Detecting the Gravitational Field

Overview: Ok, sort of a silly experiment I admit. But here's what we're going for – there is an invisible force acting on you and the ball. Things don't change the way they are moving unless a force acts on them. When you jump, the force that we call gravity pulls you back to Earth. When you throw a ball, something invisible acts on the ball, forcing it to slow down, turn around, and come back down. Without that force field, you and your ball would be heading out to space right now!

What to Learn: Everywhere you go, the acceleration due to gravity will be the same. I mean that it will work the same on Earth, on the moon, on Jupiter, etc. For a long time, we knew there was something pulling us down (towards the center of the earth), but we didn't know all that much about how it worked. We thought it acted differently on different objects. For example, we thought it would make heavier objects fall at a faster rate than lighter objects (it would make a cannon ball fall faster than an apple). While we know that if we dropped a cannon ball on our foot and an apple on our foot, the cannon ball would definitely hurt more, it wouldn't necessarily fall faster!

Materials

- two different-sized objects
- tape measure or meter stick
- partner

Lab Time

1. Pick your two different-sized objects.
2. Hold them both at a height of 1 meter.
3. While your partner watches, drop both objects to see which one hits the ground first.
4. Repeat the experiment at least 2 more times.
5. Make an initial conclusion (was your hypothesis correct?)
6. Pick another item (larger or smaller) and repeat the experiment.
7. Does your initial conclusion hold true?
8. Change another variable about the experiment (change the height dropped from, change the weight of the object, or the volume of the object)

Detecting the Gravitational Field Data Table 1: Testing the Mass

Use objects of the same size but different weights.
(Ping pong ball, golf ball, foam ball, crumpled up wad of paper, tin foil ball, etc.)

Trial #	Mass/Weight	Guess First! Which Object Will Hit First?	Observations: Which Hit First?

Conclusion:

Detecting the Gravitational Field Data Table 1: Testing the Size

Use objects of the same mass but different surface areas.

Trial #	Diameter/Area	Guess First! Which Object Will Hit First?	Observations: Which Hit First?

Conclusion:

Detecting the Gravitational Field Data Table 1: Testing the Height

Use objects of the same size but different weights.
(Ping pong ball, golf ball, foam ball, crumpled up wad of paper, tin foil ball, etc.)

Trial #	Height	Guess First! Which Object Will Hit First?	Observations: Which Hit First?

Conclusion:

Reading

Gravity is probably the force field you are most familiar with. If you've ever dropped something on your foot you are painfully aware of this field! Even though we have known about this field for a looooong time, it still remains the most mysterious field of the four.

What we do know is that all bodies, from small atoms and molecules to gigantic stars, have a gravitational field. The more massive the body, the larger its gravitational field. As we said earlier, gravity is a very weak force, so a body really has to be quite massive (like moon or planet size) before it has much of a gravitational field. We also know that gravity fields are not choosy. They will attract anything to them.

All types of bodies, from poodles to Pluto, will attract and be attracted to any other type of body. One of the strangest things about gravity is that it is only an attractive force. Gravity, as far as we can tell, only pulls things towards it. It does not push things away. All the other forces are both attractive (pull things towards them) and repulsive (push things away).

Exercises Answer the questions below:

1. What did you determine about gravity and how it affects the rate of falling?

2. Did changing the object affect the rate of falling? Why or why not?

3. Did changing the variable affect the rate of falling? Why or why not?

Answers to Exercises: Detecting the Gravitational Field

1. What did you determine about gravity and how it affects the rate of falling? (Gravity appears to affect all objects the same.)
2. Did changing the object affect the rate of falling? Why or why not? (No, it appears that gravity affects all objects the same.)
3. Did changing the variable affect the rate of falling? Why or why not? (No, it appears that gravity affects all objects the same.)