Bobsleds

Overview: We'll get more kinetic energy practice in this fun lesson where we let our marbles fly again, this time down a handmade bobsled track.

What to Learn: We continue to explore the means by which energy is transferred and used according to the laws of physics.

Materials

- aluminum foil
- marbles (at least four the same size)
- long tube (gift wrapping tube or the clear protective tube that covers fluorescent lighting is great)

Lab Time

1. Take a piece of aluminum foil, around 12 inches on each side. Scrunch it up and make a torpedo-like shape.
2. Squish one of the marbles onto one side, and then arrange the other three marbles along the length of the aluminum clump so that they resemble peas in a pod. Continue to pinch and form the foil around each one of the marbles.
3. Test your bobsled by turning it over and rolling it on the table a few times. If it doesn't roll, re-pack the marbles so they can move freely.
4. Place the bobsled in the tube with one side elevated, and release!
5. Experiment with different amounts of marbles or marble sizes and record your observations on the worksheet below.

Bobsled Observations

Configuration of Bobsled	Observations:

This is one of those quick-yet-highly-satisfying activities which utilizes ordinary materials and turns it into something highly unusual… for example, taking aluminum foil and marbles and making them into a racecar.

While you can make a tube out of gift wrap tubes, it's much more fun to use clear plastic tubes (such as the ones that protect long overhead fluorescent lights). Find the longest ones you can at your local hardware store. In a pinch, you can slit the gift wrap tubes in half lengthwise and tape the lengths together for a longer run or side-by-side for multiple tracks for races. (Poke a skewer through the rolls horizontally to make a quick-release gate.)

If you're finding that the marbles fall out before the bobsled reaches the bottom of the slide, you need to either crimp the foil more closely around the marbles or decrease your hill height.

Check to be sure the marbles are free to turn in their "slots" before launching into the tube – if you've crimped them in too tightly, they won't move at all. If you oil the bearings with a little olive oil or machine oil, your tube will also get covered with oil and later become sticky and grimy… but they sure go faster those first few times!

Reading

Energy changes to other forms of energy all the time. The electrical energy coming out of a wall socket transfers to light energy in the lamp. The chemical energy in a battery transfers to electrical energy which transfers to sound energy in your personal stereo. In the case of the ball falling, gravitational potential energy transfers to kinetic energy, the energy of motion.

Here's an example: As Phillip holds the ball at the top of the building, the ball has 100 Joules of potential energy (the number is just an example). When he drops it, the potential energy of the ball drops since the height of the ball gets less and less. At the same time, however, kinetic energy increases because the speed of the ball increases. All

the way down, the sum of the two energies equals 100. No energy gets lost, it only gets transferred. Energy is conserved.

Now here's a question you may be asking yourself, "If energy is neither created nor destroyed in a closed system then why doesn't a pendulum swing forever?"

Energy is neither created nor destroyed, but it can be transferred into non-useful energy.

In the case of a pendulum, every swing loses a little bit of energy, which is why each swing goes slightly less high (achieves slightly less PE) than the swing before it. Where does that energy go? To heat. The second law of thermodynamics states basically that eventually all energy ends up as heat. If you could measure it, you'd find that the string, and the weight have a slightly higher temperature than they did when they started due to friction. The energy of your pendulum is lost to heat!

If you could prevent the loss of energy to useless energy, you could create a perpetual motion machine. A machine that works forever! There have been a lot of folks who have spent a lot of time trying to make a perpetual motion machine. So far, they have all failed. A perpetual motion machine is one that is said to be 100% energy efficient. In other words, all the energy that goes into it goes to useful energy.

Your pendulum could be said to be about 90% efficient. Very little energy is converted into useless energy. In most systems, energy is converted to useless heat and sound energy.

Exercises Answer the questions below:

1. Potential energy is energy that is related to:
    a. Equilibrium
    b. Kinetic energy
    c. Its system
    d. Its elevation
2. If an object's energy is mostly being used to keep that object in motion, we can say it has what type of energy?
    a. Kinetic energy
    b. Potential energy
    c. Heat energy
    d. Radiation energy
3. True or False: Energy is able to remain in one form that is usable over and over again.
    a. True
    b. False

Answers to Exercises: Bobsleds

1. Potential energy is energy that is related to: (the system that it is in.)
2. If an object's energy is mostly being used to keep that object in motion, we can say it has what type of energy? (kinetic)
3. True or False: Energy is able to remain in one form that is usable over and over again. (false)