# 3rd Grade Science Experiments

24

# What Happens When Forces Are Unbalanced?

## Key Concepts

Forces push or pull an object.

Forces act in pairs on an object. They can be balanced and unbalanced.

Unbalanced forces occur when one force is stronger than the other force.

Balanced forces occur when both forces are equal in strength.

Unmoving objects are at rest because of balanced forces.

Objects move because of unbalanced forces. They move in the direction that the stronger force applies.

## Materials

- plastic cup K
- 1 cup of water
- 7" round Styrofoam plate K
- 1 egg (may need more if it breaks)
- 4" to 5" cardboard tube
- a pencil
- towel or paper towels
- Experiment Sheet #24 P

# Introduction

It's a breezy, spring day, and you are sitting on a swing. At this moment, both your body and swing are at rest. The forces acting on you are balanced. You then push your feet against the ground and slowly lift your body and swing away from the ground. You lift your feet and the swing begins to move, carrying you through the air. What you are experiencing as you feel the wind on your face is the result of unbalanced forces. **Forces** change the motion of an object by changing its speed or direction. It can also be described as a push or pull, like you experienced while swinging.

**Balanced forces** do not change the speed or movement of an object. They act on an object in opposite directions and with equal strength. When you push against a wall, you are acting on the wall with a force, but you do not move and neither does the wall. Why? Believe it or not, the wall pushes back with an equal amount of force. This is an example of a balanced force.

Motion occurs when two forces are not equal in strength. They are known as **unbalanced forces.** Unbalanced forces change the speed and/or direction of an object. A group of friends playing a game of tug of war is a good example of unbalanced forces. Let's say there are only five people available for the game. Three friends form one team, while the remaining two friends form the second team. If all five friends are about the same size and weight, can you predict which team will win the match? If you guessed the three-member team, you have a good understanding of forces. The force of the three-member team is greater than the two-member team, giving the three-member team an advantage.

In this activity, you will explore the balanced and unbalanced forces that act on an egg as it falls into a cup.

# Make a Prediction

What will happen to an egg when the forces acting on it become unbalanced?

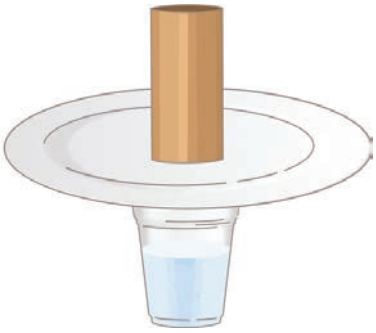
# Investigate

1. Think about what you already know about forces. Write down what you know on the first experiment sheet, including your prediction about how unbalanced forces will affect the egg.

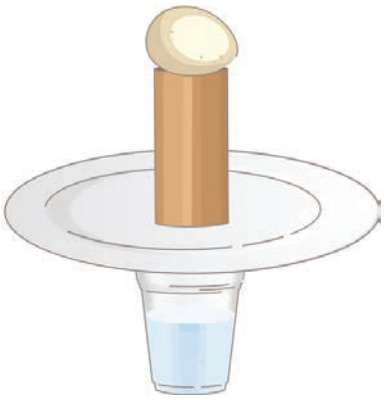
2. Fill a plastic cup halfway with water.

3. Place a small plate on top of the cup and center it.

4. Stack the cardboard tube on top of the plate. Center it on the plate.



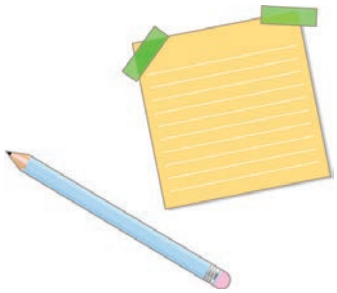
5. Carefully balance the egg on top of the cardboard tube.



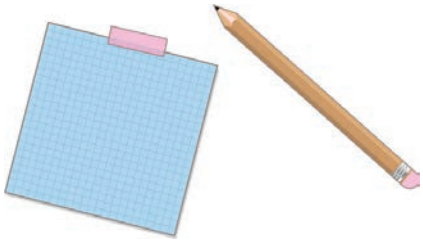
6. Your challenge is to drop the egg into the cup of water by only using one motion. Use the palm (underside) of your hand to knock the plate away in one quick movement. (***Hint:** Don't hit the tube or the cup.)

7. Record your observations on the datasheet.

8. Repeat the experiment two times to collect additional data.



9. Record your observations on the datasheet.



## Draw Conclusions

- Why did the egg remain still while it sat on the cardboard tube? (Possible: The forces acting on the egg were balanced.)
- What happened to the egg when you knocked the plate away? (Possible: The egg fell into the water.)
- How did the forces change to cause the egg to fall? (Possible: The forces on the egg became unbalanced.)
- What was the direction of the stronger force? (Possible: The stronger force came from on top of the egg.)
- What happens when forces become unbalanced on an object? (Possible: The object begins to move.)

### Make Connections

Cars use both balanced and unbalanced forces. Before starting a car, it is not moving and the forces acting on it are balanced. Earth's gravity is a force that pushes down on the car where it is parked. The parking lot or driveway underneath it acts as an equal force, pushing up on the car. Once the car has been started and is moving, there is an unbalanced force acting upon it.

24

## See the Bigger Picture

Forces that are equal in strength and opposite in direction are known as balanced forces. When you push a wall, it does not move and you also do not move. This is a balanced force because you and the wall are acting on each other with the same amount of force. Unbalanced forces cause a change in motion and sometimes direction. Unbalanced forces occur when one force is stronger than another. Kicking a ball is an example of an unbalanced force. When your foot hits the ball, it acts on the ball with a greater amount of force, putting the ball into motion. Balanced forces cause no motion, while unbalanced forces cause motion.

# Takeaway

At the beginning of the experiment, the egg was at rest on top of the cardboard tube. This is an example of a balanced force. There were two forces acting on the egg. Gravity pulls the egg down. The cardboard tube pushes up on the egg from below. These forces acted in two directions. When you pushed the plate out of the way, the toilet paper tube fell which caused the egg to fall. The forces on the egg became unbalanced, causing it to fall into the glass with water. The tube was a force holding the egg. Once it was removed, there was only one force acting on it—gravity—which caused the egg to drop into the cup.

## Go Further

Try the experiment again and change the variables. Trade the small cardboard tube for a longer one, such as a paper towel tube. How was the motion of the egg affected? Do you think that the size of a force affects the speed of an object? Try using a smaller force by hitting the plate with less force, and then try hitting the plate with greater force.

Consider examples of balanced and unbalanced forces in your daily life. Think about how forces come into play during a game of soccer, baseball, football, or another recreational sport. Identify ways that force comes into play during a game. For example, if a player kicks a soccer ball toward the net, but it stops a few feet in front of the net. How could the force have been changed to allow the ball to follow through into the net?