Energy Explorations Outline  
Station 8

**Forces and Motion Station**

**Materials:**

Marbles-small, medium, large Plastic cup with hole cut out

Ping-Pong ball Two rulers, tape

Wooden blocks Long paper, pencil

**Introduction to Forces & Motion:**

* What is motion? *Motion is a change in position of an object. Anytime something moves, a force has been applied.*
* Find a partner. *Have students pair up. A leader will need to participate if there is an odd number in your group. Make sure EVERYONE is included.*
* You and your partner are going to thumb wrestle. *Allow 15-20 seconds (NO LONGER) for student to thumb wrestle. This shouldn’t go on very long!*
  + So why did we thumb wrestle? To talk about forces and motion! When our thumbs are straight up, is there any motion? No, there is no force so there is no motion.
  + What happened when you started to thumb wrestle? The person with the greater force pushed the other person’s thumb down.
    - Greater forces results in a greater change in motion.
    - A force can do three things: speed up, slow down or turn an object.
    - The motion of an object depends on the amount of force applied and the mass of the object that is moving.

**Activity #1: Force, Motion & Gravity**

* *Drop a ping pong ball on the table.* What force is acting on the ball? *Gravity.*
  + Gravity is a force that pulls objects toward one another. The gravity of the Earth pulls the ping pong ball to it.
  + The force of gravity from the sun keeps the earth in orbit around it.
  + You and I stay on the earth because of the force of gravity.

**Activity #2: Force, Motion & Mass**

marble

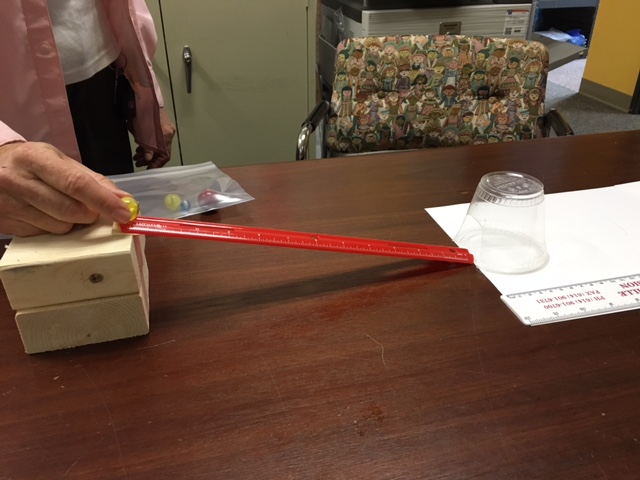
cup

Long paper

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Wooden blocks

ramp

* *Set up the experiment using 2 wooden blocks to make the ramp. Tape the ramp to the edge of the block. The bottom of the ramp is exactly at the edge of the track. The cup is on the edge of the paper with the open side to the ramp. Tape the long paper to the table.*
* I’m passing around 3 marbles. Which is lightest and which is heaviest?Which marble do you think will push the cup the farthest? *Allow students time to make predictions.*
* Place the smallest marble on the edge of the ramp. Let a student release the marble (do not push).
* The ball will go into the cup and push it on the paper. Mark the distance traveled by the cup on the track. Mark the far edge of the cup where it stopped moving. Measure the distance from the end of the track to the mark. *(Have students do this.)*
* Repeat steps with the medium and large marbles. Compare the distances moved by each marble.
* Why did the cups move different distances? We have to remember two things: the force applied to the marble and the mass of the marble.
  + What force pulled the marble down the ramp? *Gravity*. Was gravity the same for all three marbles? *Yes!*
  + Then what caused the cup to move farther? *The larger mass of the biggest marble. A moving object with greater mass can apply more force.*

**Activity #3: Force, Motion & Distance**

* What is gravity? Which way does it pull? *Gravity is a force that pulls down vertically on earth.*
* For this activity, we’re going to look at the height of the ramp. When using a ramp, the energy of the falling or rolling marble depends on the height of the ramp. The higher the ramp, the greater the potential (stored) energy. More potential (stored) energy changes to more kinetic (moving) energy and the ball accelerates faster.
* What two things determine how far the ball and cup will travel?*The distance the cup and marble travel (motion) depends on the mass and the amount of force.*
* Set up the experiment using **one** wooden block to make the ramp. Place the medium marble on the edge of the ramp. Allow a student to release the marble (do not push).
* The marble with go into the cup and push it on the paper. Mark the distance traveled by the cup on the paper. Mark the far edge of the cup where it stopped moving. Measure the distance from the end of the paper to the mark. *(Have students do this.)*
* What do you think will happen if we add a second block to the height? *Allow time for student responses. Use the medium marble for all three trials.*  Add a block and repeat the process so the ramp is now **two** blocks high.
* Add another block so the ramp is now **three** blocks high. Compare the distance moved at each height.
* Let’s talk about a couple questions…
  + Which ramp set up caused the marble to travel with the greatest acceleration? *3 blocks.*
  + Which ramp set up caused the marble to have the most force? *3 blocks.* As we added blocks, we increased the potential (stored) energy. The additional potential energy transformed into kinetic (moving) energy or force. More force results in more motion.

**Complete Student Worksheet Questions:**

*Note to Leaders: Ask these questions to the students. Do not just give them the answers. If incorrect answers are given, talk the students through the correct answer. You may need to refer back to the definition.*

The motion of an object depends on what two things? **FORCE & MASS**

Name the force that is acting on your body and pulling it toward the Earth.  **GRAVITY**