



## CARDBOARD CHALLENGE

# MARBLE MAZE

### STEM LESSON:

Newton's Law of Conservation of Energy states that energy can neither be created nor destroyed. Marble mazes are a terrific demonstration of how energy can be transformed from one form to another. The first form of energy we encounter when using our mazes is potential energy. Potential energy is the stored energy an object has because of its position. If you hold the marble just at the edge of the maze, the marble has potential energy. When you release the marble, it begins to move through the maze as you tilt the cardboard base. Releasing the marble into the maze transforms the marble's potential energy into kinetic energy. Kinetic energy is the energy of motion. Any object that has mass and is moving has kinetic energy.

Your marble maze also demonstrates Newton's 3 Laws of Motion:

1. An object at rest remains at rest, and an object in motion remains in motion at constant speed and in a straight line unless acted on by an unbalanced force. (The marble will remain at rest in the maze unless you exert a force on the maze to move it. The marble travels in zig zag patterns, as opposed to a straight line, because the walls of the maze exert a force on the marble whenever it collides with them.)
2. The acceleration of an object depends on the mass of the object and the amount of force applied. (The marble moves around the maze quickly due to its low mass unless we exert very little force on the maze as we move it.)
3. Whenever one object exerts a force on another object, the second object exerts an equal and opposite on the first. (This is why the marble bounces off of the maze when the marble hits the walls.)

### STEM CAREERS:

ENGINEER, ARCHITECT,  
PSYCHOLOGIST

# MATERIALS NEEDED:

- Cardboard
- Cardboard boxes assembled (or help students assemble their own)
- Cardboard tubes
- Hot glue gun
- Hot glue sticks
- Masking tape
- Duct Tape
- Regular straws
- Milkshake straws
- Fuzzy sticks
- Scissors
- Box cutters
- Markers
- Marbles

# ACTIVITY INSTRUCTIONS

1. Select a piece of cardboard or cardboard box to work with. If there are no more boxes left, you can make your own by taping pieces of cardboard together into a cube. Be sure you leave the top of the box open.
2. Choose straws and/or pipe cleaners to build your maze. Feel free to add tunnels that your marble can travel through using the cardboard tubes.
3. Don't forget to make a wall around your maze so that your marble doesn't escape.
4. Draw a circle at the top of your cardboard. This will be the starting line. Cut a hole large enough for your marble to fit through on the bottom of your cardboard - this will be the finish line.
5. Challenge: can you add a base or device below your maze that will catch your marble?
6. Test your marble in your maze!