# Student Worksheet for Ep. 19: Building Bridges

**Overview:** What keeps building from toppling over in the wind? Why are some earthquake-proof and others not? We're going to look at how engineers design buildings and bridges while making our own.

**Materials**

- Popsicle sticks (big box)
- Hot glue guns and glue sticks
- Bottle of water (empty at first)
- Two tables parallel to each other, spaced 3 to 4 feet apart
- Optional: 5 feet of string
- Optional: Scale

**Challenge:** Can you build a bridge using only popsicle sticks and hot glue that can carry a bottle of water? (For smaller kids, use a smaller water bottle.) The only limitation is that you may *not* glue the bridge to the table. I will use masking tape to attach the end of the bridge to the table if needed only *after* they build the bridge and are ready for testing.

You have 30 minutes to complete this challenge… Ready? Set? Go!

After 30 minutes is up, it's time to test your bridge! When testing, start with an empty bottle (you can hang it from the bridge, or rest it on top) and slowly add water, keeping an eye on the bridge itself. When the bridge starts to buckle or break, stop pouring and record the volume or measure the weight of the water.

*Optional:* For older students, I might also include a length of rope. They don't have to use it, but they can opt to. For high school students, I've been known to offer chocolate bars as prizes, with something for everyone participating and big prizes for winners. College students in my engineering classes have to complete their bridge at home and get a whole week to come up with something I can put an entire case of water on.

Important distinction: I don't give prizes for "first place", "second place", etc. where students compete against each other; instead I give prizes cooperatively: I do set the bar (the expectation, or goal) at a certain level (like supporting a gallon of water), and have enough prizes for all kids who complete the challenge successfully, along with small prizes (like a *Hershey's kiss*) for those who gave it a good try.

**Exercises**

1. Give three examples each of a contact force and an action-at-a-distance force:

   _____ _____

   _____ _____

   _____ _____