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LESSON PLAN

PATTERNS OF MOTION AND FRICTION
GRADES 3-5

SUMMARY

Students think about motion that they have seen before, as well as observe and identify repeating patterns of motion. Students also recognize that the force of friction resisting an object's motion can explain why that object slows or stops. They explore evidence for heat as a product of friction.

DURATION

Two 45-minute classroom periods

PRE-ASSESSMENT QUESTIONS

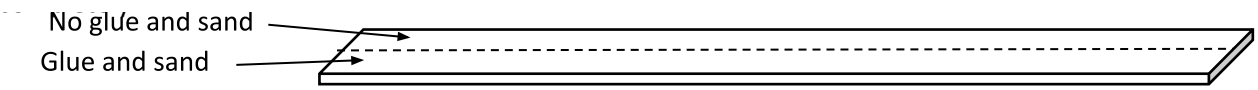
Please see Discussion Questions located under the video. These can be discussed as a group or answered individually in student science notebooks.

MATERIALS

- Wooden board (3-4 feet in length)
- Two identical toy cars or balls
- Glue
- Sand
- Access to playground equipment (swings, slide, etc.)
- Stuffed animal
- Masking tape
- Science notebooks
- Pencils

ENGAGE

At least one day prior to the lesson draw a line lengthwise down the center of the wooden board. Cover one half of the board with glue and then sprinkle sand on top of the glue. Allow to dry completely.



Prop one end of the board up on a stack of books, about 45 cm in height. When students arrive, show them the two identical cars or balls. Place the two cars at the top of the ramp next to each other—one aimed straight down the sandy side, the other aimed straight down the clean side. Release the cars simultaneously. The car on the sandy side will move more slowly than the car on the clean side. You may want to repeat this demonstration a few times.

EXPLORE

Ask students to write about what they think happened during the phenomena they just observed. Why did the car on one side move slower than the car on the other side? (Likely students will understand that the sand slowed the car down, but they may not understand how to talk about friction.) Explain to students that in this lesson they will be exploring the science of motion. They will think about how to predict motion of objects.

Now take the class outside to the playground, or walk to a local park. Students should take their science notebooks and a pencil. Also bring masking tape and a stuffed animal. Use the stuffed animal to demonstrate the motion of several of the playground toys. Prior to demonstrating, ask students to make predictions about the magnitude and direction of motion. For example:

Swings: Tape the stuffed animal to a swing. Ask students: if the swing is pulled up and back and released, what do you predict its motion will be? (If the swing is pulled up and back and released, it will swing down and forward. Then, it will swing back and up again and continue with that motion.) How do you know what to predict? (Students will have used swings before so they will use their previous observations of motion to inform their predictions.) What do you predict will happen to the motion over time? (Students may understand that the swinging motion will slowly decrease and come to a stop). If you think the motion will change over time, why? (Students may not know that the swing slows and stops due to friction—both between the air and swing/stuffed animal, and the chain on its hinges.)

You may want to ask students why you are using a stuffed animal instead of student volunteers. (These simple experiments involve changing the variable of motion and the stuffed animal is a constant while students are different sizes.)

During discussion tell students about motion on different scales. For example a plant may move extremely slowly while an animal can run fast. No matter how slow, motion is motion.

EXPLAIN

WATCH THE GENERATION GENIUS PATTERNS OF MOTION AND FRICTION VIDEO AS A GROUP.

Then facilitate a class discussion using the Discussion Questions.

ELABORATE

Use the DIY Activity to create your own paint pendulum just like Zoe's from the video. Then use what you have learned to try predicting motion of the pendulum as instructed in the Further Exploration section of the DIY Activity.

EVALUATE

Ask students to explain why the phenomena they observed in the Engage portion of the lesson occurred. Why did one car move faster than the other? They should be able to explain that the force of friction caused the car on the sandy side of the track to move more slowly than the other car.

Find one or more still photos that show examples of repeating motion in action. For example, a girl jumping on a trampoline. Ask students to predict the motion. Can they identify and explain the pattern of this motion?