



# Tightrope Walker

Have you ever tried to walk on a balance beam or even a sidewalk crack? Discover how tightrope walkers are able to lower their center of gravity, increase their moment of inertia, and exert torque in order to stay balanced and perform stunts at great heights. Create your own tightrope walker to explore the best way to keep them balanced.

## TEKS:

3.6C: The student is expected to observe forces, such as magnetism and gravity, acting on objects.

8.6: Force, motion, and energy. The student knows that there is a relationship between force, motion, and energy. Investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction, such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.

## Materials:

- 1 clothespin (one-piece wooden one, not the spring type)
- 5 feet of fishing wire
- 2 full water bottles of different heights
- 2 pieces of 9" long beading wire (skinny enough to bend easily)
- 1 pipe cleaner
- 1 straw (not bendy)
- 2 washers
- Optional: markers and googly eyes for decorating

## How To:

1. Wrap one 9" piece of beading wire around each "leg" of the clothespin (so each leg has its own wire). Bend each wire so that they point out at a downward angle from each leg of the clothespin.
2. Wrap the other end of each wire through the hole in a washer. If needed, use tape to hold the wires in place.
3. Wrap a pipe cleaner around the clothespin near the top and curve the edges up to make arms.

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4. Place a straw in the pipe cleaner arms. The straw will serve as your tightrope walker's pole.
5. Tie each end of fishing line to a water bottle to make a sloped tightrope for your tightrope walker. Make sure that the string is taut between the two water bottles!
6. Test your tightrope walker along the string by placing one "leg" over each side of the fishing line. Make modifications as needed until your tightrope walker can balance on the string on its own.
7. Decorate your tightrope walker!

### **STEM Explanation:**

When we think of tightrope walkers, we usually picture them holding a long pole to help them balance. Why do they hold this pole? When a tightrope walker is walking across the rope, gravity is pulling her down. Each time she takes a step, she must shift her weight, making it very difficult to balance on the skinny wire. Balancing is also difficult because torque, a rotational force, acts on the tightrope walker and is rotating her sideways off the wire with every unbalanced step. By using a pole weighted at the ends, the tightrope walker is able to counter the torque and keep balanced on the wire. The weighted pole increases the walker's moment of inertia, or resistance to rotating and falling off the wire, allowing the walker time to correct her position and stay balanced. In addition, holding the pole low helps to keep her center of gravity low, and this further increases her ability to balance. On the example that you made, your clothespin tightrope walker is able to balance because the washers lower its center of gravity, and the straw increases its moment of inertia. Does a clothespin with nothing attached to it balance on the string? Try experimenting with the way your wire is bent or where your straw is placed. What works best?

### **Career Connection:**

*Physicists* are scientists who study matter and its motion through space and time, along with related concepts such as energy and force. More broadly, the field of physics analyzes the world around us in order to understand how the universe behaves.

### **Resource:**

<http://familyfun.go.com/crafts/crafts-by-material/pipe-cleaner-crafts/amazing-acrobats-670033/>

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