

Balloon Cars

Safety Precautions

- Glue guns can reach very high temperatures and should never be used without adult supervision.
- Foam board may need to be cut with a craft knife, and should be cut only by an adult.

Vocabulary

- dependent variable - a variable whose value depends on another variable
- friction - resistance an object encounters when moving over a surface
- mass - the amount of matter in an object
- independent variable - a variable whose value does not depend on another variable
- radius - half the distance across a circle
- weight - the force an object exerts due to gravity

Materials and Equipment

- 3" x 6" piece of foam board
- 9" round balloons
- balloon inflator (optional)
- 2 3" pieces of drinking straw
- 1 uncut drinking straw
- 2 4" pieces of barbecue skewer
- 4 bottle top, wooden, cardboard, or CD wheels
- packing or other strong tape
- stiff wire or large paperclip
- pliers
- glue gun and glue
- a partner

Construction

1. Hot glue one end of each of the two barbecue skewers to two of the wheels and hold the skewers until the glue has set.
2. Slide the two cut straws onto each of the skewers.
3. Hot glue the wheels on the other ends of the skewers and hold until the glue has set. Do not let the straws to stick to the hot glue.
4. Cut off two loops of a large paperclip or use stiff wire to make two U-wires, each about an inch long.
5. Push one of the U-wires through the center of the top side of the foam board, and bend the ends on the underside so that the paperclip or wire does not fall off.
6. Push the other U-wire parallel to the first one, near one end of the foam board, and bend the ends on the underside so that the paperclip or wire does not fall off.
7. Tape the axle straws to the bottom side of the car, parallel to the 3" sides.
8. Securely tape the mouth of the balloon to the uncut straw and slide it through both of the U- wires.



Questions

1. Assume that all balloon cars (axles, foam board, straws, balloons, U-wires) have the same *mass (weight)*, and you put the same amount of air in each balloon. Which balloon cars will travel the greatest distance? which will travel the shortest distance? Why?
2. Does wheel *radius* affect how far the balloon cars travel? Why or why not?
3. Does wheel material (plastic, wood, cardboard, CD) affect how far the balloon cars travel? Why or why not?
4. Does wheel texture (smooth, rough) affect how far the balloon cars travel? Why or why not?
5. How would the travel distances change if you release the balloon cars on the sidewalk or on the grass?

Research

The distance traveled by balloon cars is affected by the amount of air in the balloon, the weight of the balloon car and its wheels, the radius of the wheels, and the *friction* between the balloon car wheels and the surface on which they are rolling.

If there is too little friction, the balloon car wheels will slip, like tires with only a little tread, stuck in mud. If there is too much friction, the wheels won't turn, and the balloon car won't move.

Hypothesis

What is your hypothesis? Be sure to include your "best guess" answers to each of the 5 questions above.

- 1.
- 2.
- 3.
- 4.
- 5.

Experiment

1. Blow up the balloon. Be sure that the straw attached to the balloon passes through both U wires, put the balloon car on the ground, and release it.
2. Measure the distance traveled by the balloon car.
3. Repeat this process using more or less air in your balloon and record your observations and data.
4. Repeat this process using other balloon cars with smaller or larger wheels, and wheels made from other materials, and record your observations and data.



Data and Observations

Balloon car wheels	Balloon car number	Distance traveled in centimeters
small white plastic	1	
medium white plastic	2	
large white plastic	3	
teal plastic	4	
black plastic	5	
small wooden	6	
medium wooden	7	
large wooded	8	
small cardboard	9	
large cardboard	10	

- Which balloon car traveled the greatest distance? What is its number? How far did it travel?
- Which balloon car traveled the shortest distance? What is its number? How far did it travel?

Analysis

1. Did the amount of air in the balloon affect the travel distance? Why or why not?
2. Did wheel radius affect travel distance? Why or why not?
3. Did wheel material affect travel distance? Why or why not?
4. Did wheel texture affect travel distance? Why or why not?
5. Did the travel distance change on the sidewalk and on the grass? Why or why not?

Conclusions

There are several variables in this experiment.

The *independent variable* is the mass (weight) of the balloon cars (axles, foam board, straws, balloons, U wires), which are assumed to be the same.

The *dependent variables* are the amount of air in the balloon, wheel sizes, wheel materials, and wheel textures. It is difficult to consistently blow the same amount of air in the balloons, and it may also be difficult to determine which balloon cars actually travel the greatest and shortest distances without testing each balloon car many times.

When scientists ask questions, do research, form hypotheses, and test those hypotheses, they need to think carefully about both the independent and dependent variables to ensure that they are consistent, accurate, precise, and that they are actually asking questions that can be tested. This can be difficult and time consuming, but it is also very rewarding when we learn something new about the natural world.

Additional Questions

1. How could this experiment be modified to reduce the number of dependent variables?



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