

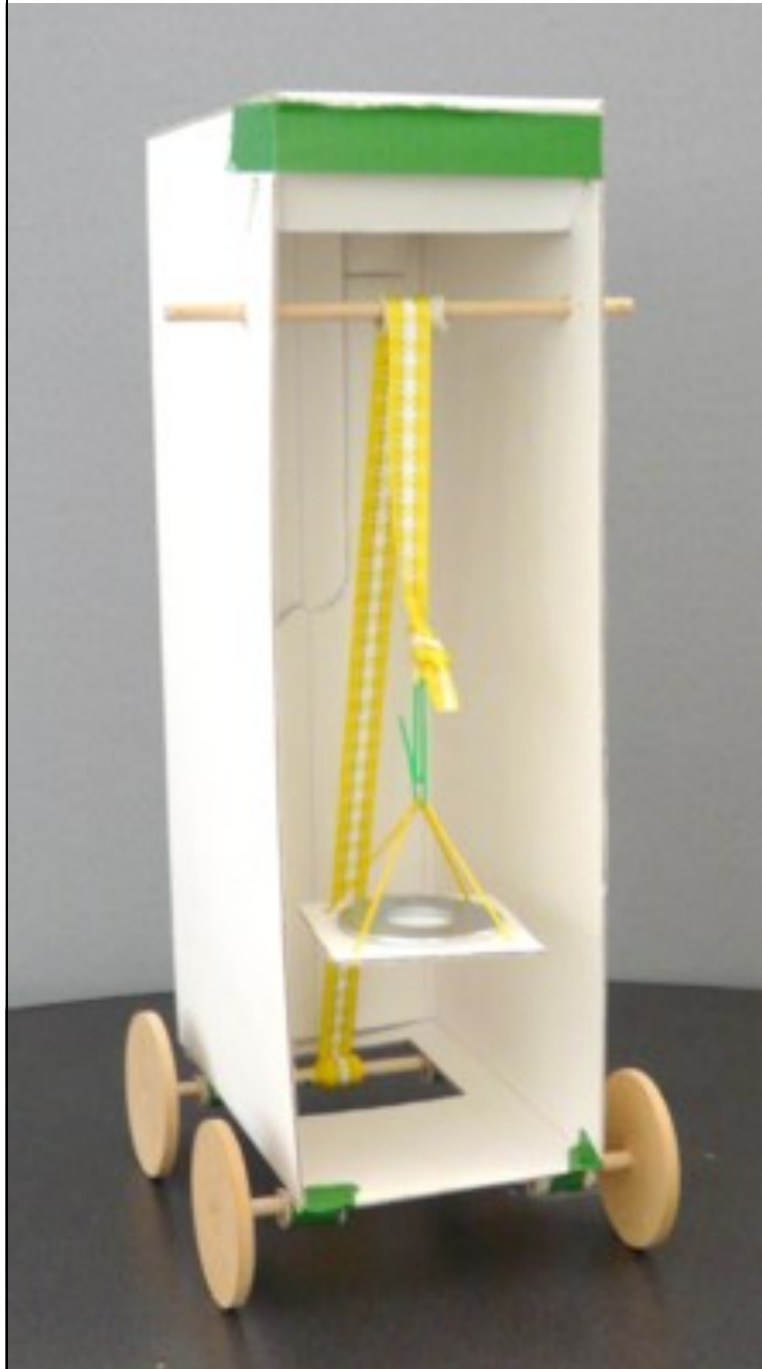
Gravity Power Cars

Building a Gravity Force Car (GFC)

Student Inquiry Sheet



Name _____ Class _____ Date _____



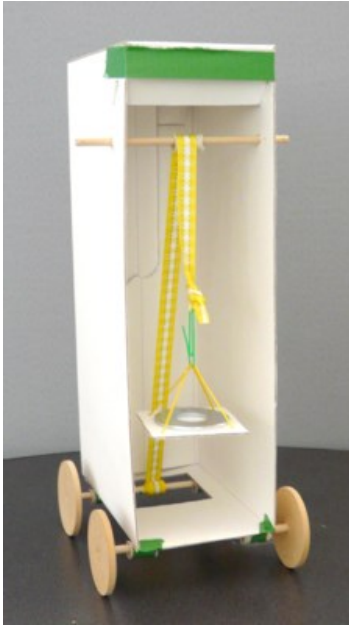
Investigation #2: How do you build and operate a model GFC car?

Bicycles use people power, cars use gas or electric power, and airplanes depend on air power. In this investigation, you will build a Gravity Force Car or GFC that operates on “washer power.” As you can see from the picture, your GFC consists of a shoebox style cardboard box with wheels. It is powered by washers that are suspended from a pulley via a ribbon. The ribbon is attached to the GFC’s back wheels and axle through a hole in the floor. The washers are raised by turning the wheels and axle. The force of gravity makes the weights fall and propels your GFC forward.

You are invited to be the scientist and engineer. You will build your own GFC car and design ways to make it work better. Let’s build some cars!

Here is a photo of a Gravity Force Car to help you build your own vehicle.

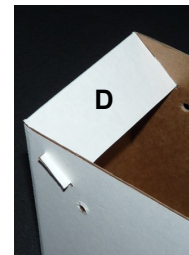
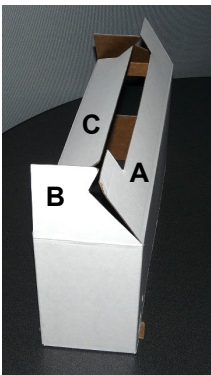
Materials Needed to Build and Test a GFC



<ul style="list-style-type: none"> One shoebox style cardboard box (about 20 x 12 x 40 cm). The cardboard should be 2 mm thick and strong enough to hold washer weight. 	<ul style="list-style-type: none"> One large paper clip. One spool
<ul style="list-style-type: none"> One length of ribbon (about 1.5 cm wide by 120 cm long or three times the height of the box.) 	<ul style="list-style-type: none"> Six 1 inch steel washers (OD = 2.5 inches & thickness = 1/8th inch).
<ul style="list-style-type: none"> Three split-end wooden dowels for axles about 17.8 cm (7 inches) long and ¼ inch diameter. 	<ul style="list-style-type: none"> Ruler to measure in cm.
<ul style="list-style-type: none"> Two bubble tea straws about 1 cm in diameter. 	<ul style="list-style-type: none"> Two sets of wheels (Diameters about 5 & 10 cm and 1/8" to 1/4" thick with a 15/64" axel hole).
<ul style="list-style-type: none"> 25 cm of duck or masking tape about 2.5 cm wide (cut to size from tape roll). 	<ul style="list-style-type: none"> One set of instructions and journal/data sheets
<ul style="list-style-type: none"> One piece of cardboard 8 cm square. 	<ul style="list-style-type: none"> A hard, smooth, flat surface +- 3 m long to run your GFC.
<ul style="list-style-type: none"> One piece of #18 string 60 cm long. 	<ul style="list-style-type: none"> A stopwatch (an I-Pod is a good source).

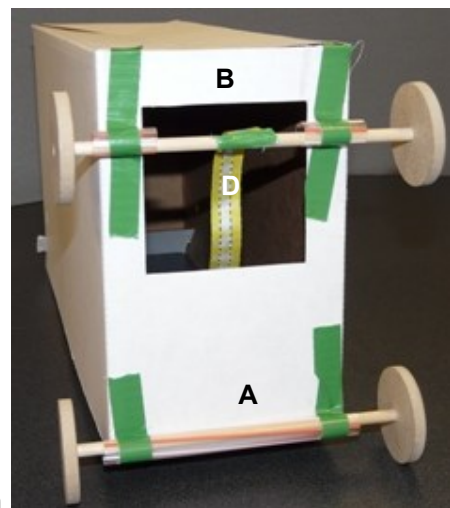
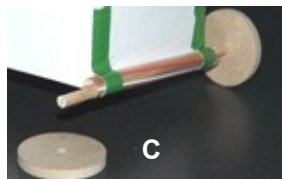
Step 1: Assemble The GFC Body

To assemble the body (box) of the GFC, push the box up and flex back and forth several times so that it will set up straight. Fold flap "A" down. Then fold both end flaps "B" down. Then push flap "C" down and continue pushing into the box until the top edge of C snaps under flap A. Push all the flaps back out a little to form the back of the GFC. On the front of the GFC push flap "D" down and force inward so that the tabs snap into the slots on the sides.



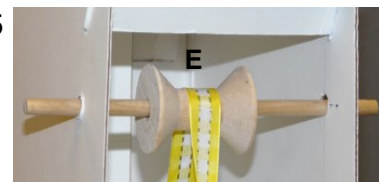
Step 2: Put axles and wheels on the GFC.

- Cut one straw 1 cm longer than the width of your GFC. Tape this straw as close to the open end of the box as possible using duck or masking tape. It is important that the straw go straight across the box so the axle is not crooked. (See "A".)
- Cut the other straw into two 2.5 cm sections. Tape these sections 4 cm from the back end of the box (next to the hole in the bottom) making sure they are also straight. These straws should extend about 3 mm from the side. (See "B".)
- Assemble your wheels and axles by inserting the axle into the wheel hole as you turn the wheel. Because the wheels fit tightly on the axle, this must be done carefully. Bending the axle could cause it to break. Insert wheels on the axles several times to make sure they have a proper fit.
- Attach one wheel to each axle. Push the axel though the straw and then attach the other wheel. (See "C".)
- Attach the end of the ribbon to the middle of the rear axle with a piece of tape. (See "D".)



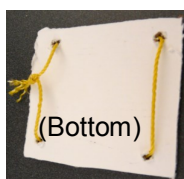
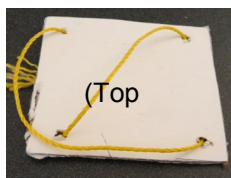
Step 3: Make a pulley to lift the washer weights.

- At the top of the box, there are two holes. These holes are approximately 5 cm from the top and 5 cm from the open end on either side of the box. These holes must be exactly across from each other so that the pulley is level.
- Holding the spool inside the box, across from the holes, push the dowel through the near hole, the spool and the far hole. This forms the pulley which is actually a wheel and axle.
- Thread the other end of the ribbon over the top of the spool. (See "E")



Step 4: Make a platform to lift the washer weights.

- Thread the string through the holes on the 8 cm square piece of cardboard as shown. This forms the platform to lift the washer weights.



Step 5: Attach the platform to the pulley.

- Attach the ribbon to the platform using a paperclip hanger as shown. (See "F".)
- Adjust the platform so that it is level and flat.
- Add washers to the platform by laying them within the four strings of the platform.
- Lift the washers by turning the rear wheels and winding the ribbon on the axle.
- Test drive your GFC on a flat, smooth surface. How does your car go?

