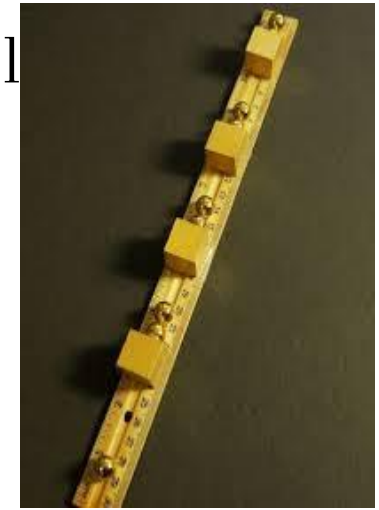
Magnetic Linear Accelerator

Deerfield Run Elementary School
2016-2017
Ms. Ryland
Grade 5
STEM Fair Project

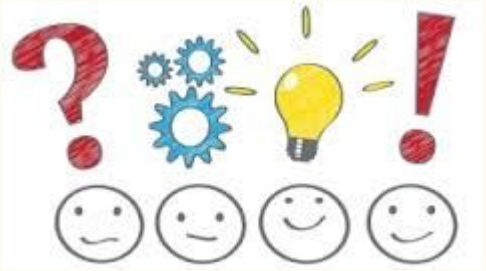


Question

Will speed be affected by using different sized ball bearings in a gauss launcher?

The reason for this project is to find out if the speed will be affected when launching a gauss launcher by using different sized ball bearings. I also liked the idea of measuring the speed of the different sized ball bearings. I will use a chronograph meter to measure the speed of each ball bearing that was launched from the magnetic linear accelerator. I chose this project because I like magnets and I am very interested in launching and building objects.

Hypothesis



My hypothesis is that the smallest size ball bearing will launch faster than the rest of the other size ball bearings. I think this because the smallest ball bearing weighs the least out of the ball bearings used in this project and the less weight and force, the faster the ball will travel.

Research

In this STEM Fair project, the problem is that I want to know if the launch speed in a gauss launcher when launching 3 different sized ball bearings. You must first setup the experiment by finding 3 different sized ball bearings (10 of each size), taping magnets to two glued together wooden dowels 3.65 centimeters apart, and placing 2 ball bearings on the left side of each magnet and one in the back of the gauss launcher. Once you have done these steps, you can now put down the last ball bearing in the very back the ball bearing and the very front ball bearing will shoot out. This happens because what you release the last ball bearing, that ball bearing is carrying kinetic energy which then transfers the energy to the next ball bearing through the magnets in a chain reaction until the energy finally reaches the last ball bearing which has no where to transfer the energy into therefore, the ball bearing launches.

A chronograph is a tool used by scientists to measure speed and time and is very accurate. In this experiment, I used a chronograph to measure the speed of the launched ball bearings. Magnets were used in this experiment in order to launch the magnets in the gauls launcher (magnetic linear accelerator) in a magnetic chain that causes the magnets to hit the left and right side of each other. The transfer of energy was used in this project in order to launch the ball bearings. The transfer of energy happens when an object with energy transfers that energy to the next object in a magnetic chain in order to perform something. A magnetic linear accelerator is a simple experiment that uses a magnetic chain to launch a ball bearing at a high speed. Weight was included in my hypothesis because I thought just because the ball bearing that weighed the least out of all of the ball bearings, would cause that ball bearing to be launched faster. Force was included in my hypothesis and experiment because in order for the ball bearing to launch, the ball bearing would need a source of force to push it. The sources of force in this experiment was the magnet chain and the ball bearings.

Variables

Dependent Variable (What will be measured?):

The speed of travel of different sizes of ball bearings will be measured.

Independent Variable (What will you change?):

I will change the different sizes (different weights) of the ball bearings.

Controlled Variable (What will have to stay the same?):

The same magnets used, distance between magnets, and the chronograph meter will all have to stay the same.

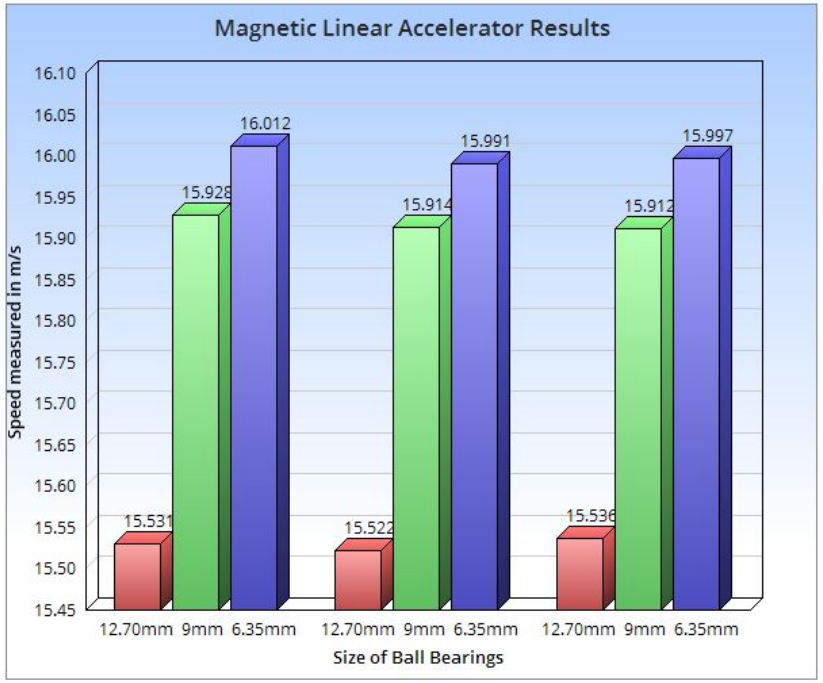
Materials

- 3 Magnets (2 and a half inches apart when taped)
- 10 same sized ball bearings (3 different sizes)
- Chronograph
- Tape (Tape the magnets to wooden dowels)
- 2 wooden dowels, 18 inches each
- Ruler
- Wood glue (Glue dowels together)
- Digital caliper

Procedure

1. Glue wooden dowels together.
2. Measure dowels and every 3.65 centimeters, place a magnet.
3. Tape magnets to secure them to wooden dowels.
4. Setup chronograph in front of gauss launcher to measure speed of each time you launch the ball bearing.
5. Place 2 ball bearings in the front of each magnet. (right of magnet)
6. Place ball bearing on the end of gauss launcher to launch the ball bearing in the very front of the gauss launcher.
7. Quickly look at the results of the chronograph. (Speed measurement that the ball bearing had launched.)

Results



Bar Graph

Data Chart

Size of Ball Bearings	Speed measured in m/s		
	Trial 1	Trial 2	Trial 3
6.35 mm	16.0120	15.9910	15.9970
9 mm	15.9280	15.9140	15.9120
12.70 mm	15.5310	15.5220	15.5360

Data Chart

Written Explanation

During this experiment, I thought that the smallest sized ball bearing would launch the fastest because the smallest ball bearing weighs the least out of all of the ball bearings used in this investigation and my hypothesis was correct. My hypothesis was only correct by a very slight difference in the speeds measured of the 3 sized ball bearings and three trials by the chronograph. Something that I could've done differently in this investigation was try to use a smaller or larger size gauss launcher to see if the ball bearing's speeds would be affected because there is less magnets.

Conclusion

My hypothesis was correct. There was only a very slight difference in the ball bearing's speeds. Something that I could've done differently was trying to use non-magnetic ball bearings to see if my investigation would still work even though the ball bearings are not magnetic.