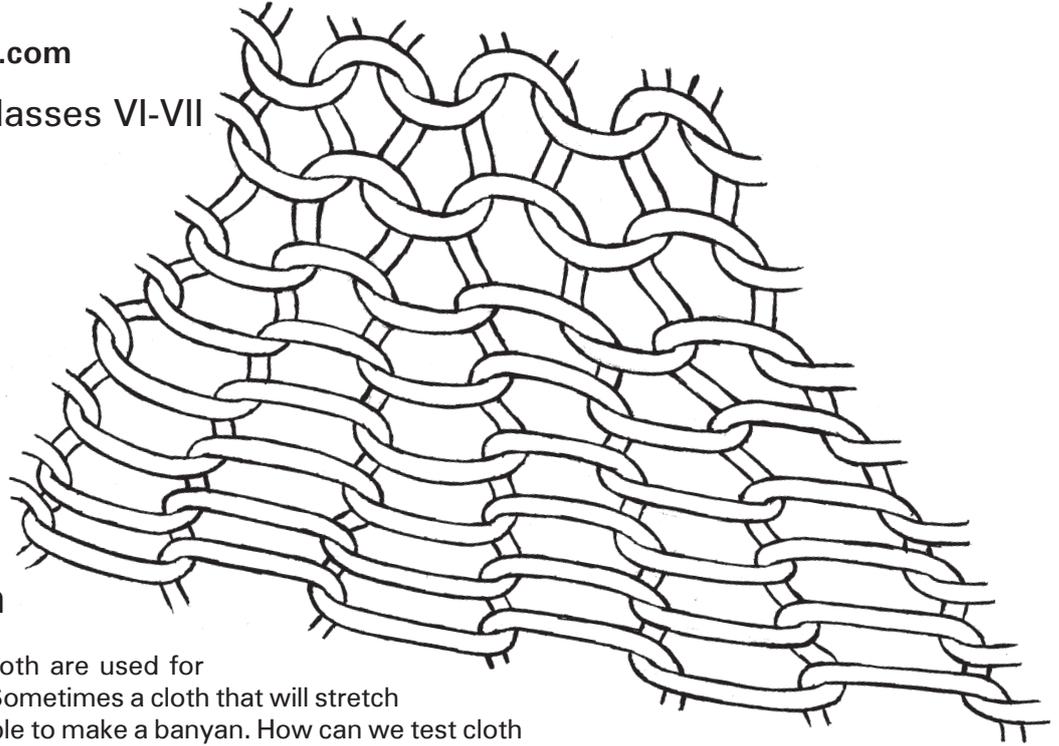


# What Kind of Cloth Stretches a Lot?

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Grade level: Classes VI-VII



## Introduction

Different kinds of cloth are used for different purposes. Sometimes a cloth that will stretch is needed, for example to make a banyan. How can we test cloth to find out how much it will stretch?

## Science concepts

1. Comparing characteristics of cloth: stretchiness
2. Observation and comparison of different types and weaves of cloth
3. Designing a fair test for cloth stretchiness

## Previous knowledge

The students should have some previous knowledge of:

1. Measurement of distance in cm and mm

## Teaching/learning materials

Samples of a number of different types of woven and knitted fabrics

Scales, scissors, hand lens, string, rubber bands, cardboard, paper, graph paper, pins, paper clips, stapler, glue, and other general supplies

# Students' Guide

## Scenario: The Three Sisters

Once upon a time there were three sisters, Fabrikina, Fabrikona, and Fabrikita. Fabrikina, the oldest sister, was a woman of the world. Fabrikona, the middle sister, was with it. But poor Fabrikita, the youngest sister was just plain Fabrikita.

One cold, rainy winter's day, when Fabrikita was only 11 years old, a grave misfortune struck their family. The father and mother of the three sisters were both killed in a bus accident. The sisters didn't know what to do because they had no other relatives that they knew of. Finally they decided they would have to go to work in the cloth mill. They went to the owner of the cloth mill to ask if they could work there. It was the end of the day and everyone was just leaving the mill. But they found the owner on his way out, just as he was about to lock the door. He said he did not need any more workers, and he wanted to go home and have a cup of tea. But they pleaded and told him that they would not survive if they could not find some work. So finally he agreed, but only on the condition that they had to design a new cloth and make enough of it to make 1000 banyans. Furthermore, they had to do this by the next morning. The owner locked the three sisters up in the mill and went home.

The sisters were scared. They had no idea what to do. How could they design and make cloth? Besides, it was cold and dark in there (there was only one small light hanging from the enormous ceiling), and the three sisters had nothing to eat. They just sat down and thought. Fabrikina was so cold that her teeth were shattering. She looked around and noticed a small brass lamp in the corner. She went and picked it up, thinking maybe they could light it. It was rather tarnished, so she rubbed it to get it clean.

Then, to the amazement of the three sisters, a jinn came out of the lamp in a puff of smoke!

"At your service! You are three sisters and you have three wishes! Your wishes are my commands!" the

jinn announced.

The three sisters were overcome with joy.

Fabrikina knew exactly what to wish for. "I wish for a design for a new cloth that will be good for making banyans!" she exclaimed.

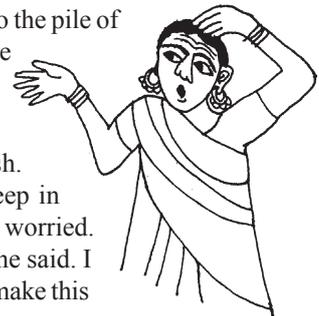
No sooner had she finished than the jinn disappeared back into the brass lamp. Only to return a few seconds later with a detailed design for the new cloth.

"Ah, but now it is my turn," said Fabrikona. "I wish that we had enough of this new cloth to make 1000 banyans!"

Again, the jinn disappeared into the brass lamp, and again he returned in a few seconds, this time pulling metre after metre of the new cloth out of the lamp.

The two eldest sisters ran to the pile of cloth, exclaiming with glee on its beauty.

But now it was the turn of Fabrikita to make a wish. She was standing back deep in thought. She looked a little worried. "This doesn't seem right," she said. "I wish we could design and make this cloth ourselves!"



The next thing the sisters knew, the jinn was gone, the lamp was gone, and the cloth was gone as well!

The two eldest sisters glared at Fabrikita. "What have you done!" they exclaimed. "We had such good fortune – but now you have spoiled everything!"

"Don't worry," said Fabrikita. "We must have gotten my wish – now we will be able to design and make the cloth!"

And indeed, that was what happened. All three sisters went to work. First they discussed what kind of cloth would be good for a banyan. They all agreed that, most important it should be a stretchy cloth. Then they designed a number of different kinds of cloth. They made small samples of each one. Then they tested each sample to see how stretchy it was. They found the stretchiest one and set to work making it. Just as the sky began to get light in the east, they finished making enough of it to make 1000 banyans.

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## Your Tasks:

1. Read the story out loud with expression and action.
2. Work in groups to:
  - a. Devise a fair way to test different types of cloth to find out how stretchy they are.
  - b. Take 5-10 different samples of cloth and test them for stretchiness. Record your results.

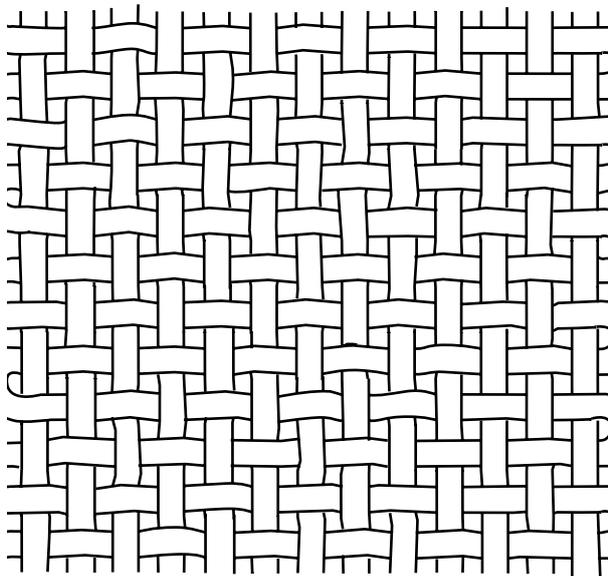
Each group will then present their conclusions to the rest of the class.

The class will discuss and compare the results and the methods used.

## 2 What Kind of Cloth Stretches a Lot?

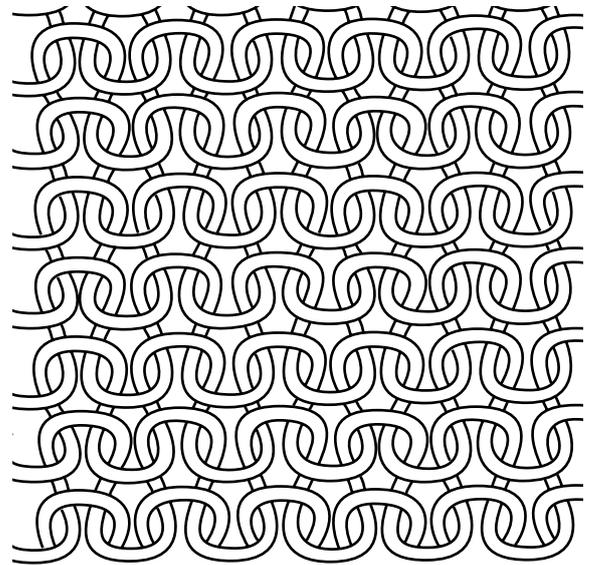
## Extension Handout : Identify Types of Weave

### Woven and Knitted Fabric



Two main types of fabric are woven and knitted fabric.

**Fig 1:** In woven fabric, separate yarns are lined up lengthwise (the warp or baanao), through which the weft yarn (tanao) is horizontally woven by



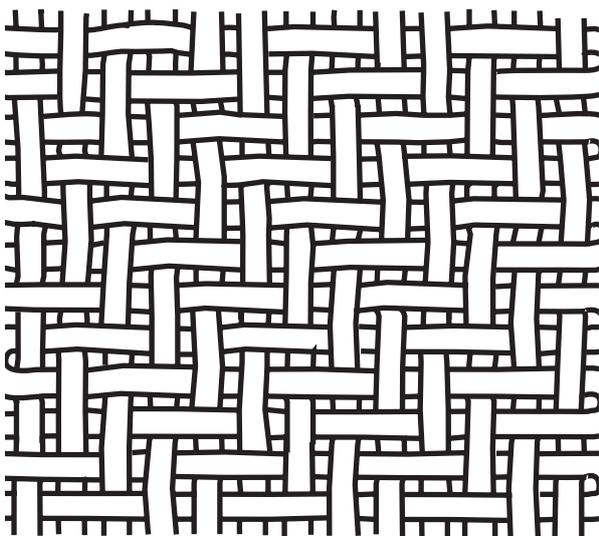
inserting it over and under the warp yarns.

**Fig 2:** In knitted fabric, one continuous yarn is intertwined in a series of connected loops left from each previous row.

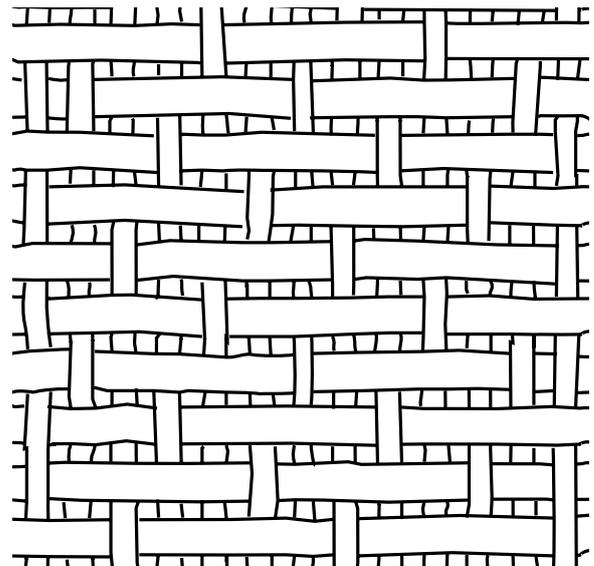
By examining the above pictures, you can imagine which type of fabric might stretch more.

### Different types of weaving.

The following pictures show more types of weaving. Using a hand lens if necessary, examine cloth samples and see if you can find examples of these different kinds of weaving.



**Fig 3:** Twill weave.



**Fig 4:** Satin weave.

Colour the yarns differently in the above pictures to get interesting patterns.

# Teachers' Guide

## Suggested Teaching Strategy

1. Ask the students to read the story out loud, with expression and action.
2. Divide the class into small groups (4-6 students). Each group should devise a fair test for cloth stretchiness, use their method to test 5-10 samples of cloth, and record their results.
3. Each group should present their results and conclusions to the rest of the class and a class discussion can follow.

It might be best to give each group the same kinds of cloth, to see if different groups get different results. Reasons for the differences could then be discussed. This might lead to further questions and further tests.

## The following kinds of questions might be discussed:

- a. How did each group's methods differ?
- b. What problems did you have in testing the cloth?
- c. What methods for testing were tried but not used because they didn't seem to work?
- d. Was each test really fair? Why or why not?
- e. Did every group get the same results? Try to explain any differences.
- f. Did anyone find that the same piece of cloth stretched different amounts in different directions? If so can you think of a reason for this?
- g. What questions arose as you worked?
- h. Can you think of other ways cloth can be tested and other methods to use?

## Possible extensions:

1. Ask the students to make bar graphs to show their results.
2. Try more kinds of cloth.
3. Observe each cloth closely (maybe using a hand lens) and classify each cloth according to how they are woven or knitted.
4. Give the students diagrams of different types of weaves and knits and ask them to identify each of their types of cloth samples (see Extension Handout).
5. Analyse why different weaves and knits are more or less stretchy, and why they are more stretchy in some directions.

## About the Script:

This script was tried out by the adult participants of the First Chandigarh STL Workshop.

First the Scenario, was enacted. Then we went around the circle of participants counting off the numbers from 1 to 6 in order to randomly divide everyone into 6 groups of about 5 each. Each group was asked to:

- Devise a fair way to test different types of cloth to find out how stretchy they are.
- Take 5-10 different samples of cloth, test them for stretchiness, and record their results.

The teachers were not given any other explanations or guidance, except that we told them that there was a table with supplies that they could use if they wanted. The supplies included scales, scissors, glue, string, thread, needles, clips, and other stationery items.

After about 30-45 minutes everyone was called together to present their findings.

Group 1 said that they had tested the cloth samples by stretching them horizontally and diagonally, noticing that they stretched more diagonally. They had some difficulties measuring with the scale and holding the cloth from all sides to keep it even, so then they removed one thread from each sample and tested how much it stretched. They found that threads from the more stretchy materials got curly when they were removed, while those from less stretchy materials remained straight. One sample had two different types of thread (for the warp and weft) – one was stretchy (because it was wavy) and the other wasn't. They also wet the samples to see if that made a difference. They said they could plot a graph based on their measurements, although they didn't have time to do so. An additional question that they thought of in the course of their experimentation was: since the stretchability of the cloth and the threads was different, how can they compare and resolve the question?

Group 2 began by labelling the cloth A, B, C, and D. While writing they realised that writing on each material was different – and writing on a stretchable material was the most difficult. They then cut the length of each material to 5 cm and then measured how much it increased when it was stretched. They found that the green and cream coloured cloths were the most stretchable. Finally, they removed yarn from each cloth and tested its stretchability. They also classified the cloth, and found that cotton was non-stretchable and synthetic was stretchable. They made a graph of the results.

Group 3 numbered each piece of cloth, and used scales to measure how much they stretched. They identified three ways to stretch the cloth: along the warp or along the weft (baanao or tanao), or diagonally. They found that the cloth stretches the most diagonally. They also reported that since they used manual tests the results are bound to differ each time.

Group 4 used scales to measure the stretchability of threads taken from each cloth. Their results were similar to those of Group 2.

Group 5 didn't feel the need to go into too much detail in the testing. They measured the stretchability lengthwise (along the warp?). They observed that stretchability depends on the type of weave: loose knit cloths stretched the most, while tightly knit ones stretched the least. Also the stretching is the most along the diagonal. They realised that this can explain why clothes can get distorted if they are hung in the wrong direction to dry. They also reported that the elasticity of the thread determines the stretchability. An additional question that occurred to them was: if a cloth is made of two types of thread, one stretchable, the other not, will the material stretch? It will probably depend on the weave.

After the group presentations, we all discussed the activity and the script, including also the Teachers' Guide.

Some people said that they could easily continue to have a good time for the next 2 days investigating these pieces of cloth. Also, the activities are useful because people do need to solve such problems and do tests before they produce cloth.

Others said that the results of the problem are not as important as the process we were going through to solve the problem. It may take students some time to realise that they are not expected to get 'the unique, correct answer,' and that the process is important.

All participants took part in the activity, each contributing a special quality. People liked the idea of having materials available without being told exactly what to do with them.

The group work made the participants realise that there are many different ways of doing things. Most teachers said it would be possible to do such group work in their classes, but certain problems were also pointed out.