CURIOSITY AT HOME

FOLLOWING THROUGH

Have you ever wanted to throw a ball farther or more accurately? By learning a little bit about some of the physical forces interacting when you make a throw, you too can become a free-throw pro or softball superstar.

MATERIALS

- Basketball or ball of choice
- Tape measure
- Chalk or tape
- Optional: Basketball hoop or something to use as a target
- Science notebook or paper
- Something to write with

PROCEDURE

- Make a starting line using chalk or tape somewhere that you have plenty of clear space and a long distance in front of you to throw a ball.
- Copy the table below in your science notebook or create your own.

	Stop	Follow Through
Throw 1		
Throw 2		
Throw 3		

- Standing with your toes on the starting line, throw the ball as far as you can, but stop moving your hand the moment you let go of the ball. Note where the ball hits the ground.
- Mark the spot where the ball hit the ground with chalk or tape. Measure the distance between this spot and the starting line, and record this distance in your science notebook under the column labeled “stop.”

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- Go back to the starting line, and throw the ball as hard as you can again. This time, continue moving your hand after you have let go of the ball. Continuing your movement past the moment you let go of the ball is called **following through**.
- Mark and measure the distance the ball was thrown, and write it in your science notebook in the “follow through” column.
- Continue this experiment by throwing the ball two more times each way: by stopping short, and by following through.

EXPLORE MORE

Try an accuracy challenge next. Try throwing the ball to hit a target or make a basket. First try throwing and stopping the moment the ball leaves your hand, then try following through. Repeat this many times and see whether you score more points while following through or not.

WHAT’S HAPPENING?

Following through helps to improve a throws speed and accuracy in a simple way. When you stop short while throwing a ball, your muscles start preparing for you to stop the throw while you are still holding the ball. You aren’t able to go from full speed to stopping immediately, so first your movement slows down. In physics, this slowing down is called deceleration. If you follow through, you won’t start decelerating until long after the ball has left your hands.

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K–2 GRADE EXPLORATION

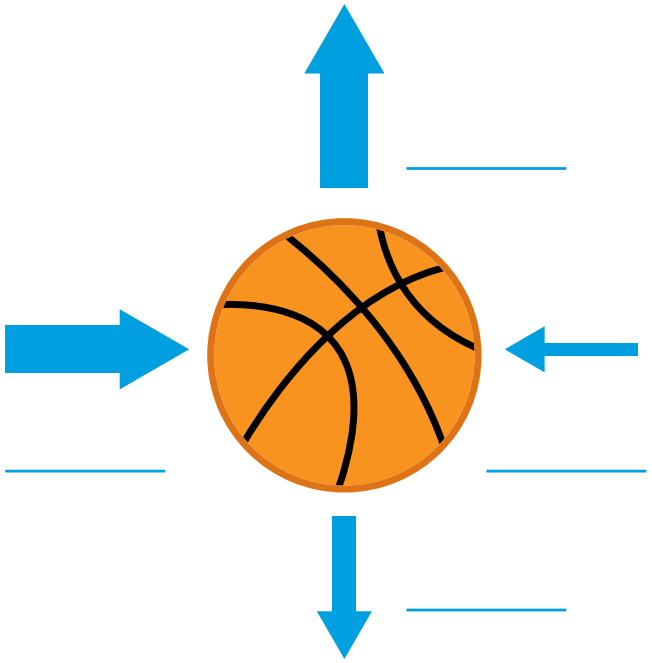
- Which way did you throw farther: by stopping, or by following through?
- When you throw the ball, your hands are pushing it forwards. Which way of throwing created a stronger push: stopping, or following through?
- How does the strength of a push relate to the distance a ball moves?
- When the ball collides with the ground, what happens to the direction of the ball's movement?

CURIOSITY AT HOME

FOLLOWING THROUGH

3–5 GRADE EXPLORATION

- In your science notebook, calculate the average throw distance for each category
  - If your distance measurements are in feet and inches, convert them to just inches by multiplying the distance in feet by 12, and adding the distance in inches. If your measurements were in meters and centimeters, divide your centimeters by 100, and add this to your meters. This will make the next step easier.
  - Add up the distances of all 3 throws in the “stop” category, and divide by 3 to get the average distance. Then, do the same thing for the “follow through” throws.
  - Compare the two averages. Which way allowed you to throw the ball farther?
- When you throw a ball, many pushes and pulls known as forces are acting on it at once. Copy the diagram to the right in your science notebook. Match the forces to the arrows in the diagram, and label each one as a push or a pull.
  - Direction: Vertical force of throw
  - Direction: Horizontal force of throw
  - Gravity
  - Air resistance
- Once the ball is thrown, there is no more upward or forward push acting on the ball. Eventually, gravity and air resistance overpowers the forward and upward movement. Using this information, draw what the motion of the ball looks like, and how its position changes.
- Does the ball have to be touching the earth for the force of gravity to affect it?



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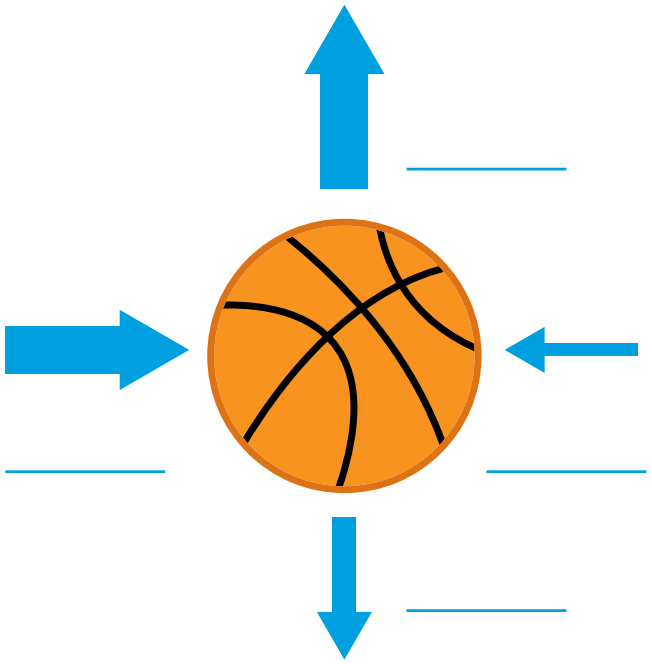
CURIOSITY AT HOME

FOLLOWING THROUGH

6–8 GRADE EXPLORATION

- In your science notebook, calculate the average throw distance for each category
  - If your distance measurements are in feet and inches, convert them to just inches by multiplying the distance in feet by 12, and adding the distance in inches. If your measurements were in meters and centimeters, divide your centimeters by 100, and add this to your meters. This will make the next step easier.
  - Add up the distances of all 3 throws in the “stop” category, and divide by 3 to get the average distance. Then, do the same thing for the “follow through” throws.
  - Compare the two averages. Which way allowed you to throw the ball further?
- When you throw a ball, many forces are acting on it at once. Copy the diagram to the rightinto your science notebook. Match the forces to the arrows in the diagram.
  - Direction: Vertical force of throw
  - Direction: Horizontal force of throw
  - Gravity
  - Air resistance
- Once the ball is thrown, there is no more upward or forward push acting on the ball. Eventually, gravity and air resistance overpowers the forward and upward movement. Using this information, draw what the motion of the ball looks like, and how its position changes.
- When the ball finally comes to a stop on the ground, the force of gravity is still pulling on it. What object is pushing on the ball with an equal but opposite force to keep it from falling through the ground?
- Which requires more force to move: a basketball or a bowling ball? Why is this?
- Does the ball have to be touching the earth for the force of gravity to affect it?
- Forces can either pull an object closer or push an object further away. Can gravity ever push objects away, or does it always pull?



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