

# MOTION COMMOTION MIDDLE SCHOOL

## TEKS

*Sixth Grade:* 6.8A, 6.8B, 6.8C, 6.8D

*Seventh Grade:* 7.7A, 7.7C

*Eighth Grade:* 8.6A, 8.6C

## Vocabulary

acceleration, friction, gravity, inertia, kinetic energy, Newton's first law, Newton's third law, potential energy, speed

## Pre-Show Activity

### Pre-Show Lesson: Newton's Laws of Motion

Post this question on the board: "How do Newton's Laws of Motion Work?"

#### Materials:

Per class: table, raw eggs, toilet paper tube, aluminum pie pan, tall narrow glass, water, natural bristle broom

Per group: stack of pennies, index card, plastic cup, 5 nickels, plastic knife

#### Procedure:

1. Set up the demonstration as shown in Appendix A-1. Place it at the edge of a table and center everything above the glass. Use a natural bristle broom; flick the broom against the pie pan.

You may want to test the effects of different variables with this; Styrofoam tray, paper towel or wrapping paper tube, Easter egg with coins, no water in cup or using a meter stick instead of a broom.

## 2. Discuss with students:

- What did you notice? Be sure to mention the direction of forces and objects, potential and kinetic energy, sources and types of energy being used.
- Does the egg have energy?
- Why did the egg drop down?
- Does the edge of the pie plate matter?
- Does the amount of force make a difference?
- What happened to the energy in the pie pan?
- How does the size of the tube affect the results?
- Why not put egg in tube vertically?

Discuss these questions with the students, but do not give them any explanation. This is just to get them thinking about forces and motion.

## 3. *Student Exploration Activity 1*

### *Materials:*

Per group: penny, index card, plastic cup

### *Procedure:*

1. Give each group a penny, an index card and a plastic cup. Have the kids set the cup upright on the table. Students should center the index card over the opening of the cup. Then, center the penny in the middle of the index card.
2. Ask: "How can you get the penny into the cup without touching the penny, picking up the card or touching the cup?"
3. Students will flick the index card with their finger very quickly. This should cause the penny to drop into the cup, and the index card to fly forward.
4. Students should draw and label this activity in their science notebook. They will need to use arrows to show the direction of the forces. Students should write an explanation for each arrow explaining what caused the object to move in that direction.
5. Try different strengths/sizes of cards, different amounts of pennies, different amounts of force.
6. Debrief with students about what they noticed. What direction was the card going? What direction were the pennies going? What direction was the force? Where was the force applied?

#### 4. Student Exploration Activity 2

*Materials:*

Per group: 5 nickels, plastic knife

*Procedure:*

1. Give each group five nickels and a plastic knife. Ask students, "How can you remove the bottom nickel without touching the others?" Push knife in and pull out quickly.
2. Have kids draw and label activity in their science notebook. They should use arrow to show the direction of the objects. Students should write an explanation for each arrow explaining what caused the object to move in that direction.
3. Ask students how these two activities were alike and different. Why did these things happen?
4. Discuss and model for students the similarities and differences from the above activities.

*Similar :* A force was applied to get movement. When the objects were heavier, you had to use a greater force. The direction of the forces were the same, both were pushes. The objects moved in the direction that they were pushed. In both activities the objects on top that were not pushed forward fell down because of gravity. In both experiments the objects that were pushed forward eventually stopped moving forward because of friction.

*Different:* The size of the objects and the amount of force needed to move them were different.

*Explanation of egg on tube activity:* Kinetic energy was put into the broom (mechanical energy). The broom transferred that energy to the pan. The tube moved due to friction with the pan. (Kinetic energy) The edge of the pan caught the tube and pulled it forward with it, so the tube stayed with the pan. There was no edge on the tube that caught the egg, so the mass of the egg caused it to go straight down. The type of energy that the egg had was potential gravitational.

5. Students should record and define the following words and concepts in their science notebooks: potential energy, kinetic energy, forces applied (push and pull), friction, gravity, Newton's First Law of Motion (Inertia): An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

## Post-Show Enrichment Activities

### Activity One: Sheep in a Jeep (Seat Belts)

#### *Materials:*

Per class: *Sheep in a Jeep* by Nancy Shaw, sand paper (to change surface), aluminum foil, string, tape, stop watches, ramp materials, books or objects that a car can crash into

Per group: at least one toy car that you can put things in, measuring tape

#### *Procedure:*

1. Read and discuss *Sheep in a Jeep* by Nancy Shaw (scan book into computer and show). In this book, the sheep get into a car accident. They have no seat belts and they end up in a heap.
2. Discuss the forces involved and the movement of the car and sheep, the direction of the forces, and direction of the objects (Newton's Third Law).
3. Students will design an experiment with toy cars and objects in the cars (aluminum foil shaped into people) to experiment with forces. They will need to choose a variable that they would like to test: amount of force, type of surface (friction), angle of ramp, mass of objects, direction of force, loose or secured objects, etc. Students will design a test to see how this variable affects the movement of the vehicles or the people inside.
4. Students will work in groups and fill out the questions below in their science notebooks.
  - Problem
  - Hypothesis
  - Procedure (They can draw and label this or write it in steps.)
  - Manipulated Variable
  - Responding Variable
  - Controlled Variables
  - Data Chart
  - Conclusions
  - Inference
  - Recommendation
5. Students will explain/draw and label why/how seat belts are used to protect us in a car accident. Be sure to explain Newton's first and third laws, including the direction of the forces, friction and gravity in your explanation.

## Activity Two: Potential and Kinetic

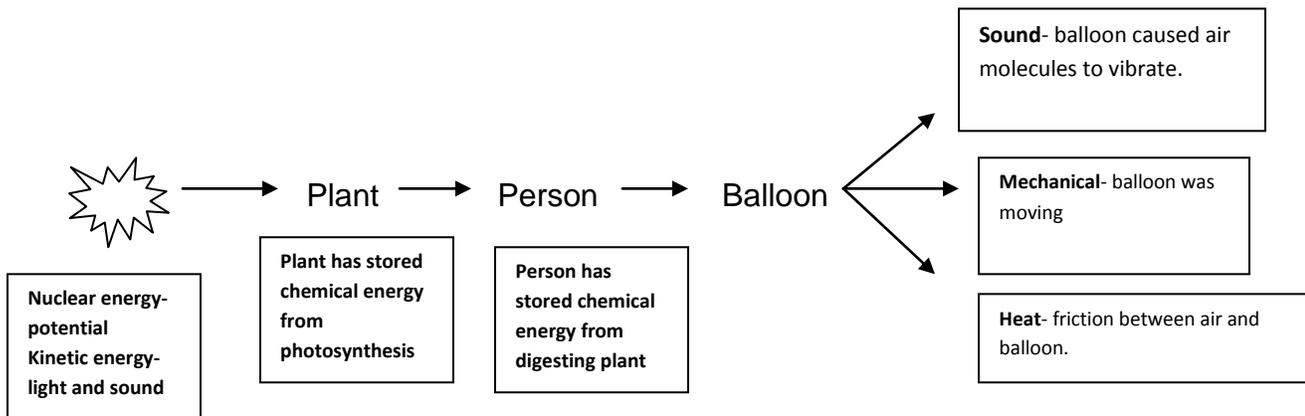
### *Materials:*

Per class: balloon

Per group: rubber bands, sticky note

### *Procedure:*

1. Blow up a balloon and let it fly through the air. The air you force into the balloon causes it to stretch and change shape. You gave the balloon a form of potential energy (elastic potential energy). When you let go of the balloon, it forces air out of the opening. The air pushes back on the balloon causing it to go forward. Elastic potential energy is changing into kinetic energy when the balloon forms. The types of kinetic energy it changes into are mechanical (movement of balloon), sound (motion of air molecules), thermal (friction of balloon with air molecules). How did the balloon get its energy? You blew into it. You got your energy from food – for example, a salad (chemical potential), which got energy from the sun (light, a form of kinetic energy).
2. As you explain, create the diagram below on chart paper. Students should copy it into their science notebook. Discuss how Newton's third law of motion plays into the balloon's movement. Newton's Third Law: for every action, there is always an equal and opposite reaction (the balloon moved in one direction and the air moved in the opposite direction).



### *Teacher Information*

Energy forms are either potential or kinetic. Potential energy comes in forms that are stored including — chemical, gravitational, mechanical, and nuclear. Kinetic energy

forms are doing work — like electrical, heat, light, motion, and sound. Source: U.S Energy Information Administration (EIA)

3. Partners will get a rubber band and a small sticky note paper. They will wad up the paper and stretch the rubber band like a sling shot to release the paper into the air.
4. Students will experiment with pulling the rubber band back different amounts or using thicker or thinner rubber bands. You may want to do this activity outside or line students up on one side of the classroom. Be sure to warn students that they should not hit another student with their paper or they will lose the privilege of participating and they will have to just observe. You may want to have students measure how far back they are pulling the rubber band and the distance that the paper travels.
5. Students should record the information in a data chart and look for relationships.
6. Finally, students will create an energy transformation diagram for the activity like the one modeled in class.

### Activity Three: Ramps (Calculating Speed)

#### *Materials:*

Per group: ramp (books and a ruler with a groove), a marble, stopwatch, meter stick

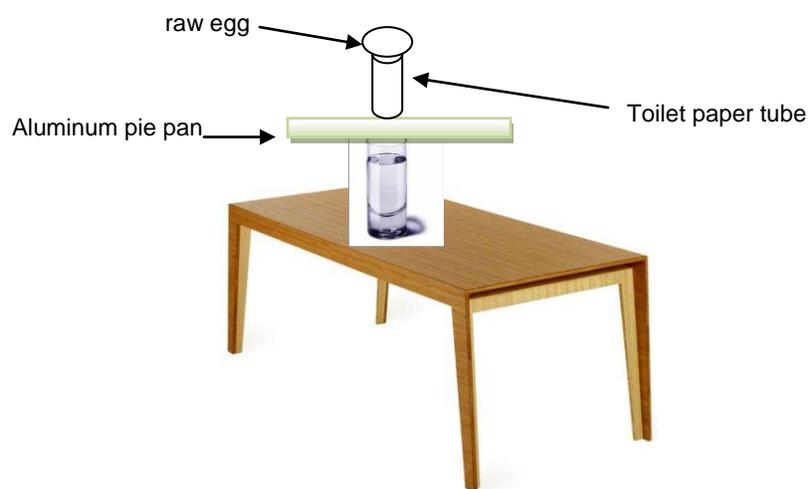
#### *Procedure:*

1. Each group will set up their ramp making sure that it is stationary. The ruler should be taped in place. Students will measure one meter from the base of the ruler (ramp) and mark it with tape. Students should create a data chart in their notebooks to collect their observations (see example below). Students will place a marble  $\frac{1}{4}$  of the way up the ramp. This should be at the 3" mark or the 9" mark depending on the direction of their ruler. Using the stop watch, they will record how long it takes the marble to travel from the base of the ruler to the one meter mark. Repeat this at least five times and find an average.
2. Next, students will repeat the same steps, but from the top of the ramp. Be sure they are starting their stopwatch at the base of the ramp and stopping at the 1 meter mark. Repeat five times, average and record.
3. Students will calculate the speed the marbles traveled by dividing the distance (1m) by the time (use their average). This should be fairly simple since the distance was always one meter.

4. Debrief with students. They should see that the marble is moving twice as fast in the second situation (when released from the top of the ramp). It should take the marble about half the time to go the same distance. Why does the acceleration change?

## Appendix

A-1



You can view a similar demonstration at TeacherTube here:

[http://teachertube.com/viewVideo.php?title=Egg\\_inertia&video\\_id=6684](http://teachertube.com/viewVideo.php?title=Egg_inertia&video_id=6684)