

Are you stronger than a cotton ball?

Facilitator-Led Tabletop Activity



Why is yarn twisted? Deconstruct a piece of yarn to find out how it is made. Then unroll a cotton ball and twist it to make a piece of yarn. Pull with all your might. The better you twist, the harder it is to break. Even if you can break it, clearly twisting gives fibers a great deal of strength! No wonder people all over the world have twisted fibers from plants and animals for thousands of years to make yarn.

Question to investigate

Am I stronger than a (twisted) cotton ball?

Chemistry concepts

- Intermolecular forces between polymers hold fibers together. These forces alone are not very strong.
- Twisting fibers which are pointing in the same direction give the resulting yarn strength.
- Whether from plants, animals, or petroleum, fibers are made of long thin molecules called polymers.

Activity logistics

- **Ages:** As written, this activity is best suited for elementary and middle school students.
- **Group Size:** This activity serves up to 48 children or teens over a period of 2 hours, with each iteration of the activity lasting approximately 10 minutes.
- **Set-up:** Arrange the materials along one side of an 8-foot table into four stations to reach up to four children at once.
- **Facilitators:** One facilitator can comfortably manage four stations at the same time.

Prepare on-site

What you'll need

- Yarn (any fiber)
- Scissors
- Ruler
- Cotton ball

Notes about the materials

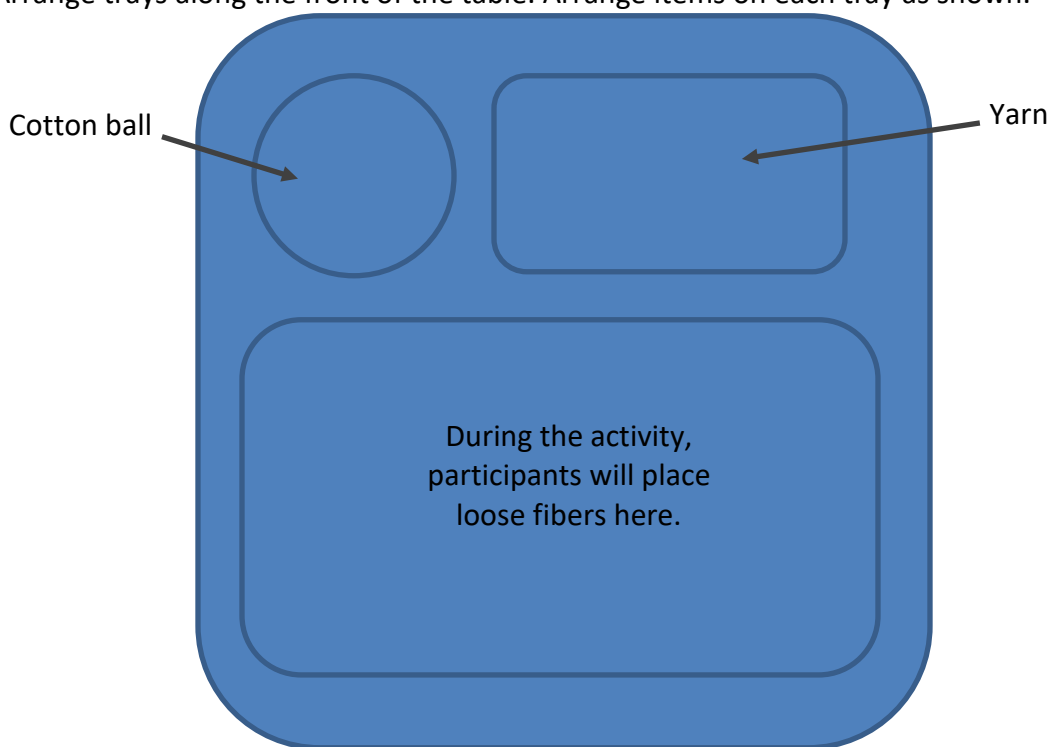
- Any size cotton ball will work. The less expensive polyester balls work fine, too.
- Cotton balls that appear to be rolled, like a sticky bun, work best for this activity.

Cut the yarn

1. Use scissors to cut yarn into 15 cm lengths, one per participant.

Prepare four stations to accommodate up to four participant groups at one time

1. Arrange trays along the front of the table. Arrange items on each tray as shown.



Be safe

Fibers may become airborne, stick to fingers and clothing, and then get in someone's eye.

- This will be very irritating. For this reason, be sure that participants are wearing safety glasses at a minimum.
- Prevent this by collecting fibers between users and place in a container on the table. If the air is moving considerably, minimize the removal of fibers from the yarn and cotton ball and collect these fibers right away.

Facilitate the activity

Invite participation

1. **Introduce the activity by asking students if they are stronger than a piece of yarn.**

[Facilitator pulls on a piece of yarn.]

Can you break a piece of yarn with your bare hands?

[Participants pull on a piece of yarn.]

Ask participants:

- What do you notice about this yarn?
 - It is twisted. *[untwist and pull again]*
 - It is made up of different yarns. *[separate into 4 yarns]*
- Pull one of the yarns. Can you break it? *[Yes!]*

One way to learn about how something is put together is to take it apart. Let's take this apart into its smallest pieces—fibers!

Support Exploration

2. **Are you stronger than a cotton ball?**

It is very easy to pull fibers out of a cotton ball. You could certainly break it as it is.

- **What do you think would happen if we make a piece of yarn out of it?**
- **Would you be stronger than a piece of cotton yarn? Let's find out!**

Procedure

1. The cotton ball is rolled up. Turn it so that the center of the roll is pointing up.
2. Push the center up with your finger so that it comes out of the roll.
3. Unroll the cotton ball. This is called a sliver (pronounced sly-ver). It is made up of fibers pointing in the same direction. Pull a little piece of fibers out of one end to see how easy it is to break. **How could we make the cotton sliver fibers stronger? What makes you think that?**
4. Twist the cotton sliver to make a piece of yarn.
5. Pull with all your might. **Can you break the cotton yarn?**

Deepen Understanding

3. **Discuss the relevance of fibers, yarns, and fabrics.**

People all over the world have twisted fibers together for thousands of years to make yarn. Then the yarns were woven or knitted to become fabric. People invented different tools to do this because doing this completely by hand is a lot of work.

Twisted fibers kids may know about

- The clothes you are wearing are made of fabric, which is made of yarns, and then fibers. If you look at the tag on the inside of your clothes, you will find out which type or types of fibers your clothes are made of.
- Fibers formed in nature are typically shorter compared to synthetic fibers, which are made by people.
- There is a reason people throughout history and around the world spun fibers from wool, cocoons, cotton, flax, or jute: To turn the fibers into strong yarn that would make a fabric sturdy enough for daily wear and tear as well as hold up during washing.

Is there anything smaller than a fiber? Yes!

- Fibers are made of very long thin molecules called polymers. All fibers are made of polymers, but not all polymers can become fibers.
- The polymers in fibers are held together by intermolecular forces.
- Synthetic fibers are made by changing a polymer found in nature to make a different polymer that can clump up to form a fiber. Synthetic fibers are made by pushing a melted polymer through small holes, like a shower head. These are called spinnerets. The fibers are pulled, cooled, and then twisted to make yarn.
- Number 1 plastic PETE can be melted, pulled, and twisted to become “fleece” jackets, vests, and sweatshirts. It can become yarn for people who like to knit or crochet. Turning unwanted items into new items is a challenge for chemists and chemistry.

Clean-up

Reset for the next group

- Pick up the fibers and place them in a pile. Reset the table according to the instructions in the section titled, “Prepare On-site.”

At the end of the event

- Collect the loose fibers and place them with the trash.
- Pack everything else up in the box.
- Then help pack up another activity.