

RAFT IDEAS

Topics: Forces, Motion, Gravity, Potential and Kinetic Energy

Materials List

- ✓ Regular or hanging file folders
- ✓ Marbles
- ✓ Tape
- ✓ Scissors
- ✓ Matte or foam board (optional)
- ✓ Bamboo skewers or pipette tips (optional)

This activity can be used to teach:

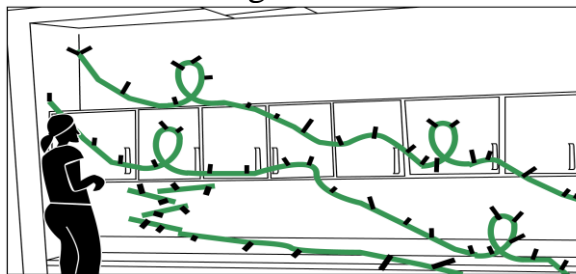
Next Generation Science Standards:

- Forces & Motion (Grade 3, Physical Science 2-1, 2-2; Middle School, Physical Science 2-2; High School, Physical Science 2-1)
- Kinetic and Potential Energy (Grade 4, Physical Science 3-1; Middle School, Physical Science 3-2, 3-5)
- Gravity (Grade 5, Physical Science 2-1, Middle School, Physical Science 2-4)



Marble Rollercoaster

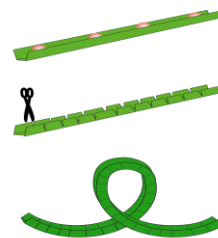
Let the good times roll!



Students will love this hands-on exploration of forces and motion!

Assembly (Younger students may need adult help with construction.)

1. Cut file folders into pieces about 8 cm x 28 cm (3" x 11").
2. Create track pieces by folding the file folder pieces into thirds to create "gutter-like" tracks, wide enough to let marbles roll.
3. Tape the tracks to walls, desks, chairs, or other available items. Be sure the tape will not damage painted surfaces. The track pieces can be overlapped to make longer sections.
4. Tracks can be curved by first adding vertical cuts to the "gutter" walls (see illustration). Create hills and loops by bending the pieces, as shown, and taping into place.



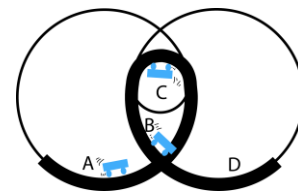
To Do and Notice

1. The path of the coaster track should contain numerous level changes. Can the marble be made to return to the starting point? If not then why not?
2. Coasters can be made permanent by taping or gluing tracks to matte or foam board. Bamboo skewers or pipette tips make excellent track supports. Push them into the foam board and then tape the tracks to them.

The Science Behind the Activity

The movement of a rollercoaster car subjects riders to changes in acceleration and deceleration, which is the rate of change of the car's **velocity**. Velocity (a **vector**) involves both the speed and the direction of movement. A car is accelerating when the speed is unchanged but the direction, as in going in a curve, is changing. Moving a rollercoaster car up the first hill (**lift hill**) increases the car's **gravitational potential energy**. This energy is the result of the car moving farther away from the center of the Earth. As the car falls or rolls down a slope, the gravitational potential energy is converted into **kinetic** (moving) **energy**.

There are numerous conversions back and forth from kinetic energy to gravitational potential energy as a rollercoaster car rolls up and down the track. Marble rollercoasters lose some of the energy of motion due to the friction where the marble touches the bottom and sides of the track and the friction with the air (air resistance).



Web Resources (Visit www.raft.net/raft-idea?isid=212 for more resources!)

- Physics involved - <http://www.learner.org/exhibits/parkphysics/coaster.html>
- History and physics - <http://science.howstuffworks.com/roller-coaster.htm>