



# High Touch High Tech®

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## Basketball STEM activity

### Supplies:

*\*\* makes 1 basketball hoop and 1 shooter \*\**

- Cardboard piece (3 x 4 inches)
- 2 x Chenille stems
- Nylon net fabric (10 x 10 inches)
- 6 x Jumbo craft sticks
- 6 x Regular craft sticks
- 1 x Dowel stick (6 inches long, 3/8 inch diameter)
- 3-4 feet Masking tape
- 1 x Large straw
- 1 x Cardboard tube
- 3-4 Rubber bands
- 1 x 3oz. or 6 oz. cup
- 1 x Ping pong ball

Pass, dribble, and shoot! Yes, it is time for March Madness – one of the most famous annual sporting events in the US. Whether you are watching college teams on TV or playing in the backyard, basketball is fun because of Science! Bouncing the ball on the ground, passing to your teammate, and shooting at the goal all depend on physics, math, and the laws of motion.

To create your own basketball tournament using a ping-pong ball, gather some friends to design and build a basketball hoop and a device to launch the ball. You can form teams to determine who can design and build the most efficient shooter and most accurate hoop.

1. Observe the materials. Imagine how to use these materials to design a shooting device that will launch the ping-pong ball into the air. Think of a catapult. How does this device propel a ball?
2. How will you use the cardboard? Could it be a backboard?
3. How will you design the hoop? Will you need the chenille stem or craft sticks?
4. Working with your teammates, plan how to build the hoop structure.
5. Plan the launching device with the craft sticks and rubber bands. How will the elasticity of the rubber bands cause a reaction.
6. What other materials will you need for your shooter?



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7. Build the ping-pong ball launcher. Do you need all of the materials?
8. Test the launcher. How high did the ping-pong ball travel? Can you make adjustments?
9. Build the hoop with the cardboard tube and netting.
10. Use one of the chenille stems as the hoop. How large is the circumference of the hoop? Can the ping-pong ball easily fit through the hoop?
11. How will you keep the cup stable in the air?
12. Test the ping-pong ball launcher. Did it reach the hoop?
13. Adjust the launcher and the hoop.
14. Encourage another team to build a hoop and launcher.
15. How is your design different or similar to the other group?
16. How can you better design your devices?
17. Hold a tournament between the 2 teams. Whose ping-pong ball shooter works the best? Which launches the ball higher?

## The Science Behind It:

An official basketball for men has a **circumference** of 29.5". The official basketball for women has a **circumference** of 28.5". The **circumference** is the distance around a circle.

The rim of a basketball hoop is 18" in **diameter** with a **circumference** of 30 inches. If a basketball has a circumference of 29.5" and the rim is 30", that leaves only .5" of free space for the ball to go through the hoop! That is  $\frac{1}{2}$  of an inch!

In addition, the basketball hoop is 10 feet above the ground. This makes it even more difficult to score points during the game,

The dimensions of the basketball, rim, and height of the hoop are extremely important for the game. If the hoop is not perfectly symmetrical, the ball would bounce off the rim and not go through the basket!



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## Real World Relevance – Science of Basketball

*Bounce* – A basketball is a sphere made of rubber wrapped in layers of fiber. A small opening allows someone to increase or decrease the **air pressure** of the basketball. The inflated rubber ball can bounce with the right amount of air pressure. Usually, the higher the air pressure inside the basketball, the higher it will bounce.

*Pass* – When passing and receiving a basketball, players use **force**. A player pushes the ball forward with the body, arms, and fingers. This is an outward force. The second player receives the basketball by controlling the motion of the ball.

*Jump Shot* - When a player makes a jump shot, the force of his arms and arc of the ball determine if it goes through the hoop. The ball follows a **parabolic arc** – an arch – through the air. The parabolic arc is shaped like a **parabola**, a symmetrical curve.

*Dribbling* – Basketball players must dribble the ball when walking or running down the court. Dribbling a ball is both **potential** and **kinetic** energy. When the player is holding the ball, it has **potential energy**. When she drops the ball to the floor, the potential energy is converted into **kinetic energy**. When the ball bounces back up to her hand, it turns back into potential energy.

*Shooting* – When a player shoots a basketball, he exerts a **downward force** on the ball. He also might flip his wrist, causing a backspin on the ball as it moves through the air. The backspin counteracts the downward force of **gravity** giving the ball an added lift in the air.

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