Penny in a Balloon

Outcome: Students learn that inertia can be both an object staying at rest or a moving object continuing to move.

This activity is a great choice for a family science night. It uses simple materials, can easily be reproduced later, and is fun to watch.

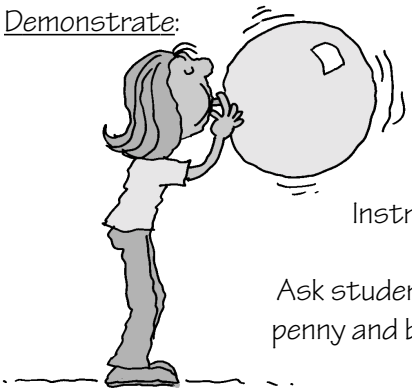
An object that is moving, will move in a straight line unless forced to change its direction. With this experiment, the penny is forced to move in a circular pattern by the balloon.

SAFETY CAUTION: This activity uses balloons. Make sure students are not latex sensitive.

Supplies in the kit: jewel-tone or gem-tone balloons

Supplies for find: pennies

Demonstrate:



Place a penny inside the balloon. Inflate the balloon, twist the mouth, and hold securely to avoid deflation.

Instruct students to look at the penny in the balloon.

Ask students to explain why the penny doesn't move (friction between the penny and balloon). Review the definition of inertia from the previous activity.

Explain that if the balloon is shaken, the penny begins to move. When it continues to move, it shows inertia. A penny at rest (in the last activity) continues to rest unless forced to move. A penny that moves, continues to move unless forced to stop. An object keeps doing what it's doing–that's inertia.

Procedure:

Hand out a balloon and penny to each student.

Ask them to insert the penny into the balloon, inflate, twist the neck, and shake the balloon.

A few students will find that the penny spins in the balloon. This encourages other students to get their penny to spin in the balloon.

Ask students to explain why the penny continues to move. (There is very little friction between the penny and the balloon since the penny rolls on its edge.)

Ask students to deflate their balloons and set them aside.

Review inertia using the last activity. The penny at rest on the loop stays at rest.

Explain inertia with this activity. A penny that is moving continues to move unless forced to change speed or direction. Friction between the penny and balloon causes the penny to slow and stop.

Teacher Background

The penny would move in a straight line, except the balloon makes it follow a curve. It forces the penny to move in a circular path. There is very little friction between the penny edge and the balloon that would cause the penny to slow down and stop, so it continues for quite a while with one quick shake or spin of the balloon as a start. The inertia of the penny causes the penny to continue to move inside the balloon.

There is a commonly coined force called "centrifugal" that really does not exist. It is inertia, the property of a substance to move in a straight line. If a person is driving a car and suddenly turns right, he or she will feel thrown into the door of the car. Actually, the person's body has a tendency to move forward in a straight line and the car prevents this from happening.

Just like the balloon in the experiment, the car forces the person to move in a circular direction.

Centrifugal force, "center fleeing", is named by scientists to help people understand, but the misunderstanding is rarely corrected.

There is a force named centripetal. In an ancient language, this means "center seeking". Centripetal force is in a direction opposite to the fictitious centrifugal force. The balloon, the car, a string that makes a yo-yo spin in a circle. All three items are all exerting a centripetal force.

Questions to ask/notes to make in a science journal:

What happens when you shake the balloon?
How can you make the penny spin in the balloon?
Why does the penny spin so long in the balloon?
What makes the penny stop?
What is friction?
How does friction help us?
How does friction harm us?

¿Qué sucede cuando sacudes el globo?
¿Cómo puedes hacer que el penny de vueltas dentro del globo?
¿Por qué gira por tanto tiempo el penny dentro del globo?
¿Qué es lo que hace que el penny se detenga?
¿Qué es fricción?
¿En qué forma nos ayuda la fricción?
¿En qué forma nos perjudica la fricción?

Naive Conception: An object must be continually pushed in order to keep moving.

Scientific View: An object that is moving continues to move unless forced to stop by another force, friction with the balloon in this activity. The penny has forward motion and moves until forced to slow by friction and then stop.

Naive Conception: Acceleration is when the speed of an object increases.

Scientific View: When an object accelerates, it speeds up, slows down, and/or changes direction. When the balloon is shaken, the penny accelerates. When friction between the penny and the balloon causes the penny to slow, it accelerates. Acceleration also occurs when the penny changes direction as it spins around the balloon.

Naive Conception: The penny is forced to move in a circle by centrifugal (center fleeing) force.

Scientific View: The penny is forced into a circular path by the balloon. This is centripetal (center seeking) force. There is no such force as centrifugal force, it is inertia. The penny moves in a straight line unless forced, in this activity by the balloon, to change direction.

Homework Suggestion: Each student deflates the balloon and takes it home to demonstrate the activity for parents. Parents sign a note saying that their child shared the experiment.

Science Challenge: Four students stand side by side, starting a penny spinning in a balloon, and at a signal, holds the balloon still. When a penny stops spinning, that student sits down on the floor. The last student standing advances to the next round. Continue until all students have had a turn.

Each student who advances then stands side by side, begins a penny spinning, and then holds the balloon still. The last student standing wins! The student doesn't receive a prize, instead explains any strategy attempted to keep the penny spinning to the class.

SAFETY: Caution students that the balloon may pop–be ready for a few loud noises. Also, students should retrieve pennies or pieces of popped balloons.

Vocabulary for this lesson: force, gravity, inertia