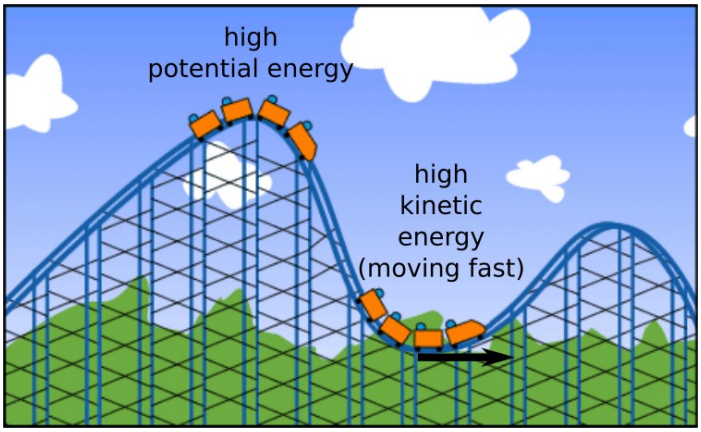
Kinetic and Potential Energy: Marble Coasters

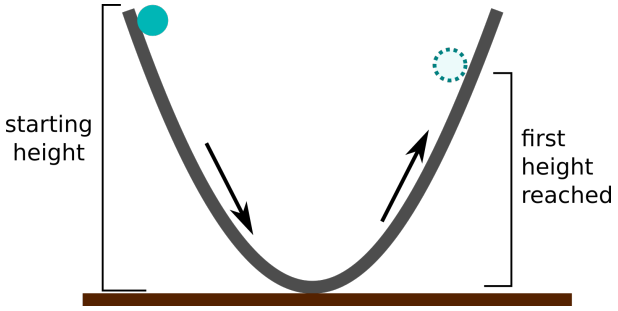
- **Energy** is the ability to cause movement
- Energy is **conserved**: it can be changed from one form to another, but the total amount remains the same
- Things that are moving have **kinetic energy**
- Things that are high up have **gravitational potential energy**
- Rubbing objects against each other (**friction**) converts kinetic and potential energy into **thermal energy** (warmth).



Work in a group of 3 to explore energy conservation in a marble roller coaster.

Part 1: Shuttling Back and Forth

1. Use one of the foam tracks to make a U shape. Tape the bottom of the U to the floor. **Use tape to secure the track to wall / table, so it doesn't wobble.**



How high are the ends of the track above the floor? This is your starting height

Starting height: _____

2. Start the marble off at one end of the track. Have a partner measure: How high does the marble go on the other end?

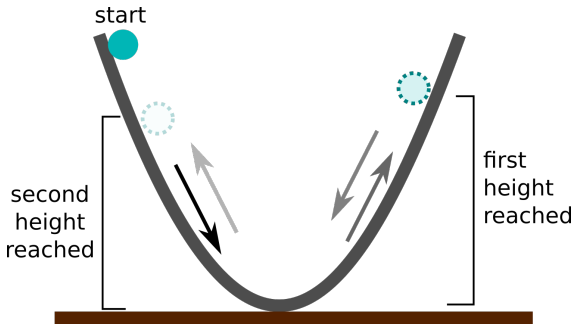
First height reached: _____

How does this height compare to the starting height? (circle one)

much bigger much smaller about the same

4. Now let the marble roll back and forth: up the far side and then again up the starting side.

How high does the marble go up the second time?



Second height reached: _____

Compared to the 1st height, the 2nd height is:

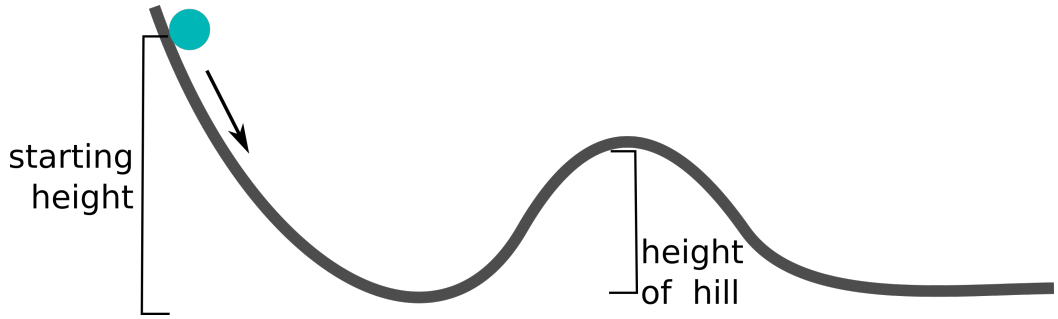
bigger smaller about the same

Discuss:Why do you think this is? Can you do anything to change the final height without changing the initial height?

Part 2: Over the Hill

1. Tape two tracks together, end-to-end (place tape on under-side of track). Make the junction smooth, so you have one long track.

2. Use the long track to make a coaster with a hill. Leave the initial height as before.



3. Start the marble at one end. Does it make it over the hill?

4. Try making the hill taller or shorter. What is the tallest hill the marble can go over?

Height of tallest hill: _____

How does the tallest hill compare to the first height the marble reached going up the U-shaped track? (circle one)

Hill is much taller Hill is much lower About the same height

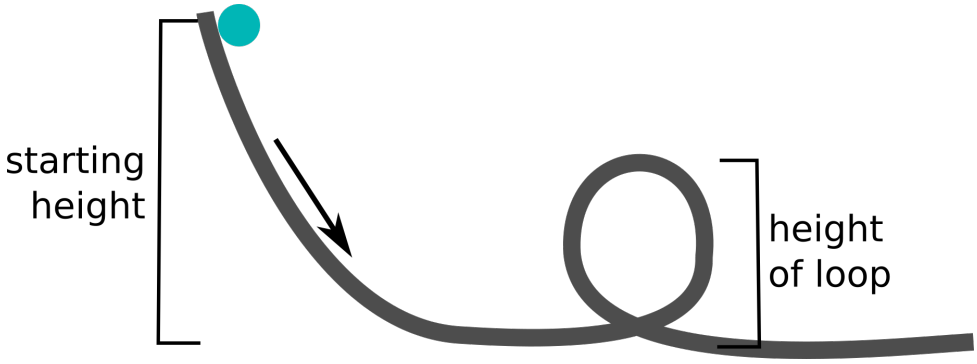
Discuss: Is it possible for the ball to get over a hill higher than the starting point? Why or why not? In what situation could the hill be nearly as high as the starting point?

Part 3: Loop-the-Loop

Now you will try making a loop in your roller coaster.

In order for the marble to make it around the loop it has to be moving fast enough that it goes over the top before it has time to fall.

1. Using the long track, make a roller coaster with a loop. Make sure the marble starts at the same height as before.



2. Try making the loop taller or shorter.

What is the tallest loop that the marble can get over?

Height of tallest loop: _____

How does the tallest loop compare to the tallest hill? (circle one)

Loop is taller Loop is shorter About the same height

Discuss: What forms of energy must the marble have at the top of the loop? Does this mean the loop needs to be shorter or taller than the hill for the marble to get all the way around?