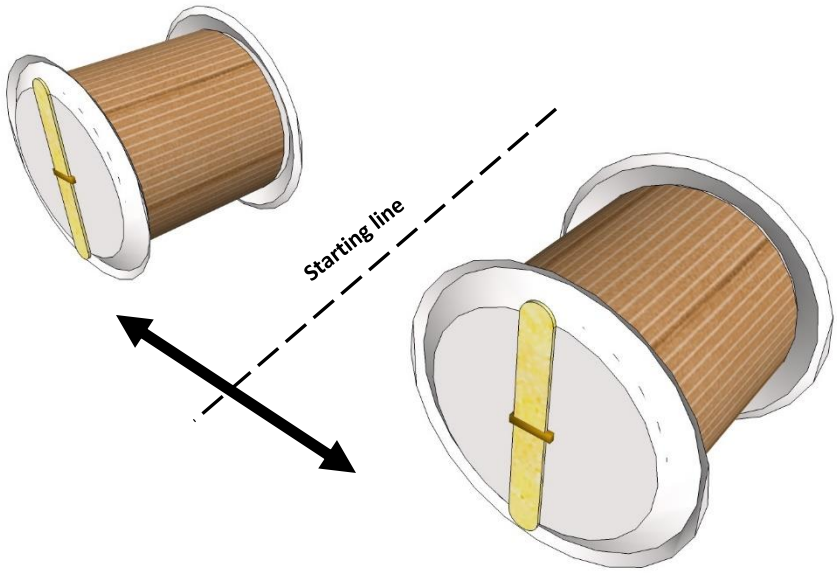
Subjects

- Engineering
- Physical Science

Grade range: 6 – 8

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

This clever device is ideal for investigating how energy is stored and converted into motion and demonstrates the concept of balanced and unbalanced forces. It amazingly rolls back and forth to its starting point on its own!



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

Materials

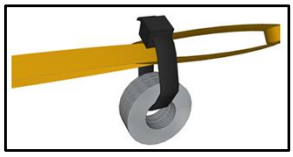
Materials in the kit may vary but generally, this kit contains the following:

- Plastic plates, 6”-7”, w/ holes (2)
- Corrugated cardboard, 6” x 17” (1)
- Paper clips, jumbo (2)
- Rubber bands, #64 (3)
- Flat metal washers (4)
- Craft sticks, jumbo (2)
- Releasable zip tie
- Not included: Scissors

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

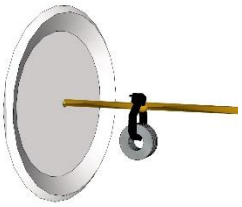
To Do and Notice

1 Interlock the 3 rubber bands, leaving them loosely connected (shown below left). Insert the thin zip tie end through one of the 2 rubber band knots. Pull the rubber bands until tight.



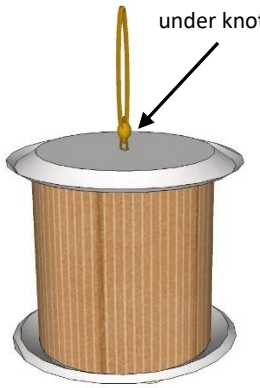
2 Insert the zip tie end through all four metal washers. Put the thin end through the locking head of the zip tie and pull until the washers hang loosely near the rubber band knot. Cut off the slack (see above right).

3 Push the rubber band loop nearest the washers through the food side of one plate (right). Form a loop to insert a craft stick (see below). Pull the rubber bands to tighten.



4 Place the plate with craft stick side-down on a flat surface. Form a cardboard cylinder that fits inside the diameter of the plate, overlapping the cardboard ends, and secure with paper clips. Pull up on the rubber bands.

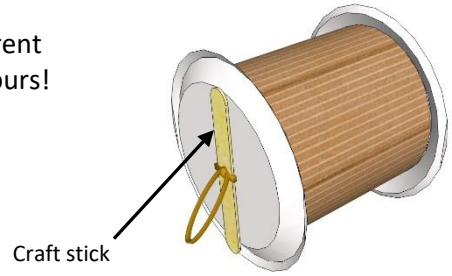
5 Insert the rubber bands through the hole in a second plate. Hold the second plate food side down and pull the rubber bands upward until a knot comes through the hole. Insert and center a craft stick into the rubber band loop under the knot.



6 Place the Rollback Can on a smooth, level surface about 10 feet long. Give the Rollback Can a firm push in a direction that is clear of obstacles. Observe its motion. What happens as it rolls? What do you think is happening to its kinetic energy (energy of a moving object)? Where is energy being stored in the device?

7 If a rapid rattling sound is heard while the device is rolling, the weights are too close to the rubber band and are causing it to unwind. Loosen the zip tie to make more room for the washers. Adding more washers to increase the weight can also fix this issue.

8 Get creative with the Rollback Can and its motion. Try using a ramp, different surfaces, or make larger or smaller versions of the device. The choice is yours!



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, Developing Possible Solutions, Optimizing the Design Solution, Forces and Motion, Definitions of Energy, Conservation of Energy, Cause and Effect

Social Emotional Learning

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

The Content Behind the Activity

Much of the **kinetic energy** (moving energy) provided by pushing the Rollback Can is stored as **potential energy** in the stretched rubber band as it twists. The potential energy is converted back into kinetic energy as the rubber band unwinds. The narrow edges of the plates minimize the rolling friction so that the Rollback Can will come back almost to (or even past) the starting point when rolled on a level surface.

The weight of the washers is pulled down by gravity. If the weight does not lift over and around the rubber band, the rubber band will become twisted tighter and tighter as the Rollback Can's ends rotate. This happens after the user applies an initial push/roll to the Rollback Can. The twisting rubber band stores elastic potential energy. At some point all the kinetic energy of motion has been changed into the potential energy stored in the tightly twisted rubber band and friction. When all the kinetic energy has been changed, the Rollback Can will stop moving forward (state of rest = no motion =**balanced forces**). The rubber band applies a twisting (torsional) force to the ends of the can and the weight in the middle. Only the ends are free to rotate if the weight cannot be lifted over and round the rubber band. The potential energy in the twisted rubber band is released as the Rollback Can rotates in the opposite direction, moving back towards the starting point (motion = **unbalanced forces**).

Sometimes the rubber band can become so tightly wound that the weight is lifted and then rotates around the rubber band in the opposite direction, unwinding the rubber band. Some of the stored elastic potential energy is then converted into the kinetic energy of the rotating weight, therefore the device will not return as closely to the starting point as when the weight stays below the twisting rubber band

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
Roller Racer
Racing Cups
Retractor Car

Resources

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