

Physics

Exploring Newton's 3rd Law – Playing with Toys!

Name: _____ Block: _____

We have already spent time exploring Newton's 1st Law dealing with inertia. Today, you will be exploring Newton's 3rd Law, which deals with action and reaction forces. It states that *forces always occur in pairs*. For example, when you hit a nail with a hammer, the hammer exerts a force on the nail that drives the nail into the piece of wood. However, the hammer doesn't drive the nail through the wood and cause it to fly away forever. You can feel the resistance of the nail when the hammer stops its forward motion and bounces backward in your hand. The hammer is driving the nail into the wood, but you can see and feel the force that the nail is exerting back on the hammer. In other words for every action, there is an equal but opposite reaction.

In this activity, you will explore and experience several equal and opposite reactions using children's toys. You will see the Normal force at work, magnetic force propel objects, and buoyant force lift an object. All three forces oppose other forces that act on objects.

Materials

- Bouncy ball
- Piece of string
- Sink full of water
- Toy car
- Popsicle stick
- Meter stick
- 2 same polarity magnets
- Wooden block
- Tape

Procedure

Part 1: Bouncy Balls

1. Drop a bouncy ball from a height of one meter. What force is acting on the ball?
2. Drop a bouncy ball from a height of two meters. What force is acting on the ball?
3. Both times, what happened when the ball hit the floor?
4. Drop the ball again and explain, based on Newton's 3rd Law, what is actually happening when the ball hits the floor.
5. What force is opposing gravity in this exercise?
6. Sketch a Force Diagram that shows all forces at work in this exercise and what they are acting on.

Part 2: Toy Cars

1. Tape **one** of the magnets to the back of your toy car and set it on the table.
2. Hold the other magnet in your hand.
3. Slowly bring the magnet in your hand toward the back of the car. Stop your hand as soon as you detect a force at work. Describe what happens.

4. Put your car back at the starting point on your table. Slowly bring the magnet in your hand toward the back of the car again. This time, try to bring the two magnets together. Describe what happens.

5. Now, tie one end of the string to your magnet and one end to the popsicle stick. Slowly bring the stringed magnet toward the back of the car. Describe what happens.

6. What force is at work in this exercise? What force does it oppose?

7. Sketch a Force Diagram that shows all of the forces at work in this exercise and what they are acting on.

Part 3: Wooden Block

1. Put a stopper in the sink and fill the sink about 2/3 of the way full with warmish water.
2. Set the wooden block in the water. What happens? Why?

3. Become the applied force (F_A) and push the block halfway down between the surface and the bottom. What do you notice/feel?

4. Become a greater applied force (F_A) and push the block all the way to the bottom of the sink. What do you feel? What happens when you release the block?

5. What force is your F_A opposing in this exercise?

6. Sketch a Force Diagram that shows all of the forces at work in this exercise and what they are acting on.

Conclusion

Write a paragraph that explains how each of the exercises in this activity are examples of Newton's 3rd Law. Attach it to this sheet.