Testing the Tensile Strength of Spider Silk versus Thread

Name: _____

Date: _____

Experiment #: _____

QUESTION

Is spider silk stronger than thread of the same diameter?

HYPOTHESIS

If spider silk is tested against thread of the same diameter, then _____

BACKGROUND

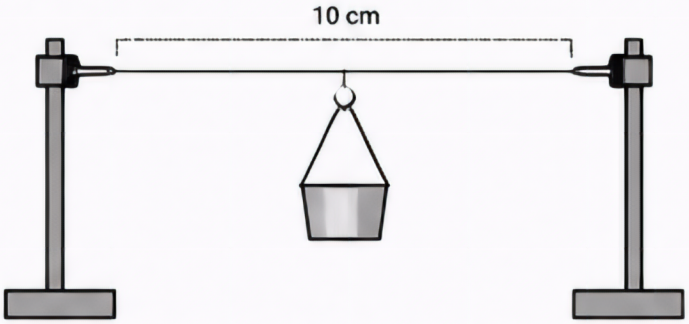
Tensile strength is the maximum amount of force a material can withstand while being stretched or pulled before it breaks. Spider silk is known for being incredibly strong for its size. In this experiment, we will compare the tensile strength of spider silk to a common thread.

MATERIALS

- Spider silk strands (from large orb-weaver webs)
- Thread (e.g., cotton or polyester) of similar diameter
- 2 sturdy stands or supports
- Clamp or binder clips
- Small cup or container for weights
- Mass set (gram weights) or small objects with known mass
- Ruler or calipers (to measure diameter)
- Tape measure (to keep the length at 10 cm)
- Notebook and pen/pencil
- Safety glasses (recommended)

Note: Handle spider silk gently. It is very fine and delicate.

EXPERIMENT SETUP



A 10 cm length of spider silk or thread is stretched tightly between two supports. Weights are added to the cup until the strand breaks.

PROCEDURE

1. Collect spider silk from the frame line of a large orb-weaver web. Carefully remove any debris.
2. Measure and cut (or select) a strand of spider silk 10 cm long.
3. Measure the diameter of the spider silk using calipers or by comparison with thread (record in the data table).
4. Stretch the spider silk gently between two supports and secure it with clips. The length between the clips should be 10 cm.
5. Attach the cup to the center of the strand.
6. Add mass to the cup in small increments (e.g., 1 gram at a time). Wait a few seconds between each addition.
7. Record the total mass at the moment the strand breaks.
8. Repeat steps 2–7 for the thread.
9. Perform at least 3 trials for spider silk and 3 trials for thread.

DATA TABLE

Material	Diameter (mm)			Breaking Mass (g)		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
Spider Silk						
Thread						
Average (g)						

Calculate the average breaking mass for each material.

CALCULATIONS (Optional)

Tensile strength can be estimated using:

$$\text{Tensile Strength (N/mm}^2\text{)} = \frac{F}{A}$$

Where:
F = breaking force in newtons (N)
A = cross-sectional area (mm²)
(1 g ≈ 0.00981 N)

If you measured the diameter (d in mm):

$$A = \pi\left(\frac{d}{2}\right)^2$$

Calculate the tensile strength for each trial (Optional).

CONCLUSION

Which material had greater tensile strength? Use your data to support your answer.

_____

_____

REFLECTION

What did you learn from this experiment? _____

How could you improve your experiment? _____

_____

⚠ **SAFETY FIRST:** Wear safety glasses when collecting spider silk. Do not touch spiders.