

Lesson Goal: Friction causes some of the moving energy to be changed to another form of energy, usually heat or sound.

Review(10 mins)

Take some time to review the different types of energy we've discussed (Worksheet).

Now that we've reviewed the types of energy we know, we're going to talk about how energy is lost. Push (or have the kids push) a pencil (gently) on the table so it rolls. Why doesn't it roll forever? Friction causes some of the moving energy to be lost, as heat or sound.

*** Rotate between the next three small group activities at will, as there are limited supplies.**

1) Two Similar Pendulums (10 mins)

How does friction affect the performance of pendulums?

You will make a "good pendulum" and a "bad pendulum", with approximately the same period. (Bad one is tied poorly and rubs at the top. You can also try a different weight--washers are in the supply box)

a) Use a yo-yo and a pencil to construct either the "good" or "bad" pendulum. Explain what a pendulum is to your kids if they don't know.

b) Start it off and ask the kids if it will stop.

Why will they stop? [friction – if we put energy in, the only way for them to stop is if energy is taken out somehow]

c) Then perform the experiment on the other one (optional). They both stop eventually. Then, ask if one will stop sooner than the other. Why? Why not? Perform the experiment, being careful to point out that they are being started from the same height.

How much more energy is being lost in one than another? Ask older students how we could compare them in an experiment? [perhaps by timing, but the best way is to count the number of times that it takes for the pendulum to stop]

d) Have the kids help you count both times. Several kids can be involved as starters to make sure the height is correct (perhaps by the height of their head) on the pendulum or as recorders of data. One kid can be appointed to determine when the pendulum has "stopped."

f) Repeat the experiment on the second pendulum. Talk about where the friction is. How could we find the friction/solve the problem? [tie on the string better at the top, oil the joint, different string] What could we change to see if it affects anything? [i.e. the weight on the string]

2) Frictional Surfaces of Different Materials (15 mins)

a) Rub a towel together (or on the table) to feel the force friction can exert. Towel is a macroscopic version of the surface of every object. Explain that even really smooth surfaces are rough if you zoom in enough. [need pictures of surfaces to prove this? Or can we look at

the towel, the carpet or some cotton (if your student is wearing cotton clothing) to see that it also has texture/frictional surfaces.]

b) Try rubbing the towel on different surfaces. Which is hardest? Towel on Towel. Easiest? Middle? Can we generate heat? Can anyone think of a material that has so much friction that when you put one surface on top of the other that they can't be rubbed apart but must be pulled apart? [Velcro]

c) Now use a plank of wood and several rubbing sticks of different material makeup: plastic/PVC, wood (other blocks), rough yellow block, metal, styrofoam. Try to rub the wood plank and create heat with the different materials. What happens when the surface is wet vs. dry?) Try different amounts of pressing (different levels of force). There should be enough materials that each kid gets to play with/hold something at all times. Let them switch off. Observe that the harder one presses, the hotter it gets. This is "proof" that the energy that you are putting in is being turned into heat. Is your arm getting tired? Why is that? [spending energy to heat up stuff]

c. Now use two styrofoam pieces-> rubbing them together generates loud noises, but not much heat. Friction can dissipate energy in the form of sound, or heat, or vibrations (which is really what causes the sound).

3) Beach Balls, pumped up vs. not (10 mins)

Two beach balls, one fully pumped, and one only partially pumped.

How far will they roll before falling over/stopping? Run experiment. Use meter sticks to measure the distances.

Stick some rolled tape onto the pumped beach ball and see if it affects the distance.

Wrap up

Ask the kids what they learned today. Which was their favorite activity?

Extra time: Discuss why it's important to save energy. What are ways they can save energy. Go over the energy saving worksheets with them. Have them go home and look for ways they could save energy.