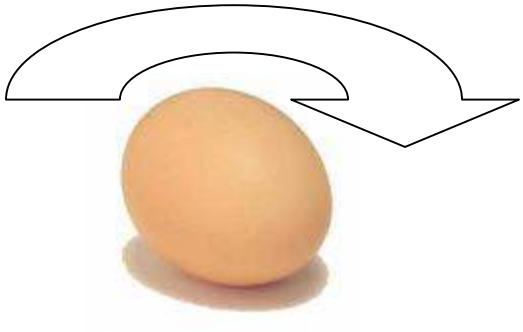
FORCE MOTION AND ENERGY EXPLORATION

Egg Spin



In this “eggsperiment” you will use two eggs, one marked with an “O”, the other with an “X.” Spin the egg marked with an “X.” Now stop the egg with your hand. Immediately after the egg stops, remove your hand. Describe what happens.

Now spin the egg marked with an “O.” Again stop the egg with your hand and then quickly release it. Describes what happens this time.

Questions:
i) Why do think the two eggs behave the way they do?
ii) How could a cook make practical use of the results of this experiment?

Tee off time...

Balance the hoop on the mouth of an empty flask or glass soda or catsup bottle (see photo). Now place an inverted golf tee on the top of the hoop. Note: a piece of chalk or small plastic piece with a flat bottom also works well. Make certain that the tee is directly over the mouth of the bottle. Now take a deep breath, and remove the hoop by quickly grabbing the inside center of the hoop.

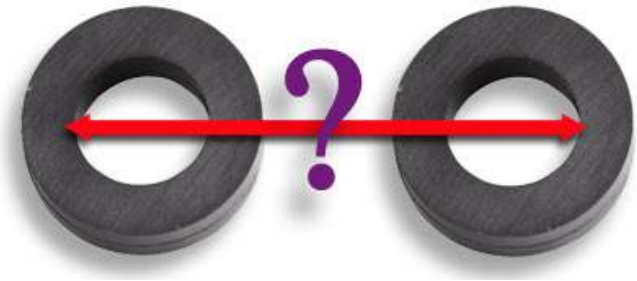
Questions:

i) What happened to the tee?

ii) Why did the tee drop into the container?

iii) Repeat the experiment, this time quickly grab the outside of the hoop. What happens now? Can you explain your observation? That is, why does the tee only fall straight down when the hoop is grabbed on the inside?

That's Repulsive!



Obtain two small disc magnets. Place the two magnets on the table and align them so that they repel each other. Bring them close together and then release them.

Questions:
i) Describe what you observe.
ii) Does each magnet exert a push on the other magnet? How do you know?
iii) Compare the strength of the two forces.

So Attractive

Arrange two disc small magnets so that they attract each other. Separate the magnets so they are one or two centimeters apart and then release them.

Questions:
i) Describe what you observe.
ii) Does each magnet exert a pull on the other magnet? How do you know?
iii) Compare the strength of the two forces.

Tug-of-War!

Using two spring scales, have a tame "tug of war" with your partner. Observe the readings on the two scales during the tug of war (don't pull too hard!).

Questions:
i) Describe the readings on the scales.
ii) Can you and your partner pull in a way that will produce a higher reading on one scale than the other?
iii) Can you and your partner pull in a way that will produce a reading of zero on one scale but not on the other? Explain your answer.

The Big Push...

With your lab partner, hold two bathroom scales back to back. Now push on the scales and observe both readings.

Questions:
i) How do the readings compare?
ii) Can you and your partner push in a way that will produce a higher reading on one scale than the other?
iii) Summarize your findings from the "Tug-of-War" and the "Big Push"

Potent Poppers

a) Compress, that is, turn inside out, one of the “poppers”. Do you do work compressing the elastic material?

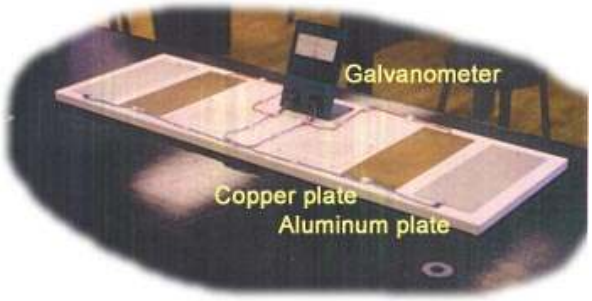
b) What becomes of the work you did?

c) Describe the energy transformation(s) that occur when the popper jumps.

d) What becomes of the popper’s energy once it has come to rest on the table?

e) Now carefully place a ping pong ball inside a compressed popper. Describe the motion of the ping pong ball when the popper inverts.

The Hand Battery



a) Examine the "Hand Battery." Describe the construction of this device as best you can. Use a sketch if necessary.

b) Observe the meter while you place your hand on the adjacent copper and aluminum plates. What did you observe? How do you suppose this device works?

c) Try pressing down harder on the plates. Did this alter the meter reading? Why? What energy transformations do you suppose is taking place?

d) Compare your meter reading with that of a friend.

e) Now place your hands on adjacent copper and aluminum plates while your friend places his/her hands on the other pair of plates. Which one of you creates the greatest voltage?

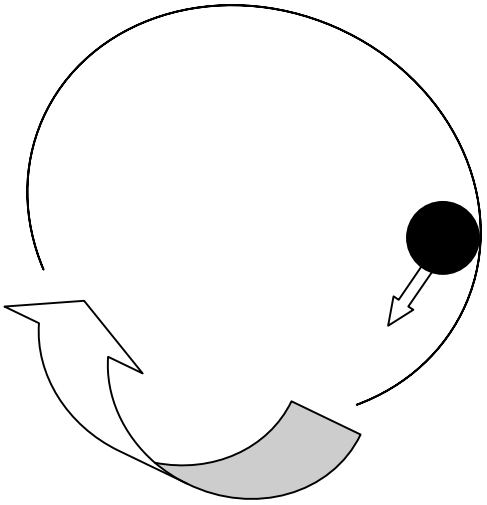
Colliding Spheres

a) Place a piece of paper between the two spheres. Now smash them together. After the spheres collide, smell the area on the paper where they came into contact. What do you detect? What do you suppose caused this odor?

b) Did the paper get hot? Where did the energy come from that was responsible for the heating? As best you can, describe the energy transformation that took place as a result of the collision.

b) Examine the point of contact. Do you observe any signs of scorching on the paper? In theory, what could you do to cause combustion?

Will It Go 'Round in Circles?



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a) If you roll a marble around the inside of a paper plate's rim, will it continue moving in a circle, go straight ahead, or curve outward when it gets to the gap in the plate? Try it!

b) Explain your observations in part (a).

The Ultimate Thrill Ride!

a) Wind up the spring car by dragging it backwards on a table top. You will hear a "ratcheting" noise during the winding process. Be sure to put your fingers on the back wheels at the end of each winding stroke to prevent the spring from unwinding.

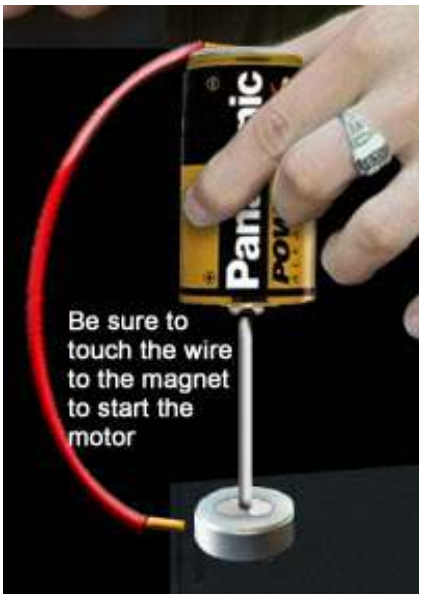
b) Once the spring is wound, place the car on the flat track and then release. The car should enter and complete the vertical loop.

c) Repeat part (b), but this time separate the track at the top of the loop by removing the connector before launching the car. Initially form only a small gap between sections before releasing the car.

Did the car move across the gap and land on the track? Why does this happen?

c) Increase the width of the gap in small steps until the car no longer completes the circle.

The Simplest Motor?



An extremely simple motor can be assembled from just a battery, a nail, a neodymium magnet, and a length of copper wire. The arrangement of these elements is shown in the image to the left.

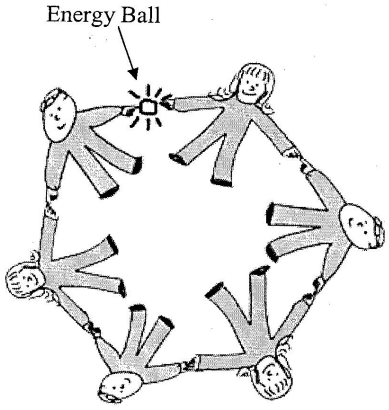
Activate the motor by holding one end of the wire to the base of the battery and touching the tip of the other end of the wire to the side of the magnet. Does the magnet/nail assembly spin? Suggest an explanation for the operation of this simple motor.

Connecting with the Energy Ball

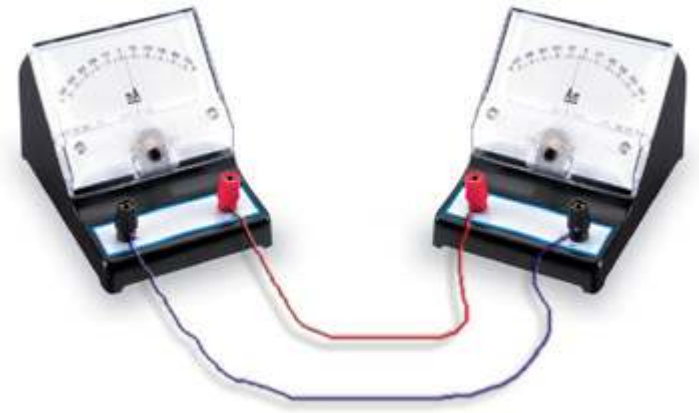
a) Place a finger of each hand on each of the two metallic electrodes on the Energy Ball. Describe what happens.

b) Have a friend place a finger on one electrode while you place a finger on the other electrode. Now join your free hand with that of your friends. What happens?

c) Add more people to your "circuit." How many people do you think your circuit can contain and still remain operational? Try it!



Shake It Up!

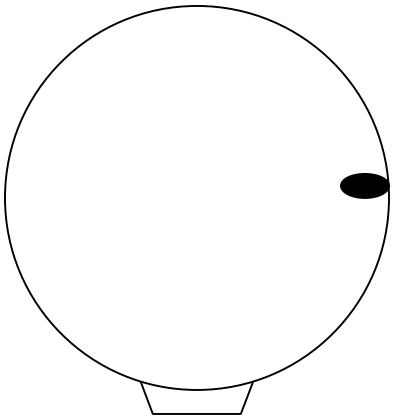


a) Shake one of the galvanometers while watching the needle of the other meter. What do you observe?

b) Now shake the other galvanometer. Is it possible to say which galvanometer is a motor and which is a generator?

The motor/generator effect may be dramatically illustrated with two Genecon generators. After connecting the two generator's clips together, turn the crank of one of the Genecons and observe the crank of the other. The first Genecon functions as a generator while other unit acts as a motor. Now reverse the roles of the two Genecons.

Coin in a Balloon



a) Before inflating a balloon, place a dime or penny in the balloon.

b) When the balloon is inflated and tied shut, move the balloon in circles.
With a little practice you should be able to get the coin to orbit on its edge on the inside wall of the balloon.

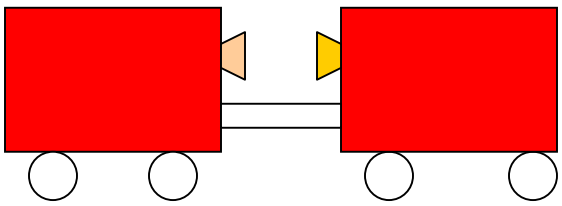
c) What force keeps the coin moving in circles? Describe the motion of the coin if the balloon were to break.

A Pushing Match

a) Follow the steps outlined below to stage a pushing match between constant velocity cars.

1) First turn on both cars. The on/off switch is located on the lower front of each car.

2) While securely holding on to the cars, place them on the tabletop with a white cardboard tube separating the cars. The tube should be placed on the flat area below the headlights on each car.



3) Which car wins the pushing contest?

4) Now place an object on the losing car to add some weight and once again let them push against each other.

5) Which car wins now? Why do you think this is so?

Transformations

1. Clip the two leads of a Genecon generator to the leads of a small light bulb. What happens when you turn the generator's handle? Describe the energy transformation that is occurring as you light the bulb.

Adjust the rate at which you turn the handle. What happens to the brightness of the bulb as the handle is turned faster? Slower?

2. Clip the leads of your generator to the capacitor's leads (that's the black rectangular object with two wires sticking out of it). Turn the handle for a minute or two and then let go of the handle. What happens? In terms of energy transformation, what is happening?

3. Connect the leads of the generator to the two pins on the resistor/thermometer device. Turn the handle of the generator for several minutes while keeping your eye on the liquid crystal thermometer located on the top of the device. Describe what you observe. What energy transformations are taking place?

4. The motor/generator effect may be dramatically illustrated with two Genecon generators. After connecting the two generator's clips together, turn the crank of one of the Genecons and observe the crank of the other. The first Genecon functions as a generator while other unit acts as a motor. Now reverse the roles of the two Genecons.