

# DIYo-Yo Challenge

## Collect

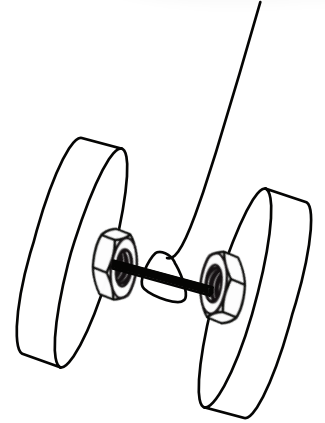
- Round objects: soda bottle caps, oatmeal container lids, or cardboard circles
- Straight objects: bamboo skewers, bolts, or wooden dowels
- Tape or glue
- Metal nuts (must be able to fit on the skewer, bolt, or dowel)
- Washers of different sizes
- String



## Basic yo-yo design

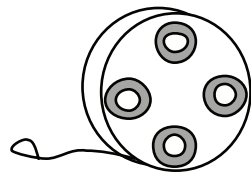
A basic yo-yo consists of two circular disks connected by an axle which is attached to the end of a piece of string.

1. Find the center of the two circles you wish to use and make a mark. This is where you will attach the axle.
2. Secure the axle to the center of each circle with glue or tape so it is in a fixed position.  
*Hint: If you want more space between the two circles, try adding two nuts to the axle to act as spacers.*
3. Tie the string around the axle.

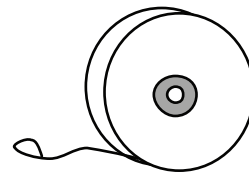


## Experiment with weight

Now that you have your basic design, use the washers to add weight to different parts of the yo-yos. Some yo-yos are rim weighted. This means the weight is distributed near the outside edge. There are also center weighted yo-yos, which have most of their weight near the axle.



Rim Weighted Yo-Yo



Center Weighted Yo-Yo

4. Decide which type of yo-yo you want to make.
5. Tape or glue washers to the outside disks of your yo-yo. To make a rim weighted yo-yo, add washers near the outer edge of the circles. Make sure the weights are evenly distributed so that the yo-yo will spin evenly. To make a center weighted yo-yo, place the washers around the axle.

## Take it further!

- Compare how the yo-yo moves when the string is tightly tied around the axle, versus when it is tied in a loose loop around the axle. Which method makes it easier to keep the yo-yo spinning in place ("sleeping") at the end of the string, and which method makes it easier for the yo-yo to return to your hand quickly?
- Try to build a few different types of yo-yos with the weights in different places. Play around with the designs and see what works best for you!

## How does a yo-yo go?

When the yo-yo is in your hand, it has potential energy (stored energy) since it is a certain height above the ground. When you release the yo-yo, the potential energy is converted into kinetic energy (energy in motion) thanks to gravity. When the yo-yo is traveling towards the floor, it spins as the string unwinds itself around the axle. When it reaches the bottom of the string, the yo-yo still has momentum from its fall. This stored energy is then used to send it back up toward your hand again.

Where the weight goes makes a big difference in how a yo-yo moves. Some yo-yos are center weighted so that they can spin faster. This works well for certain tricks that require the yo-yo to change speed or direction quickly. Yo-yos that have weight closer to the rim may spin longer and be more stable.

