



The Messy Meter

Recommended Grades:
3 - 5

Estimated Time:
45 minutes

Subject:
Physics

WHAT YOU'LL NEED

Many of the items in this activity can be swapped out for other similarly shaped household items.

PANTRY STAPLES:

- Elastic rubber bands
- Empty mustard bottle or another plastic container
- Two wooden skewers
- Plastic container tops (examples: water bottle cap, peanut butter lid)
- two small
- two medium
- two large

SPECIALTY SUPPLIES:

- Hot glue gun/super glue
- Craft knife or exacto knife
- Wire cutters or another way to cut a wood skewer

Optional Add-Ons:

- Sticky tape
- Measuring tape

Rubber Band Cars

In this activity, kids will build a four-wheeled car from random stuff you have lying around the house like water bottle caps. From this activity they will learn about the engineering design process and physics!

STEPS

The following steps can be used to make a successful rubber band car, but experiment with different objects for the wheels and the car body to find the design that can go the farthest. Check out the Bonus Fun section to attempt a **Guinness World Records™** title.

1. Choose your car's body. For our design, we used a mustard bottle.
2. Parents - you'll need to help with this step! Use a sharp craft knife to cut out one side of your car body so that you can easily access the inside.
3. Use the knife to poke four holes in the sides of your car body that will allow your skewers (wheel axles) to pass through.
4. Now start by making the rear axle. Poke a wooden skewer through the smaller, sturdier bottle lids. Depending on your lids, you may need to start this with the knife as well.
5. Attach the small bottle cap and skewer to the large container top (the wheel).
6. Now use a small and a large rubber band to make a cow hitch knot on the skewer (axle).
7. Insert the skewer through the hole in the car body and use the wire cutters to cut the skewer down to size. **Tip:** You want the wheels to be reasonably close to the body.
8. Attach the wheel on the other side just like you did in steps 4 and 5. This will complete your rear axle.
9. Now we're going to make the front axle. Attach one container top that will make your front wheel to the other wooden skewer. Whether you poke the skewer through or glue it depends on the lid you're using.
10. Push the skewer through the remaining holes on your car body. Loop the other end of your rubber band onto the front axle skewer (shaft). **Tip:** You want your rubber-band motor to be fairly tight and stretched out between the axles! You can tie extra knots in it to make it tighter.
11. Use the wire cutters to cut the skewer down to size before connecting the final front wheel.
12. Stretch some more rubber bands over each wheel.
13. To power the car, turn the back wheels so that the rubber band tightens by wrapping around the rear axle.





Bonus Fun:

Try to break the Guinness World Records title for the Farthest distance travelled by a home-made rubber band vehicle!

Find a flat space to race your car on and mark a starting line with some tape. Release the car from behind the starting line. When it stops, measure the distance between the starting point and the closest edge of the car, following a straight line.

Note: Rubber bands can only be wound by hand for the record!

For the Record: For more information on the rules to make your record attempt official, check out the make and break section of our website <https://goo.gl/eaAFGL>

Questions to Engage Youth:

- What would you change about your car if you wanted to make it go farther?
- What other things could you power with rubber bands?
- Can you name some other objects that have kinetic energy? (See explanation on the following page.)

Explanation:

By stretching out an elastic band you're creating potential energy. Lots of different objects can have potential energy, for example, lifting an object off a table creates potential energy. With the rubber band cars, the rubber used is made up of long polymer chains that in their natural state are all wrinkled up. When you wind up the rubber bands to power the car, you're forcing the polymer chains to straighten out, which creates elastic potential energy.

Winding the rubber bands requires energy, which is supplied by you. Assuming this process was perfectly efficient (no energy loss), then the amount of energy required to turn the rear axle and wind the rubber band is exactly the same as the potential energy of the rubber band. Once the rubber band is released, the polymer chains in the rubber band want to return to their natural, wrinkled state. This releases the rubber band's potential energy, converting it into the kinetic energy that powers your car. Kinetic energy is the energy of motion; any moving object is using kinetic energy.

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