GRAVITY CAR

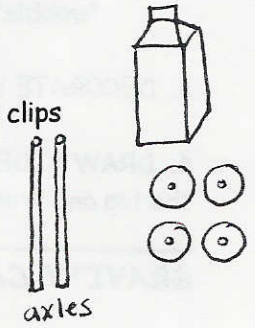
Recycle those milk cartons and build fun tools to better understand gravity, potential-to-kinetic energy conversion, and distance/time/speed measurements.

PA Dept. of Education Science and Technology Standards:

Unifying Theme: 3.1.4E
Inquiry and Design: 3.2.4C
Physical Science, Chemistry and Physics: 3.4.4B, 3.4.4C
Technology: 3.6.4B, 3.6.4C
Technology Devices: 3.7.4B

Materials for each student:

1 milk carton (8 oz., or larger)
2 axles - 4" long; 3/8 inch diameter plastic or wooden dowel rod
1 drinking straw, cut in half (each half approx. 3.75 inches long) - or 4 paper clips
4 cardboard wheels, 1.5 inch diameter
Miscellaneous construction paper, paints, etc.
Tape
All-purpose glue or hot glue gun



Materials for class:

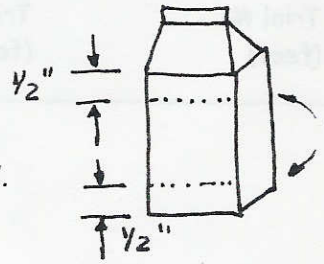
foam core boards - for race ramps

Tools for class:

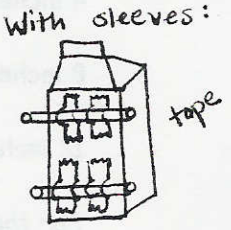
scissors, rulers, tape measurers, stop watch

ASSEMBLY STEPS:

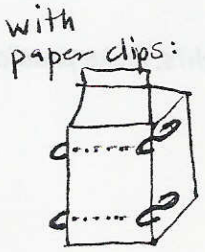
1. **WHERE TO PUT THE AXLES!?!**
   On one side of milk carton, use a ruler to draw a line for axle placement:

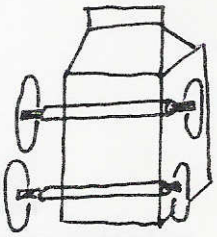


If using 4" long drinking straws - these are axle "sleeves".
Tape these straws on the axle guidelines.
be CAREFUL not to crush the straw!



If using the 4 paper clips - these are axle "hooks".
Fold open the paperclips to look like this ------>
Tape the open paperclips t o the sides of the milk carton at the 4 corners on the milk carton.





2. INSTALL AXLE AND WHEELS

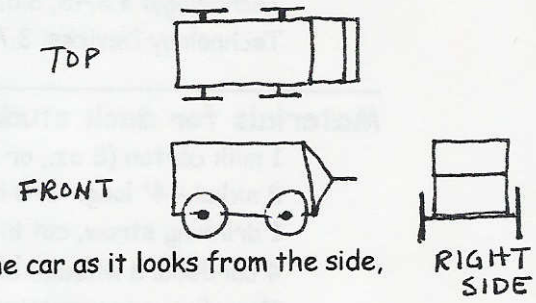
Slide the axles into the axle "sleeves" or axle "hooks".

Gently slide the cardboard wheels on to the ends of the axles. The wheels are pushed onto the axles by only 1/8 inch or so.

TEST STEP: Make sure the axle spins freely! if not, correct what may be rubbing or is too tight.

Hot glue or glue the wheels on to the axles. Make sure the wheels are straight - or else they will have a "wobble" look as they roll!

DRAWING



3. DECORATE YOUR GRAVITY CAR - MAKE IT UNIQUE!

4. DRAW A DETAILED PICTURE OF YOUR GRAVITY CAR. Draw the car as it looks from the side, the top and front.

GRAVITY CAR EXPERIMENTS

Use foam core board and a stack of books to create a Test Ramp. Be able to adjust height of ramp to 4", 8" and 12".

1. ***GRAVITY POWER!*** Observe that as the car is raised higher off the ground (on the steeper ramp) - the car rolls father. Measure and record the total distance the car rolls when sent off the ramp set at different heights. Then make predictions on performance:

Height H (inches)	Trial #1 (feet)	Trial #2 (feet)	Trial #3 (feet)	Average distance (#1+#2+#3)/3
4 inches				
8 inches				
12 inches				
For these heights, make predictions first:				
___ inches				
___ inches				

2. ADD WEIGHT TO THE GRAVITY CAR

Add weight (pennies or erasers or washers) to the Car. What do you predict will happen? Will the car perform differently? Re-run the trials from experiment #1:

WEIGHT ADDED: _____

Height H (inches)	Trial #1 (feet)	Trial #2 (feet)	Trial #3 (feet)	Average distance (#1+#2+#3)/3
4 inches				
8 inches				
12 inches				
For these heights, make predictions first:				
___ inches				
___ inches				

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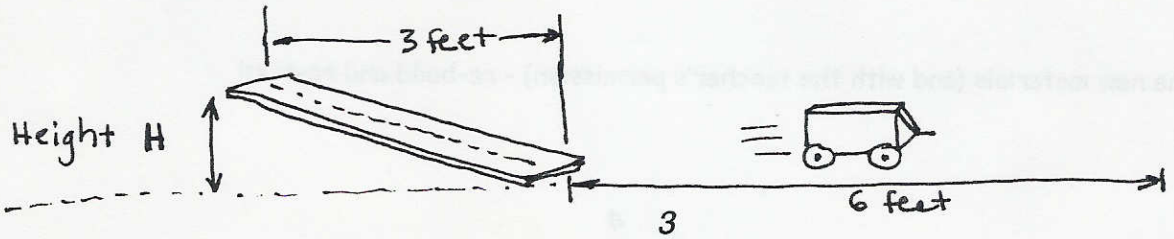
Compare the results of Experiment #1 and #2. What conclusions can you draw?

3. SPEED MEASUREMENTS

Speed (or velocity) is the measure of how fast an object covers a given distance. Using the Gravity Car and ramp:

- measure 6 feet from the bottom of the ramp.
- when the Car is released at the top of the ramp, start the stop watch. Stop the watch when the car passes the 6 foot mark. Total travel distance is 9 feet = 3 feet (on ramp) + 6 feet (on floor)
- Measure the time of travel (in seconds) for three trials - and enter in table below.



Weight added to Car: _____

Height H (inches)	Trial #1 (seconds)	Trial #2 (seconds)	Trial #3 (seconds)	Average time (#1+#2+#3)/3 (seconds)	Speed (ft/sec)= 9 ft./Ave. time
4 inches					
8 inches					
12 inches					
For these heights, make predictions first:					
___ inches					
___ inches					

4. YOU-MAKE-UP-THE-EXPERIMENT

By now you and your class mates are Gravity Car "wizards"! Design a new test for the Gravity Car to show performance changes as a variable is changed (such as weight, ramp height). Suggestions - investigate effects of:

- different floor types (carpeted, linoleum, wood, cement)
- different shaped ramps
- different size wheels
- running the Gravity Car "backward"!

Document your data collection in a table. What conclusions can you make?

5. GRAVITY CAR RE-DESIGN

With your knowledge of gravity-powered cars, how would you re-design and rebuild your Gravity Car? List the changes below, and why you would make the change.

Get the new materials (and with the teacher's permission) - re-build and re-test!