# Fibre to Fabric

**Code: 668**

Course Coordinator
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## Welcome

**Let me welcome you to this course "Fibre to Fabric"!!**

**This is a course that has been very thoughtfully designed for people engaged in textiles industry and also for those who are desirous of entering the fascinating world of textiles. Textiles, fabrics, garments are omnipresent- we are surrounded by them- be they the clothes that we wear, the sofa covering or curtains, the cloth that we use to wipe our hands as we work, the ropes that we use…… we see them everywhere.**

**This course will take you on a journey from obtaining fibres to creating beautiful yarns and then weaving the yarns into a variety of fabrics. I hope you will enjoy reading this course as much as we enjoyed preparing it. Do not hesitate to write to us at aohomesc@nios.ac.in**

**if you need any help.**

**Wish you good luck in your studies and for your future!**

**Dr. Sandhya Kumar**
**Course Coordinator**

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# Contents

# 1. Knowing Textile Fibres

KEYWORDS

- Textile Fibres
- Natural Fibres
- Man-made Fibres
- Staple Fibres
- Filament Fibres

**OBJECTIVES**

- define textile fibres;
- classify the fibres on the basis of origin and length;
- describe natural and man-made fibres
- describe the primary and secondary properties of fibres

## 1.1 TEXTILE FIBRES

Have you seen fibres in your dress? Yes, probably you have. You must have seen a lungi- they have threads at both the ends. Pull out one thread. Try to untwist this between your fingers and thumb. The tiny hair like structure you get on untwisting the thread is a fibre. See the figure given below and you will understand how you got the fibre in your hand.

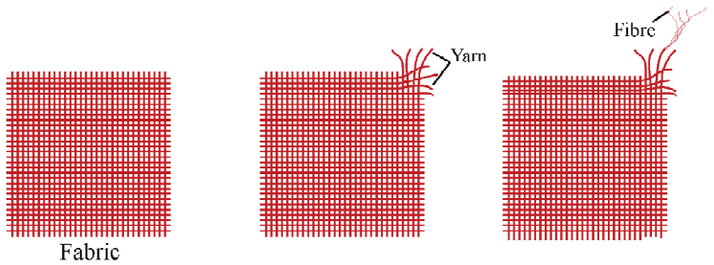



Fig. 1.1: Fabric -Yarn - Fibre

Thus, we can say that fabric is made of yarns and yarns are made of fibres. So we can say that a textile fibre is the smallest unit of fabric. There are many kinds of fibres that are used in a variety of ways.

## 1.2 CLASSIFICATION OF TEXTILE FIBRES

Textile fibres can be classified in two ways depending on-

1. Origin of fibre- from natural sources and manufactured by man.
2. Length of fibres-short/staple fibres and long/filament fibres.

Length of man-made fibres can be controlled and made into kilometers, if required. Usually natural fibres are short in length except silk fibre. Man-made fibres are filament fibres. You can see the classification of fibres based on the origin along with examples in the Fig 1.2 and the classification based on length of the fibre is briefly explained in Table 1.1.

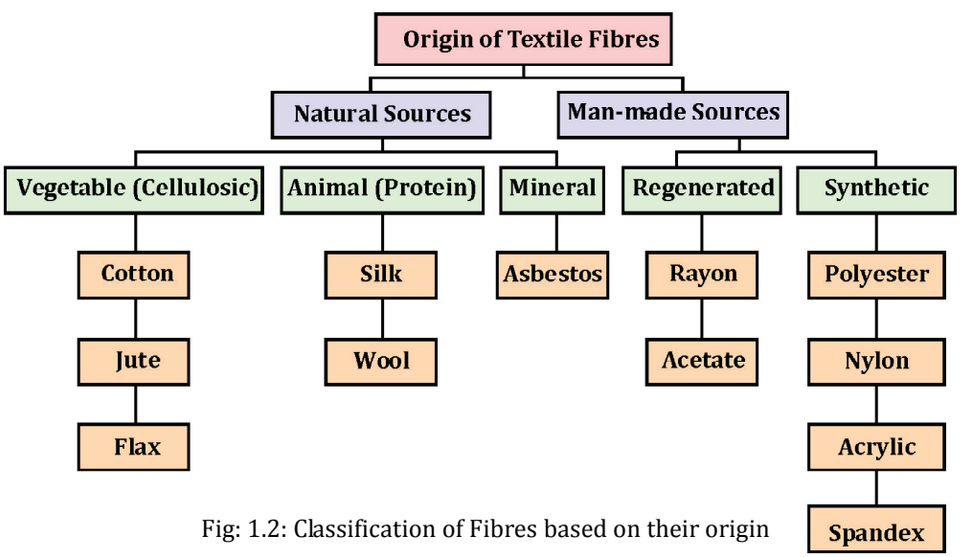
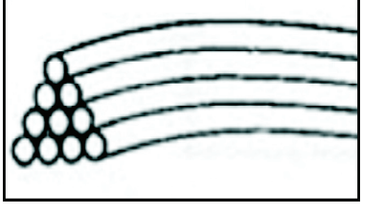
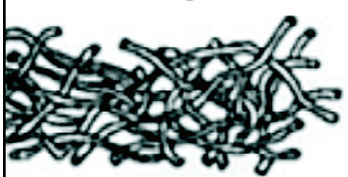



Fig: 1.2: Classification of Fibres based on their origin

**Table 1.1: Classification of fibres based on the length of the fibres**

| Type of fibres based on length | Characteristics | Examples |
|---|---|---|
| Filament fibres  | Short length<br>Single fibre = ¾ of an inch | Cotton, Jute, Wool |
| Staple fibres  | Long continuous length<br>Measured in yards or metres. | Silk and man-made fibres such as Polyester, Rayon, Acrylic |

## 1.3 NATURAL FIBRES

Various fibrous materials are found in nature. Some of them are used to make fabrics and are called textile fibres. These are obtained from natural sources such as animals, plants and minerals and are known as **natural fibres**. All natural fibres differ from each other on the basis of their source and chemical composition which, in turn, influence their properties and their end use. Depending upon the source they are categorized as:

1. Cellulosic fibres / Vegetable fibres
2. Protein fibres / Animal fibres
3. Mineral fibres

Cellulosic fibres like cotton, jute and flax are obtained from different parts of the plants. Cotton fibre is obtained from seeds and jute and flax come from the fibres in the stem of the plant. Protein fibre such as wool is obtained from different animals that have hair on their body (such as sheep and goat) and silk is obtained from silkworm. Animal fibres contain protein hence are also referred as protein fibres. Mineral fibres such as asbestos are obtained through mining.

**Fun Time!!**

Talk to people around you or research on the internet or simply use your knowledge- write the names of four more animals whose hair is used to make wool.

1. _____
2. _____
3. _____
4. _____

## 1.4 MAN-MADE FIBRES

Textile fibres manufactured by using different chemicals are called **man-made fibres**. The liquid solution of the chemicals is forced out with pressure or extruded as very thin long strands or filaments of the desired length. Since the process is controlled by us, it is possible to make filaments of different lengths according to the requirement. There are three categories of man-made fibres depending upon their raw material-

1. Regenerated fibres- the raw material is cellulose like wood pulp or cotton linters (waste small cotton fibres which cannot be used to make cotton yarn). This is treated with chemicals to form a new fibre that is known as "regenerated fibre". Examples of regenerated fibres are rayon and acetate.
2. Synthetic fibres -these are produced by using different types of chemicals under controlled conditions. Examples of synthetic fibres are nylon and polyester.
3. Other fibres - metallic fibres like gold, silver and metals or metal coated on plastic fibres.

### Portfolio Activity 1.1

Collect eight clothing items of your choice from your house such as Pant (Trousers), Bed Sheet, Sweater, Mufler/Scarf, Saree, Shirt, Baniyan (Vest), Lungi. Try and guess the fibres possibly used in manufacturing these articles. Use the format given below to record your observation in the Portfolio-

| S. No. | Name of article | Name of fibre |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |

## Portfolio Activity 1.2

You shall find it interesting to learn the background or the origin of fibres. Select any two fibres of your choice. You can use the internet or a nearby library or even by talking to experts to find their- origin, length and end use as a fabric. Draw a simple table as shown below to record your findings in your Portfolio.

| Sl. No. | Fibre | Origin | Length | Use of the fabric |
|---|---|---|---|---|
| | | | | |

## Portfolio Activity 1.3

Given below are some items you will generally find in your home. Collect them and observe fibres in terms of length of fibres. Try and name the fibre-

1. Fibre from wick (bati) used in burning a lamp
2. Filling used in razai or quilt that is used winters
3. Fibres on the surface of your sweater
4. Fibres from edge of a silk scarf
5. Fibres from a rope

| S. No. | Name of article | Length of fibre | Name of fibre |
|---|---|---|---|
| 1. | | | |

Make this table in your Portfolio to record your observations.

## Know Your Progress 1.1

1. Tick (✓) the correct answer in the following questions.
   1. Which amongst the following is a natural fibre?
      A. Asbestos B. Nylon
      C. Rayon D. Polyester
   2. Which part of the cotton plant is used to make cotton fibre?
      A. Seed B. Stem
      C. Leaf D. Fruit
   3. In which category of fibres wood pulp is used as a raw material?
      A. Synthetic fibres B. Regenerated fibres
      C. Cellulosic fibres D. Man-made fibres

4. Natural filament fibres is

   A. Rayon  B. Acetate

   C. Silk  D. Wool

2. Match the fibres in Column A with their description in Column B.

| Column A | Column B |
|---|---|
| 1. Jute | A. Staple |
| 2. Rayon | B. Bast |
| 3. Cotton | C. Protein |
| 4. Silk | D. Synthetic |
| 5. Nylon | E. Regenerated |
| | F. Sheep |

**Fill your score _____ / 18**

## 1.5 FIBRE PROPERTIES

Well, so far you have learnt that there are natural and man-made fibres. You have also learnt about their classification. Do you think all the fibres can be used to make a fabric? No, you are right that all the fibres cannot be used as textile fibres. This is because fibres need to have certain properties to be used as textile fibres. Some of these properties are essential or **primary properties** and there are others that are desirable or **secondary properties.**

### 1. Primary properties

These properties need to be essentially present in a fibre, for it to be categorized as a textile fibre. It is necessary to study these properties as they influence the manner in which the fibres are further processed for making yarns. The primary properties are briefly described here and you will learn more about them in other lessons in your course.

a. **Fiber length to width ratio:** A fibre must have sufficient length so that it can be made into a yarn. Minimum diameter of afibre should be 1/100 of the length of the fibre. This property is important in spinning process of yarn making which you will study in Lesson-5.

b. **Tenacity or strength:** Strength of the fibre is referred to as tenacity. It is determined by measuring the force required to rupture or break the fibre. It is important for machine processing of the fibre.

c. **Flexibility or pliability:** It is ability of the fibre to move freely during handling without breakage.

d. **Fibre uniformity:** Uniformity is the evenness of the individual fibre in its length

and diameter. Natural fibres are irregular in their length hence, need to be sorted and graded for yarn making. Irregular fibres are weak, rough and unsuitable for textile use.

e. **Cohesiveness (spinning quality):** It is the ability of the fibres to stick to each other during yarn manufacturing. The shape and surface of the fibre determines the cohesiveness.

## 2. Secondary properties

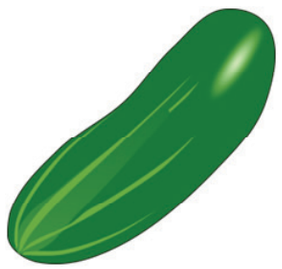
Apart from the primary properties, textile fibres also have some physical, chemical and environmental properties which affect their performance. These are desirable properties and influence the appearance, durability, comfort and maintenance of the fabric manufactured. These properties are-

### a. Physical properties

- **Morphology** - it refers to the form or shape of the fibre. These can only be studied under a microscope as the fibres are very fine.
- **Longitudinal view:** It is the view of the fibre in length wise direction.
- **Cross section view** - it is the view when the fibre is cut in width or breadth like a pipe.

Let us take the example of a cucumber- what you see along its length is the lengthwise view and you see the cross-sectional view when you cut a circular slice from it.

Cross-sectional view



Longitudinal view

- **Lustre:** It is also called gloss, sheen or shine that fibres naturally possess. It is seen when light is reflected from the surface. The fabrics made with filament fibres are more lustrous than those made from staple fibres.
- **Colour:** Natural fibres possess colours like off-white and yellowish depending upon climatic conditions, soil and environmental factors. For example, cotton grown in different regions of our country will have a different natural colour. This natural colour is removed by bleaching during manufacturing so that other beautiful colours can be added to the fabrics later on.

- **Elongation and elastic recovery:** Elongation is the amount of stretch a fibre can take before it breaks. Recovery is the ability of a fibre to return to its original length after being stretched.
- **Moisture absorption:** It is the amount of water a fibre can absorb from the atmosphere. It influences the comfort. So, fibres with high moisture absorption property are preferred in hot climate like ours.
- **Resiliency:** It is the ability of the fibre to return to its original shape after bending or creasing.
- **Dimensional Stability:** It is the ability of fibre to keep its shape and size in the presence of moisture, with changing temperature.
- **Abrasion:** Wear and tear of the material by rubbing against another surface is known as abrasion. It means that the fibre must be able to sustain force without damage.
- **Thermal properties:** The reaction of a fibre to heat and flame are known as itsthermal properties.
- **Static electricity:** It is the ability of the fibre to carry or transfer electric charges. It is generated by friction when a fabric is rubbed against itself or other fabrics. Static charge is more in the fibres with low moisture absorbency.

### b. Chemical properties

- **Effect of acids:** Concentrated, cold or dilute hot mineral acids like sulphuric acid destroy both cellulosic and wool fibres. However, wool remains safe from the effect of other acids.
- **Effect of alkali:** Alkali does not harm cellulosic fibres but damages protein fibres. This property is important while selecting the detergents for different fibres.
- **Effect of sunlight:** Some fibres are adversely affected by strong and prolonged exposure to sunlight, resulting in yellowing and damaging of the fibre.

### c. Biological Properties

This is the behavior of a fibre towards fungi (mildew), bacteria, beetles, moths, insects and silverfish. It is important during care and storage of the clothes. Wool and silk are very sensitive fibres and susceptible to moth attacks. This property guides the storage of textiles in certain climatic conditions.

You will learn about these properties in detail with respect to different fibres in the next two lessons.

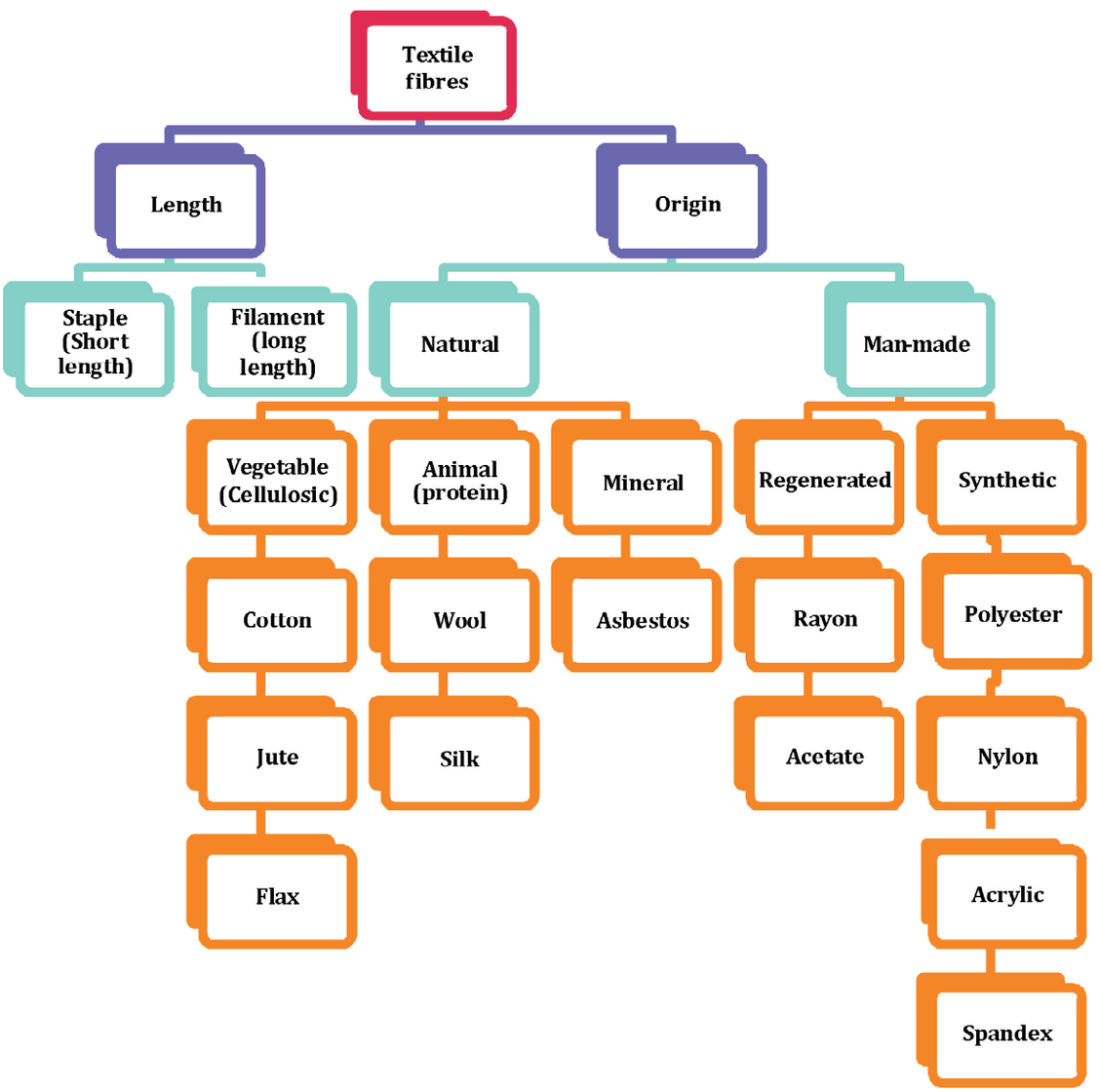
## Know Your Progress 1.2

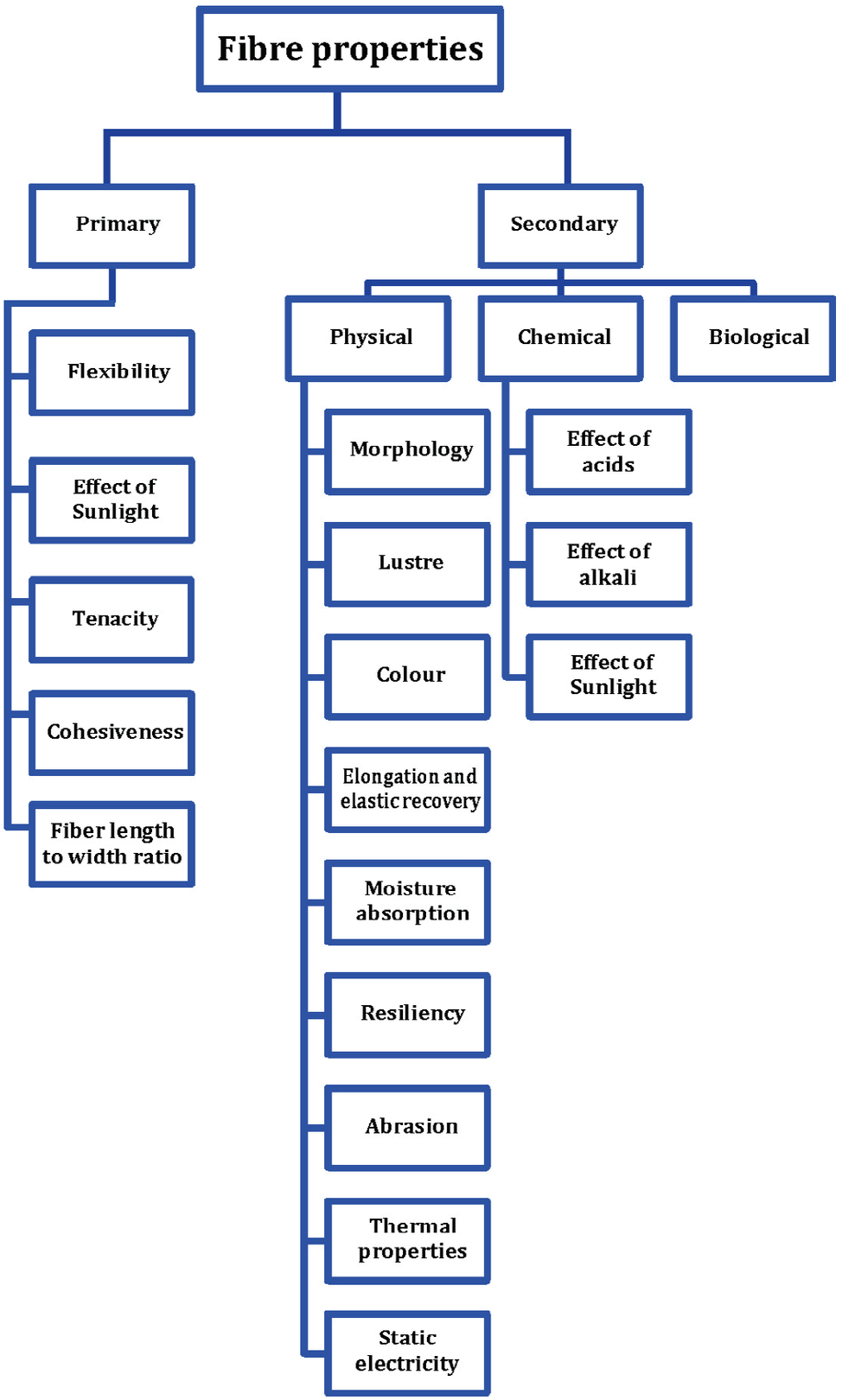
Mark the correct (✓) and incorrect (✗) statements in the given box-

1. Lustre is the natural tendency of a fibre associated with resiliency. ☐
2. Length to width ratio is the essential property of fibre to qualify as textile fibre. ☐
3. Use of alkali is harmful for woolen fabrics. ☐
4. Climatic conditions influence the colour of the fabric. ☐

**Fill your score _____ / 8**

## 1.6 THIS IS WHAT YOU HAVE LEARNT




Fibre properties
Primary
Secondary
Flexibility
Effect of Sunlight
Tenacity
Cohesiveness
Fiber length to width ratio
Physical
Chemical
Biological
Morphology
Lustre
Colour
Elongation and elastic recovery
Moisture absorption
Resiliency
Abrasion
Thermal properties
Static electricity
Effect of acids
Effect of alkali
Effect of Sunlight

## 1.7 LET US PRACTICE

1. Name two filament fibres and two staple fibres.
2. Names three natural fibres and the part of the plant they are obtained from.
3. Give at least one similarity and one difference between the following:
   i. Natural and Manmade fibres
   ii. Regenerated and Synthetic fibres
   iii. Wool and Silk
   iv. Cotton and Jute
4. Name the desirable properties of the fibres which represent-
   i. Sheen
   ii. Stretch
   iii. Water intake
   iv. Bending
   v. Wear and tear
   vi. Heat
5. Define the following fibre properties in one sentence each-

   Resiliency, Tenacity, Cohesiveness, Abrasion, Uniformity

## 1.8 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 1.1**

1. 1 - A

   2 - A

   3 - B

   4 - C

2. 2. 5. 1. 3. 4.

**Know Your Progress 1.2**

1. ✗ 2. ✓ 3. ✓ 4. ✓
2. Refer to the text

**Your final score is _____ / 26**

# PRACTICAL WORK

## Practical 1.1

**Objective:** To examine the moisture absorbency of different fibres (cotton, wool and polyester)

**Material required-**

- Fabric samples of cotton, wool and polyester (one each)measuring 15 x 15 cm (6 inches x 6 inches)
- 3 Beakers or bowls having 500 ml capacity
- Glass rod, newspaper

**Procedure:**

Perform the following test as per given method and record your observations in the given table.

**Moisture Absorbency:**

1. Take the given 3 samples of each fibre type.
2. Weigh each sample individually on the balance in the laboratory and note the reading
3. Take 300 ml plain water in three beakers or bowls
4. Soak each sample separately, in this water for 10 minutes
5. Remove the sample from the beaker and place it flat on the newspaper
6. Allow the samples to dry for 5 minutes
7. Weigh each sample again
8. Record the reading
9. Find the difference in initial and final weight

**Observation or results**

| S. No. | Samples | Initial weight | Final weight | Difference |
|---|---|---|---|---|
| 1. | Cotton | | | |
| 2. | Wool | | | |
| 3. | Polyester | | | |

**On the basis of your observations, conclude which fibre has-**

1. highest water absorption
2. lowest water absorption
3. no absorption

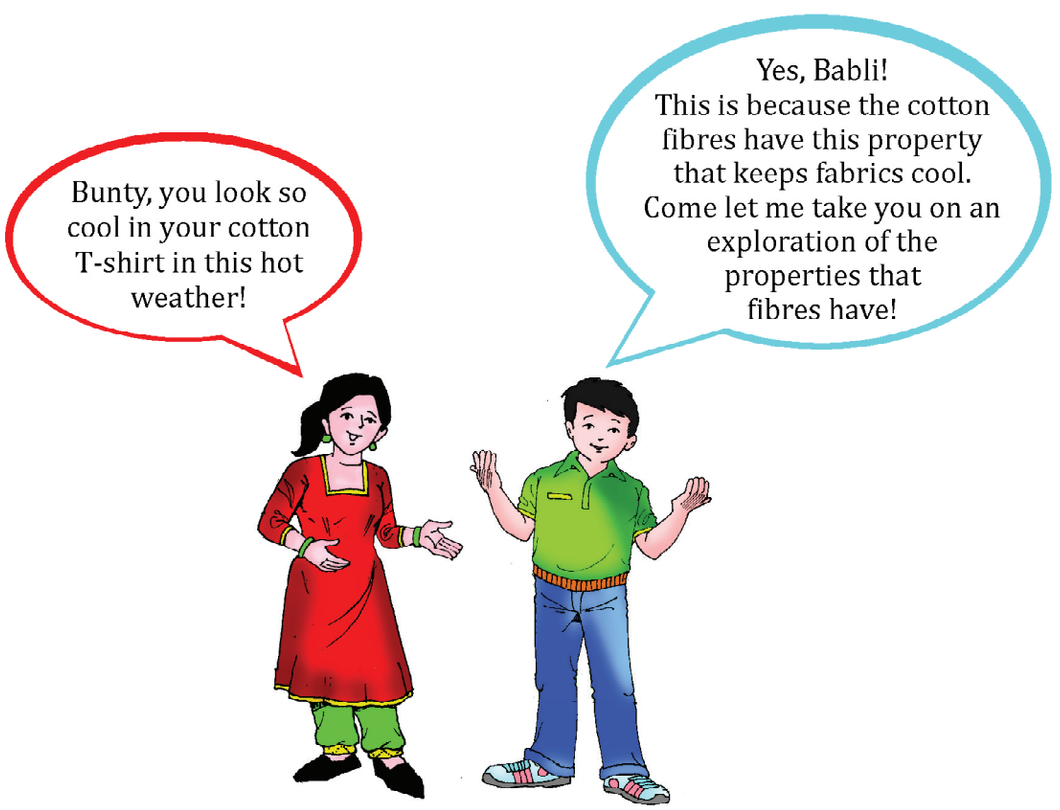
# 2. Natural Fibres

KEYWORDS

- Cotton, Flax
- Linen, Jute
- Silk
- Wool
- Asbestos

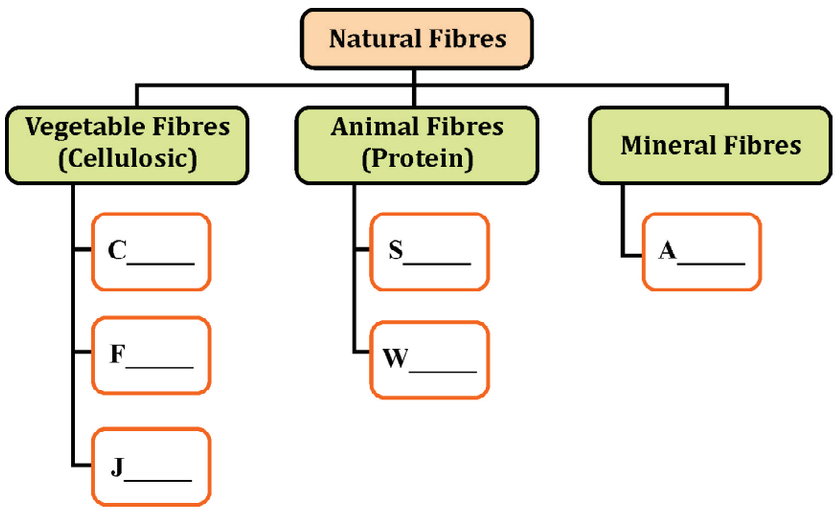
**OBJECTIVES**

- classify natural fibres on the basis of their origin;
- describe properties of natural fibres, such as cotton, flax, jute, silk, wool and asbestos;
- relate the properties of natural fibres with their end uses



## 2.1 NATURAL FIBRES

Do you remember from the last lessonthat we getnatural fibresfrom plants and animals?Let's fill the givenchart -




Among the fibres found in nature, cotton, linen, jute, silk and wool are largely used as textile fibres. These fibres are not uniform in nature because of varying weather conditions and soil. On the basis of their chemical composition, the properties vary from fibre to fibre. Have you ever noticed that you wear different fabrics in summer and winters?Why are they different from each other? Yes, that is because of different properties they possess. Let's study the properties of various fibres. Before that let us understand how these properties affect the end use of the fabrics.

**Fun Facts!**

India is the largest producer of cotton fibre in the world and there are 43 species of cotton in the world and some cotton grows on tree

You have studied primary and secondary properties of the fibres. If you can recall, primary properties are essential properties that are necessary for a fibre to becalled a textile fibre whereas secondary properties are considered as desirable properties. These properties can be further divided into morphological, physical, chemical and biological properties.

## 2.2 PHYSICAL PROPERTIES OF NATURAL FIBRES

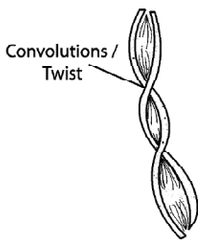
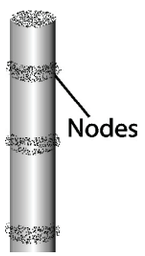
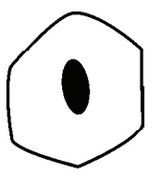
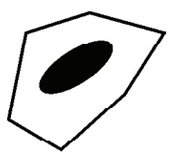
### A. Morphology of Natural Fibres

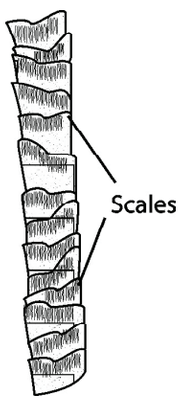
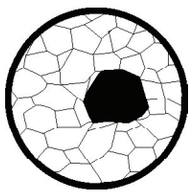
Morphology refers to the structure, shape and size of the fibre that affect its characterstics and performance. For example, if you require fine fabric, you cannot choose coarse yarn like wool. These properties affect other properties too, such as rod-like structure of the silk fibre is the reason behind lustre of the silk fabric. Let's understand how these fibres differ from each other.

**Fun Facts!**

Flax is the earliest known fibre. It was used to wrap mummies (dead bodies) in Egypt.

## Table 2.1: Morphology of Natural Fibres

| | Fibre | Morphology | | | |
|---|---|---|---|---|---|
| | | Microscopic View | | Diameter | Length |
| | | Longitudinal View | Cross Sectional View | | |
| **Cellulosic Fibres** | **Cotton** |  Figure 2.1 |  Figure 2.2 | 12 – 20 microns | ½ to 2½ inches |
| | **Flax** |  Figure 2.3 |  Figure 2.4 | Width varies, 1/1200 of an inch | A few inches - 22 inches or more |
| | **Jute** |  Figure 2.5 |  Figure 2.6 | Irregular diameter | 5 to 20 feet long |
| **Protein Fibres** | **Silk** |  Figure 2.7 |  Figure 2.8 | 9 -11 microns | 1000 – 1300 yards |

| | Fibre | Morphology | | | |
|---|---|---|---|---|---|
| | | Microscopic View | | Diameter | Length |
| | | Longitudinal View | Cross Sectional View | | |
| | **Wool** |  Figure 2.9 |  Figure 2.10 | 15 – 70 microns | 1 ½ to 15 inches |
| **Mineral Fibres** | **Asbestos** | | ----- | Too fine to measure | > 1 cm |

- Micron = 0.0005 mm

**Know Your Progress 2.1**

1. Draw a diagram of longitudinal view of wool.
2. Make a diagram of the microscopic view of cotton.
3. Write down the name of longest natural fiber.
4. Write down the name and diameter of the finest animal fiber.

**Fill your score _____ / 8**

## B. Physical Properties

Physical properties include elasticity, resiliency, absorbency and dimensional stability. As you already know these properties help us to decide the end use of the fibre. They also contribute to the appearance of the fabric. We can also determine how long-lastingthe end product will be. Let us now study the physical properties of the natural fibres.

## Table 2.2: Physical Properties of Natural Fibres

| | FIBRE | PHYSICAL PROPERTIES | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Colour | Lustre | Strength | Elasticity | Resilie-ncy | Absor-bency | Dimens-ional Stability |
| Cellulosic Fibres | Cotton | White to grey to off white | Low | Good | Low | Low. Wrinkles easily | High | Relatively stable |
| | Flax | Light ivory to dark grey | High natural lustre | High | Low | Low. Prone to wrinkle | High | High |
| | Jute | Yellow to brown | Silky | High | Very low | Low | Poor | Good |
| Protein Fibres | Silk | White to cream to tan | High natural lustre | Strongest natural fibre | Good | Medium. Creases go away slowly | High | Good |
| | Wool | Yellowish white or ivory | Low | Weak | Excellent | Excellent | High | Poor, Subject to shrinkage |
| Mineral Fibres | Asbestos | white, pale green, yellow and blue | High | High | Poor | - | Poor | - |

### Fun Facts!

- Linen can absorb almost 20% of its own weight of moisture and still feel dry. That's the reason linen clothes are always cool.
- Jute is also known as Golden Fibre because of its golden and silky shine.

**Know Your Progress 2.2**

**Mark the correct ( ✓ ) and incorrect ( ✗ ) statements in the given box-**

1. Jute has no lustre. ☐
2. Wool does not get crease. ☐
3. Silk can be obtained from nature in red colour. ☐
4. Cotton is the strongest natural fibre. ☐
5. Wool has good elasticity. ☐
6. Physical properties contribute to the life of the end product. ☐

**Fill your score _____ / 12**

## C. Chemical Properties

In chemical properties, we study the effect of acids, alkalies, organic solvents and sunlight on the fibre, which further affect the care and maintenance of the fabrics.

**Table 2.3: Chemical Properties of Natural Fibres**

| | FIBRE | CHEMICAL PROPERTIES | | |
|---|---|---|---|---|
| | | Effect of Alkalies | Effect of Acids | Effect of Sunlight and other factors |
| **Cellulosic Fibres** | **Cotton** | Resistant, no harmful effects | Weaken and degrade the fibre | Turns yellow in sunlight, prolonged exposure weakens fibre |
| | **Flax** | High resistance | Resistant to mild acids. Strong acids damage them | No Effect |
| | **Jute** | Resistant | Resistant to mild acids. Strong acids damage them | No Effect |
| **Protein Fibres** | **Silk** | Strong alkalies damage fibre | Gets damaged by mineral acids, organic acids do not damage | Prolonged exposure causes breakdown |
| | **Wool** | Low resistance, destroys fibre | Good resistance to dilute acids. Medium to poor resistance to strong acids. | Prolonged exposure deteriorates fibre |

## Know Your Progress 2.3

1. List the name of natural fibres that get damaged by strong acids.
2. Fill in the blanks
   i. _____ fibers have high resistance to alkalies.
   ii. Cotton fibres are resistant to _____.
   iii. With prolonged exposure of sunlight, cotton fibre turns _____.
   iv. Silk cannot be washed by detergents, because it gets damaged by _____.

**Fill your score _____ / 10**

## D. Biological Properties

Biological properties includes effect of micro-organisms (bacteria and fungi) and insects on textile fibers. This property is generally associated with the storage of textiles.

### Do you know?

Jute is the most environment friendly fibre. It is completely bio-degradable.

**Table 2.4: Biological Properties of Natural Fibres**

| | FIBRE | BIOLOGICAL PROPERTIES | |
|---|---|---|---|
| | | Effect of Micro organisms | Effect of Insects |
| **Cellulosic Fibres** | **Cotton** | Mildew (fungi) damages | Damaged by silverfish |
| | **Flax** | Mildew will grow and damage | Resistant |
| | **Jute** | Resistant | Resistant |
| **Protein Fibres** | **Silk** | Good resistance | Destroyed by carpet beetles |
| | **Wool** | High resistance | Damaged by moths and carpet beetles |

### Know Your Progress 2.4

**1. Fill in the blanks**

i. Mildew _____ flax fibre.

ii. _____ damages silk and wool but has no effect on jute.

iii. _____ and _____ attack cotton during storage.

iv. _____ is resistant to micro-organisms as well as insects.

**Fill your score _____ / 8**

## 2.3 END USES

Properties of the fibre influence the fabric properties. These properties help us to decide its end use. Let's study the textile products that can be made from these fibres.

### Do you know?

Asbestos is the only natural fiber that has property of flame resistance. That's why they are used in firefighting suits.

**Table 2.5: End Uses of Natural Fibres**

| FIBRES | MAJOR USES |
|---|---|
| COTTON | Garments like tops and dresses, Bed sheets, Cushion, Curtains, Tablecloth |
| FLAX | Garments like tops and dresses,Sarees, Bed sheet, Table cloth, Curtains,Cushions, Rugs backing |
| JUTE | Curtain, chair coverings, carpets, packing bags and sacks, ropes, rugs |
| SILK | Garments like Shirts, Tops and Dresses, Ties, Sarees, Cushion, Curtains, surgical sutures |
| WOOL | Sweaters, Shawls, Coats, Blankets, Carpets |
| ASBESTOS | Safety apparels, Theatre curtains, Fire resistant blankets, Fire fighting suits |

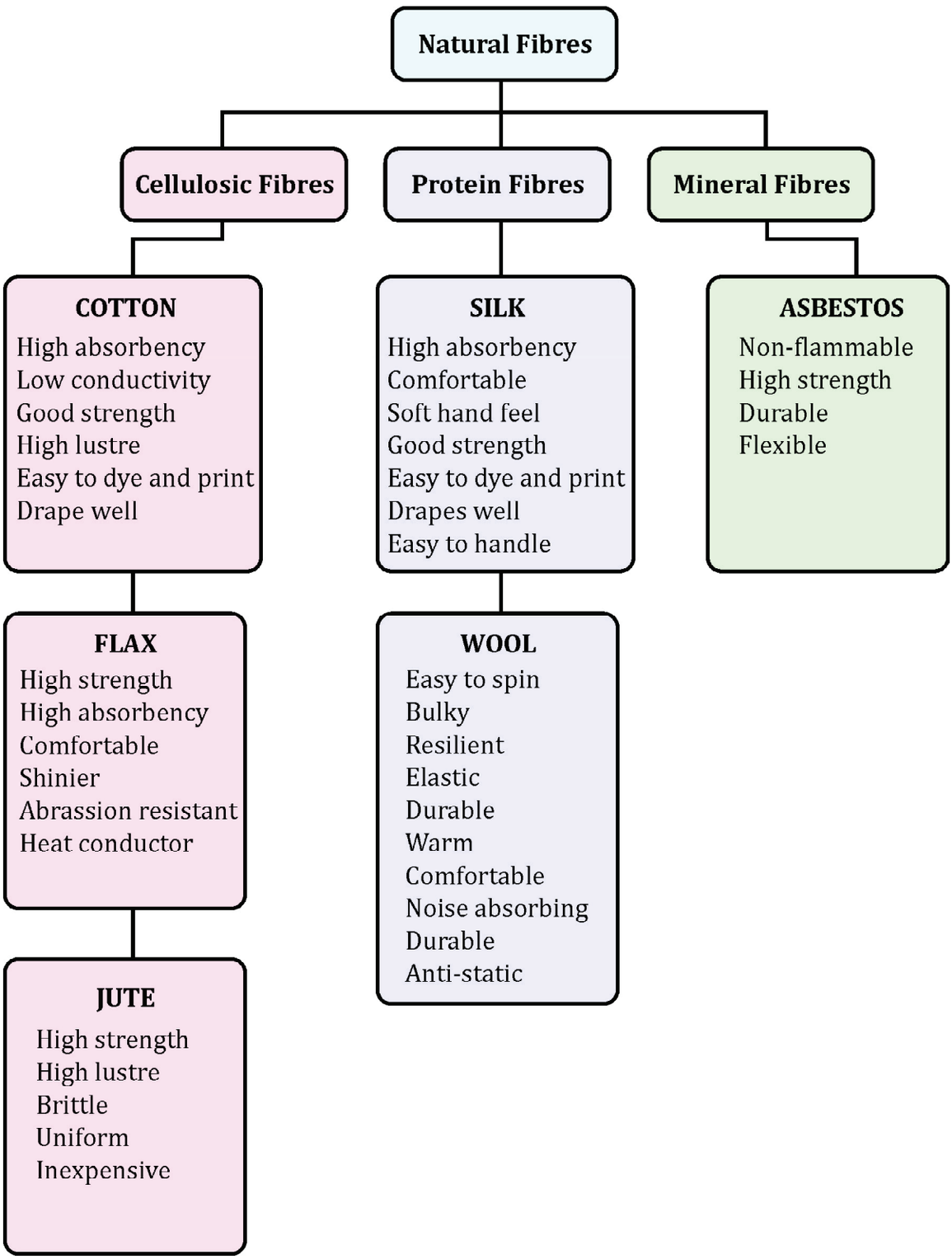
### Know Your Progress 2.5

Think of the names of two suitable fabrics for the following use and write them-

1. Scarf _____ , _____
2. Saree _____ , _____
3. Shopping bag _____ , _____
4. Curtains _____ , _____
5. Fire fighter's suit _____ , _____

**Fill your score _____ / 20**

## 2.4 THIS IS WHAT YOU HAVE LEARNT



## 2.5 LET US PRACTICE

1. Mark (✓ ) the correct answer

   A) Which part of the cotton plant is used to make cotton fibre?

   i. Seed ii. Stem iii. Leaf iv. Fruit

   B) Quality of natural fibres gets affected by -

   i. Soil ii. Weather iii. Breed of the animal iv. All of the above

   C) Which property of cotton makes it comfortable fabric?

   i. Resiliency ii. Lustre iii. Absorbency iv. Elasticity

   D) Which amongst below is not a natural fibre?

   i. Asbestos ii. Rayon iii. Silk iv. Jute

   E) Which amongst below has maximum strength?

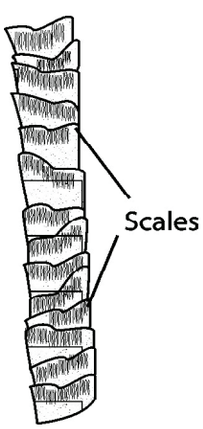
   i. Cotton ii. Jute iii. Silk iv. Wool

2. Write the two physical properties and two end uses of wool fibre.
3. Describe the biological properties of jutefibres.
4. Describe five end uses of flax fibre.
5. Differentiate between cotton andsilk fibres on the basis of their chemical properties.
6. Why would you choose cotton fabric over jute for gifting a shirt to your friend?

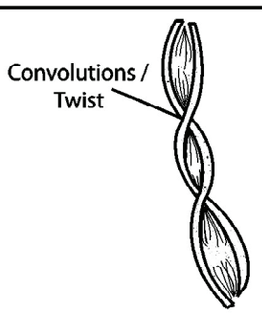
## 2.6 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 2.1**

1. Longitudinal view of wool




2. Microscopic view of cotton

| Longitudinal view | Cross-sectional view |
|---|---|
|   |  Bean -shaped |

3. Silk is the longest fiber found in nature and can be 1000- 1300 yards long.
4. Silk is the finest natural fiber with diameter of 9-11 microns.

**Know Your Progress 2.2**

1. ✗ 2. ✓ 3. ✗ 4. ✗ 5. ✓ 6. ✓

**Know Your Progress 2.3**

1. Cotton, flax and jute
2. i) Cellulosic fibers
   ii) Alkalies
   iii) Yellow
   iv) Alkalies

**Know Your Progress 2.4**

1. i) Damages
   ii) Carpet beetle
   iii) Mildew and silverfish
   iv) Jute

**Know Your Progress 2.5**

1. wool, silk
2. cotton, silk
3. jute, cotton
4. flax, jute, silk
5. asbestos only

**Your final score is_____ / 58**

## Portfolio Activity 2.1

1. Collect the 10 sample of various fabrics (size -3"x3") and record your observations on the basis of -
   - Lustre
   - Strength - when dry
   - Strength - when wet
   - Resiliency

Paste the collected fabrics (3"x3") and write their properties in your portfolio.

## Portfolio Activity 2.2

Visit any factory in nearby area, where you know cotton yarns are being made.

1) Ask the questionsgiven below and record the answers-

   a) From where do you get cotton fibre?

   b) What are the natural colours of fibres you receive?

   c) What is the size of the fibres that you receive?

   d) How do you manage the cotton waste being produced?

   e) Where do you send the yarn that you make?

2) Collect at least five different samples of cotton fibres. Put different fibres in different packets and paste them in your portfolio. Make a table in your portfolio as given below-

| S. No. | Sample No. | Colour | Fibre length |
|---|---|---|---|
| 1 | Example- Sample 1 | Off white | 1.25 inch |
| | | | |
| | | | |

# 3. Man-made Fibres

KEYWORDS

- Man-made fibres
- Regenerated fibres
- Synthetic fibres, Rayon
- Acetate, Polyester
- Nylon, Acrylic, Spandex

**OBJECTIVES**

- define man-made fibres;
- describe the properties of various man-made fibres such as rayon, acetate, nylon, polyester, acrylic and spandex;
- relate the fibre properties to their end uses.

## 3.1 WHAT ARE MAN-MADE FIBRES?

As the name suggests these fibres are made by man using chemicals.

Manmade fibres are of two types:

i. Regenerated fibres

ii. Synthetic fibres

iii. Others like Metallic fibres

Let us find out more about man-made fibres.

### (i) Regenerated fibres

These are made from natural cellulose obtained from cotton linters or wood pulp as shown in Fig. 3.1 and 3.2. This natural raw material is regenerated with the help of chemicals. Rayon is an example of regenerated cellulose fibre.

Fig. 3.1: Wood Pulp

You know that all regenerated fibres are made up of raw material obtained from the natural sources such as cotton fibres (linters) and wood pulp. Certain chemicals are added into it to produce these fibres.

**a. Rayon**

It is a regenerated fibre and is produced from the extract of the wood pulp or cotton linters and some chemicals. It has the same comfort property as natural fibers. Rayon is moisture absorbent, breathable, comfortable to wear has lower elastic recovery and can be easily dyed. It is used for making dresses, linings, blankets and bed sheets.

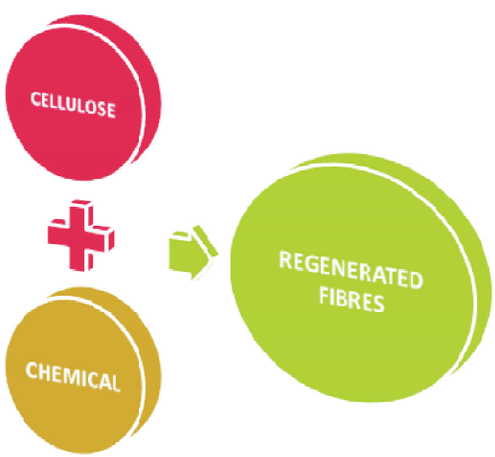



Fig.3.2: Formation of Regenerated fibres

**b. Acetate**

Acetate fibres are manufactured with wood chips or cotton linters and then processed to make fibres. It is generally used as a lining in jackets, coats and blazers etc. They are also used for making dress and curtains.

**Facts to Know**

Rayon, was the first man-made fiber created in 1910 and it was called 'artificial silk'.

## Know Your Progress 3.1

1. Fill the blanks with the suitable word given at the end of each sentence

   i. Nylon is a _____ fibre. (Man-made/Natural)

   ii. Cotton is a _____ fibre (Man-made/ Natural)

   iii. Wood pulp and cotton linters are used to make _____ fibres (Regenerated/Synthetic)

**Fill your score _____ / 6**

## (ii) Synthetic fibres

On the other hand, synthetic fibres are obtained from chemical substances as shown in Fig. 3.3 (like coal and petro chemicals) Nylon, Polyester, Acrylic (Cashmilon) are the example of synthetic fibre.

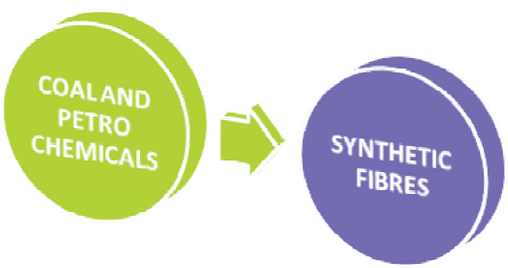



Fig. 3.3: Formation of Synthetic fibres

## Process of making man-made fibres

The filament yarns are spun by the chemical spinning process. To understand this recall how a 'halvai' makes 'sevian'. He makes a dough of 'besan', passes it through holes into hot oil, the 'besan' takes the solid form of 'sevian'. The chemical spinning process is similar to this. A spinning solution of the raw materials is made and passed through the holes of a spinnerette (looks like a bathroom shower) as shown in Fig. 3.4.

Fig. 3.4: Bathroom shower head (looks like Spinnerette)

Now, you know synthetic fibres are chemically produced. Let us discuss about different synthetic fibres with their properties and end uses.

### a. Nylon

Nylon is made by using chemicals. It is very elastic and has a strong tendency to return to its original shape after being stretched. It is used to manufacture raincoats and shower curtains, as the fabric does not absorb moisture. It melts at high ironing temperatures. It is used to make tent fabrics, ropes, tyre cords etc. Products of nylon are shown in Fig. 3.5

### Facts to Know

- Nylon was invented to replace Silk
- Nylon is the world's first Synthetic fabric.

Fig. 3.5: Nylon Products (Ropes and Fish Nets)

**b. Polyester**

Polyester is a most versatile synthetic fibre. In apparel shirts, pants, suits, saree and scarves are made. In the home, polyester is commonly used as a filling for pillows, carpets and mattresses. Polyester is also used for making sewing threads shown in Fig. 3.6

Fig. 3.6: Sewing Threads

**c. Acrylic**

Acrylic fibres are light weight, soft and durable. They have low absorbency. Excellent resistance to sunlight, and insects. It conducts heat making the fabric warm and is used in making sweaters, shawls, fur, blankets and carpets.

**Facts to Know**

Acrlyic fibre is commonly known by different Trade names such as Acrilan, Orlon and Zefan.

**d. Spandex**

Lycra is a trade name for spandex manufactured by Du Pont. Spandex is a synthetic fiber known for its excellent elasticity. It is stronger and more durable than natural rubber. It turns yellow and loses elasticity at higher temperatures. Spandex is used in combination with other fibres. It is used for making swimwear, slacks, nets and laces.

**Facts to Know**

- Spandex can be stretched up to 500-600% more than its original length without breaking
- Spandex/ Lycra fabrics are great for making sports wear

Other fibres include metallic fibres, like gold, silver and copper or metal coated or metal coated on plastic fibres. Example: Lurex and Zari threads.

**Portfolio Activity 3.1**

Look for dhoti and a synthetic sari in your home. Soak them in water for 15 minutes. Now squeeze and dry them under the sun. Write your observations on the basis of which fabric dries faster.

Record in portfolio. What does this activity tell you about the properties of the synthetic fabric?

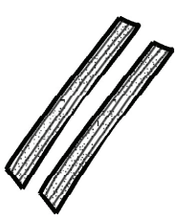
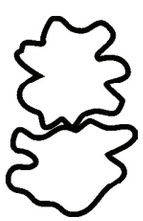
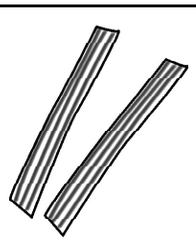
## 3.2 PROPERTIES OF MAN-MADE FIBRES

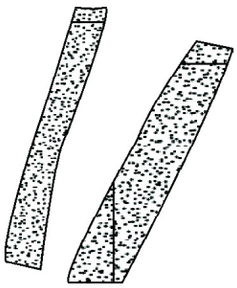
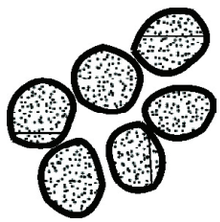
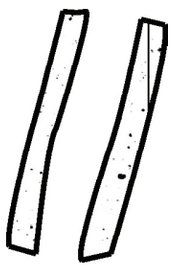
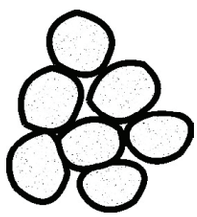
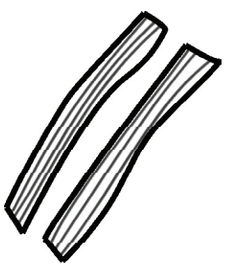
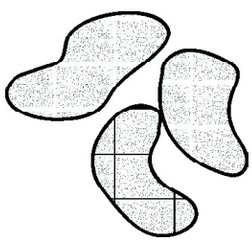
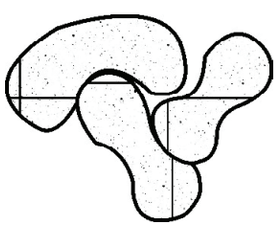
### 1. Physical properties of fibres

#### A. Morphology of Fibres

Morphology includes the structure, shape and size of the fibre that affects its characterstics and performance. Let's understand how these fibres differ from each other.

**Table 3.1: Morphology of Fibres**

| FIBRE | PHYSICAL PROPERTIES | |
|---|---|---|
| | MORPHOLOGY | |
| | Longitudinal Section (L.S) | Cross Section (C.S) |
| RAYON |  Fig. 3.7: Uniform diameter with striations |  Fig. 3.8: Highly irregular in shape |
| ACETATE |  Fig. 3.9: Uniform diameter and has lines running parallel to the length of the fibre |  Fig. 3.10: Irregular shape. |

| | | |
|---|---|---|
| **NYLON** |  Fig. 3.11: Transparent rod of uniform diameter with speckles |  Fig. 3.12: It appear fine, smooth and translucent |
| **POLYESTER** |  Fig. 3.13: Fibre appears as transparent rods of uniform diameter with a speckles |  Fig. 3.14: It is round in shape |
| **ACRYLIC** |  Fig. 3.15: Transparent rods of uniform diameter with irregular striations |  Fig. 3.16: Flat peanut cross section with speckles |
| **SPANDEX** |  Fig. 3.17: Appear as a group of fibres fused together with spots |  Fig. 3.18: Multi filament fused together forming dog bone shape. |

### B. Physical properties of Fibres

Let's study the physical properties of the man-made fibres.

**Table 3.2: Physical properties of Fibres**

| Fibre | Physical properties | | | | |
|---|---|---|---|---|---|
| | **Tenacity** | **Elasticity** | **Resiliency** | **Moisture absorption** | **Abrasion resistance** |
| **RAYON** | Fair | Good | Low | Good | Good |
| **ACETATE** | Poor | Good | Fair | Fair | Poor |
| **NYLON** | Strongest among all fibres | Very elastic return back to its original shape | Excellent | Very low | Excellent |
| **POLYESTER** | Extremely strong fibre | No Effect | Good | Very low | Good |
| **ACRYLIC** | Satisfactor y strength | No Effect | Good | Low | Good |
| **SPANDEX** | Poor strength | Loses elasticity at high temperatures | Good | Very low | Good |

## 2. Chemical and biological properties of fibres

In chemical properties, we study the effect of acids, alkalies, sunlight on the fibre while on biological properties we will discuss about effect of micro organism, and insects.

**Table 3.3: Chemical and biological properties of fibres**

| Fibre | Chemical properties | | | Biological and environmental | |
|---|---|---|---|---|---|
| | **Effect of acid** | **Effect of alkalis** | **Effect of sunlight** | **Effect of micro organisms** | **Effect of insects** |
| **RAYON** | Damaged by concentrated alkalis | Same as acids | No effect | Damaged by mildew | Damaged by silver fish |
| **ACETATE** | Damaged by Cold acid | Same as acids | Poor resistant | No effect | No effect |
| **NYLON** | Damaged by Cold acid | No effect | Poor resistant | Damaged by mildew | Damaged by moth |

| Fibre | Chemical properties | | | Biological and environmental | |
|---|---|---|---|---|---|
| | Effect of acid | Effect of alkalis | Effect of sunlight | Effect of micro organisms | Effect of insects |
| **POLYESTER** | Damaged by hot acid | Same as acids | No effect | No effect | No effect |
| **ACRYLIC** | No effect | Damage by hot alkalis | No effect | No effect | No effect |
| **SPANDEX** | Damaged by alkali | No effect | Turns yellow at high temperatures | No effect | No effect |

## Do You Know

- Shape and luster of Man-made fibres can be controlled because they are manufactured.
- Poor or low conductivity of these fibres results in building up of static charges. This leads to the clinging of clothes and in extreme cases can produce electrical shocks and sparks

## Know Your Progress 3.2

1. State True or False and if the statement is false give reason.

   i. Nylon is used to make fishing nets

   _____

   ii. Wood and chemicals are mixed to make polyester

   _____

   iii. Nylon dries quickly

   _____

2. Mark (✓) on the correct answer:

   A. An example of regenerated fibers is

   i. Rayon
   ii. Cotton
   iii. Wool
   iv. Silk

B. A synthetic fibre called artificial silk is

i. Nylon

ii. Polyester

iii. Rayon

iv. Spandex

C. Acrylic fibre has property similar to

i. Silk

ii. Cotton

iii. Rayon

iv. Wool

D. Raincoats and umbrella are made up of

i. Wool

ii. Cotton

iii. Nylon

iv. Rayon

E. Which fibre has maximum elasticity?

i. Rayon

ii. Acrylic

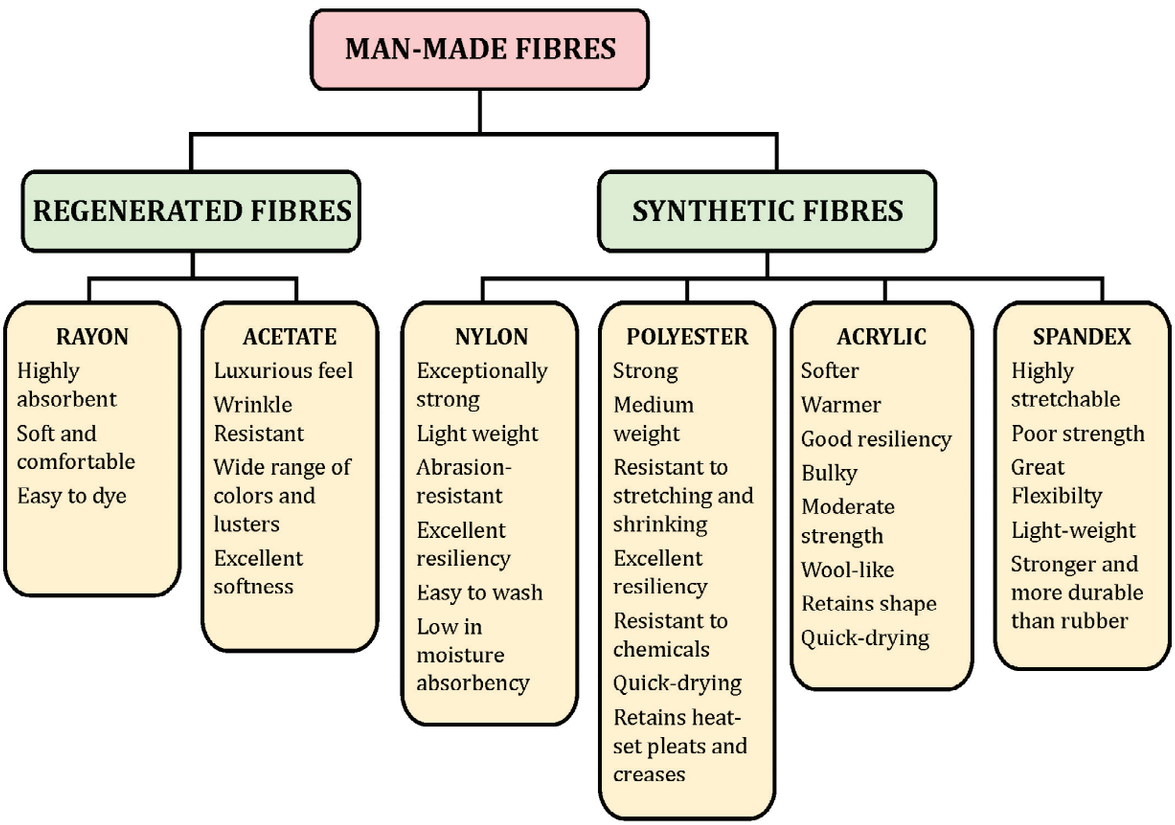
iii. Spandex

iv. Nylon

3. Match the following words given in column A with the correct answer given in column B

| Column A | Column B |
|---|---|
| Rayon | Used for making parachutes and Ropes |
| Polyester | Prepared by using wood pulp |
| Spandex | Fabrics do not wrinkle easily |
| Nylon | Also called as Lycra |
| | Wool like appearance |

## 3.3 THIS IS WHAT YOU HAVE LEARNT




## 3.4 LET US PRACTICE

1. Explain any two physical properties of Nylon.
2. Explain any two chemical properties of Rayon.
3. Give examples of the products made by Nylon.
4. Why is Spandex used for sports wear?
5. Dimple wants to buy skipping rope. Advice Dimple which material she should select and give reason to support your answer.

| Fabric | Reason |
|---|---|
| Spandex | |
| Acetate | |
| Nylon | |
| Acrylic | |

6. Manufacturing synthetic fibres is actually helping ‘conservation of forests'. Comment

7. Rohit wants to buy shirts for winters. Suggest what all fabrics he can take from the list given below. And also support your answer with reason.

| Fabric | Reason |
|---|---|
| Nylon | |
| Acetate | |
| Spandex | |
| Fur | |
| Acrylic | |
| Rayon | |

## 3.5 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 3.1**

1 i. Man-made
ii. Natural
iii. Regenerated

**Know Your Progress** 3.2

1 i. True
ii. False (Made from petrochemical products)
iii. True

2 i. Rayon ii. Rayon
iii. Wool iv. Nylon
v. Spandex

3.

| Column A | Column B |
|---|---|
| Rayon | Prepared by using wood pulp |
| Polyester | Fabrics do not wrinkle easily |
| Spandex | Also called as Lycra |
| Nylon | Used for making parachutes and Ropes |

**Your final score is _____ / 24**

# PRACTICAL WORK

## Practical 3.1

Visit three families in your neighborhood and enquire about the kind of clothes they use, the reason for their choice and advantages of using them in terms of durability and maintenance. Make a short report and write it down in your Portfolio

| Family | Clothes/fabric they use | Advantages of using | Durability | Maintenance |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |

# 4. Fibre Identification

KEYWORDS

- Identification tests
- Visual examination
- Microscopic test
- Burning test
- Chemical test

**OBJECTIVES**

- explain the importance of identifying textile fibres;
- perform visual, microscopic, burning and chemical tests to identify textile fibres;
- distinguish between natural and manmade fibre on the basis of the results of burning and chemical test.

## 4.1 FIBRE IDENTIFICATION TESTS

Fibre identification tests help us to identify the basic component of the textile fibre such as cellulosic, protein or synthetic fibres. In the previous lessons you have already learnt about properties of natural and man-made fibres.

As a weaver or manufacturer, you visit the market to buy yarns. Are you sure you always get what you ask for? If you ask for wool and the seller gives you acrylic, how will you know? Think!

As a consumer, you buy fabric from market without knowing its fibre content. Do you know the properties of the fabric you have bought? May be not, as you do not know the fibre content. What will you do now? Think!

Yes, you are thinking right. If you know how to perform some tests you can identify the fibre. Now you know why it is important to know and to be able to perform these textile identification tests.

There are four tests used to identify textile fibres:

1. Visual examination
2. Microscopic test
3. Burning test
4. Chemical test

## 4.2 VISUAL EXAMINATION

The first step in the identification of a textile fibre is inspection of fabric for appearance and hand feel. Appearance refers to the look for example - shiny or dull. Hand feel refers to how a fabric feels in hand, for example - warm or cool. Texture- rough, smooth can be examined through appearance as well as hand feel.

To perform this test:

- Hold a fabric in hand and feel it. Rub it between your fingers and observe (as shown in Fig. 4.1).
- Check for warmth, smoothness and hand feel.
- The vegetable fibres are usually cooler to touch than animal or man-made fibres.
- Man-made fibres are smoother and shinier as compared to natural fibres. Silk is an exception which has natural lustre.

Fig. 4.1: Hand feel of a fabric

**Facts to know**

Finishes can be given to fabrics to alter the characteristic visual features.

Therefore, visual examination is not a confirmatory test for any of the textile fibres.

**Table 4.1: Observation table for Visual Examination**

| | Dull | Lustrous | Cool | Warm | Smooth | Soft |
|---|---|---|---|---|---|---|
| **Cotton** | √ | | √ | | | √ |
| **Silk** | | √ | | √ | √ | √ |
| **Wool** | √ | | | √ | | |
| **Man-made** | | | √ | | √ | √ |

You can observe from the Table 4.1 that all these parameters overlap. For example, if we see the parameter of smoothness, both silk and man-made fibres are smooth. So, although visual examination is not a confirmatory test for identification of textile fibres it is useful as it gives an indication of the fibre type.

**Know Your Progress 4.1**

Score yourself- give 2 marks for every correct answer.

1. Recall the properties that you have studied. Which fibre is-
   - i) dull and cool
   - ii) dull and warm
   - iii) warm and smooth
   - iv) smooth and cool
   - v) lustrous and soft

**Fill your score _____ / 10**

## 4.3 MICROSCOPIC TEST

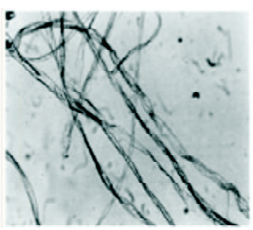
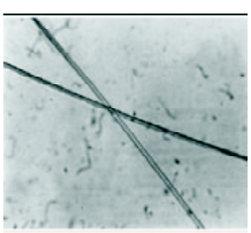
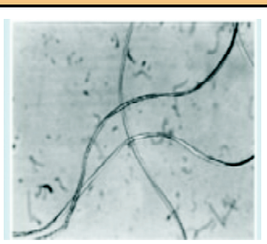
Each natural fibre and the group of man-made fibres have certain specific characteristics which help in their identification. You have read about longitudinal view of fibres in fibre morphology of natural and man-made fibres (refer to Lessons 2 and 3).

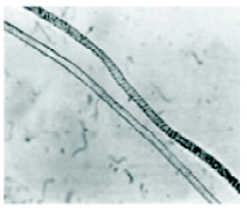
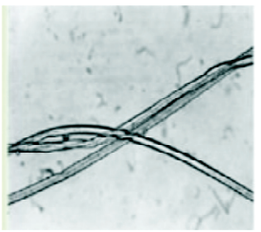
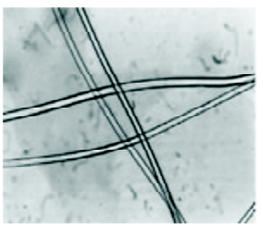
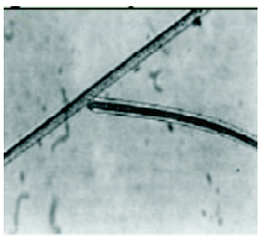
For microscopic tests:

- A slide is prepared to be viewed under a compound microscope (as shown in Fig. 4.2). The fibres are mounted on a glass slide to obtain views of the longitudinal sections of the fibres.
- Single fibres are unravelled from their respective yarns and mounted on slides with a drop of glycerine.
- After carefully lowering the cover-slip on this fibre mount (ensuring that no air bubble is formed), it is viewed under the microscope.

Fig. 4.2: Compound microscope

**Table 4.2: Observations table for Microscopic Test**

| Fibre | Observation | Longitudinal Structure |
|---|---|---|
| **Cellulosic Fibres** | | |
| **Cotton** | Under the microscope cotton will resemble a spirally twisted tube with rough surface. The thin cell wall of the fibre has turns of natural twists or convolutions. The fibre appears flat, twisted and ribbon-like. |  Fig. 4.3: Cotton – flat, twisted ribbon-like with convolutions |
| **Rayon** | Rayon fibres have a glass like lustre under the microscope and appear to have a uniform diameter when viewed longitudinally. The fibre is characterised by lengthwise lines called striations. |  Fig. 4.4: Rayon - striations |
| **Protein Fibres** | | |
| **Silk** | The 'raw silk' under the microscope shows double rod like filaments, covered with lumps of gum which appear as dots in the microscopic view. The 'pure white silk' is cylindrical or rod like in appearance. It is a narrow fibre with no markings and the smooth surface reflects light. |  Fig. 4.5: Silk – rod like filaments |

| | | |
|---|---|---|
| **Wool** | Wool fibre is irregular and roughly cylindrical. The outer layer consists of overlapping scales [as shown in Fig. 4.6(b)] which gives wool its cohesive quality. |  Fig. 4.6(a): Wool – overlapping scales  Fig. 4.6b) scales |
| **Man-made Fibres** | | |
| **Nylon** | While there are variations in the production of nylon, the basic microscopic appearance is generally fine, round, smooth and translucent (semi-transparent). If nylon is semi-dull or dull, it will appear speckled under the microscope due to the presence of delustrant. |  Fig. 4.7: Nylon – speckled appearance |
| **Acrylic** | Like other man-made fibres the longitudinal view is straight and smooth with a uniform diameter. |  Fig. 4.8: Acrylic – smooth |
| **Polyester** | Polyester fibres are smooth and straight, rod-like. Sometimes polyester fibres have speckled (spotted) appearance due to presence of a delustrant. They have a uniform diameter. |  Fig. 4.9: Polyester – speckled appearance |

Source of Fig. 4.3-4.6(a), 4.7-4.9: http://what-when-how.com/forensic-sciences/types/

## Portfolio Activity 4.1

Open your almirah and search for fabrics which are made of cotton, silk, wool and man-made fibres. Visually examine the fabrics and note your observations in the given format. Record this table in your portfolio.

| S. No. | Fibre | Observation |
|---|---|---|
| 1. | Cotton | Texture:<br>Appearance:<br>Any other: |
| 2. | Silk | Texture:<br>Appearance:<br>Any other: |
| 3. | Wool | Texture:<br>Appearance:<br>Any other: |
| 4. | Man-made | Texture:<br>Appearance:<br>Any other: |

**Texture:** soft, rough, hard, smooth, slippery, embossed, etc.

**Appearance:** shiny/lustrous, dull

**Any other:** cool, warm

## Know Your Progress 4.2

**1. Give one word answers:**

i. A test which does not require any special equipment for fibre identification

ii. A test which views the longitudinal section of fibres for its identification

iii. A fibre with striations in the longitudinal view

**2. Fill in the blanks with appropriate answers:**

i. In visual examination of the fibre _____ and _____ are observed.

ii. The fibre with overlapping scales in the longitudinal view is _____ .

iii. Under the microscope, longitudinal view of cotton shows a ribbon like structure with _____

**Fill your score _____ / 8**

## 4.4 BURNING TEST

Burning behaviour comprises behaviour of the fibre when approaching flame, removed from flame, its odour and residue. This is a simple and reliable means of identifying the category (cellulosic, protein or synthetic) of a fibre. Broadly speaking,

- Cellulosic fibres have a similar burning behaviour. They emit the odour of burning paper and have a residue which is grey ash. These fibres also exhibit an afterglow/spark that makes a fibre continue to burn.
- Protein fibres on the other hand do not burn readily, are self-extinguishing and have an odour of burning hair or feathers. The residue obtained is a bead which is brittle and can be crushed.
- Man-made fibres curl away from flame and melt. This is why you are advised not to wear man-made fibres while burning crackers on Diwali or working in kitchen. The smell is chemical and the residue is a bead which is non-crushable.

**For burning test:**

- Take the sample near flame (as shown in Fig. 4.10) and observe the reaction of fibre when it is approaching the flame.
- Followed by this you record the observation of fibre when it is in the flame and after removing from the flame.
- The odour produced while burning and the residue formed after burning is also observed.

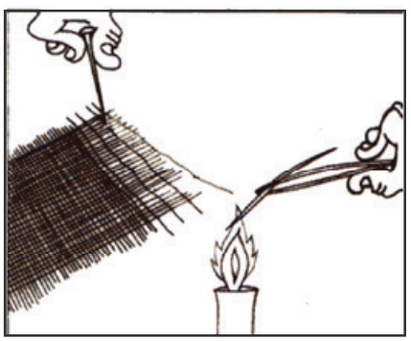


Fig. 4.10: Burning Test

Table 4.3 will help you to take observations while performing the burning test on different textile fibres.

**Table 4.3: Observation table for Burning Test**

| Fibre class | Approaching flame | In flame | Removed from flame | Odour | Residue |
|---|---|---|---|---|---|
| **Cellulosic fibres** | | | | | |
| **Cotton** | Does not shrink away, ignites on contact | Burns quickly | Continues burning with an after glow | Smell of burning paper | Light, grey in colour, fluffy ash |
| **Rayon** | Does not shrink away, ignites on contact | Burns readily | Continues burning with an after glow | Smell of burning paper | Light feathery ash in a very small amount |

| | | | | | |
|---|---|---|---|---|---|
| **Protein Fibres** | | | | | |
| **Silk** | Curls away from flame | Burn slowly and sputters | Self extinguishing | Smell of burning hair | Black bead which is easily crushable |
| **Wool** | Curls away from flame | Burns slowly | Self extinguishing | Smell of burning hair | Black bead, crisp and easily crushable |
| **Man-Made Fibres** | | | | | |
| **Nylon** | Fuses, melts and shrinks away from the flame | Burns slowly and melts | Self extinguishing | Man-made odour | Hard, tough black/brown bead |
| **Acrylic** | Fuses, melts and shrinks away from the flame | Burns rapidly and sputters | Continues to burn and melt. Hot molten drops fall while burning | Acidic odour | Hard, black bead, crushable |
| **Polyester** | Fuses, melts and shrinks away from the flame | Burns slowly and melts | Self extinguishing | Smell of chemicals | Hard, tough black/brown bead |

### Safety Tips

- Perform tests under supervision of an expert only.
- Wear a laboratory coat to prevent any accident.
- Be careful when dealing with burner.
- Hold the fibres using a holder only.
- Keep a beaker of water near the testing slab to prevent accidents.
- Tie up your hair.

## 4.5 CHEMICAL TEST

Chemical tests confirm the fibre type. These are performed only in laboratories. As the name suggests it requires chemicals for testing. Is it so that any chemical can be used for textile fibre testing?

No, there are some specific chemicals used for textile fibre testing. These are selected on the basis of chemical reactivity of the textile fibres. Some fibres dissolve completely (solubilise) in certain chemicals whereas others disintegrate or have no reaction (as shown Fig: 4.11). These are also termed as "solubility tests".

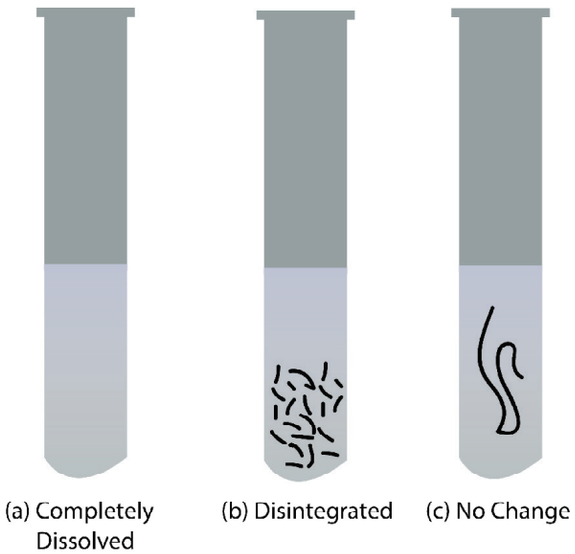



Fig: 4.11 Fibres on addition of chemicals

**To perform chemical test:**

- Fibre sample is added to test tube and required chemical is added.
- The solution is heated if required and it is observed weather the fibre dissolves or disintegrates or shows no change.
- On the basis of the observation inference is made.

Table 4.4 will help you perform chemical test on unknown textile fibres and identify them. Note the observations:

**Table 4.4: Observation table for Chemical Test**

| S. No. | Experiment | Observation | Inference |
|---|---|---|---|
| **Cellulosic Fibres** | | | |
| a) | Take the fibre and dip it in 30-50% sulphuric acid. Heat | The fibre chars and dissolves | Cellulosic fibre |
| b) | Take the fibre and dip it in 60% sulphuric acid solution in a test tube and leave it for 5-10 minutes at room temperature | Fibre dissolves<br>or<br>Fibre does not dissolve<br>(may disintegrate) | Rayon confirmed<br><br>Cotton confirmed |

| | | | |
|---|---|---|---|
| **Protein Fibres** | | | |
| a) | Boil the fibre in 5% solution of Sodium Hydroxide | Fibre dissolves | Protein fibre |
| b) | Cool the above solution and add lead acetate to it | White/No precipitate<br>Black precipitate | Silk confirmed<br>Wool confirmed |
| **Man-made Fibres** | | | |
| a) | Add the fibre in 85% of formic acid at room temperature | Fibre dissolves | Nylon confirmed |
| b) | Add the fibre in Dimethyl Formamide (DMF) solution. Heat slightly | Fibre dissolves | Acrylic confirmed |
| c) | Add the fibre to Meta-cresol solution. Heat | Fibre dissolves | Polyester confirmed |

## Points to keep in mind for fibre identification tests

- The first step in identification should be burning test, as this will indicate broad categories of the fibres (cellulosic, protein or synthetic). This should be followed by microscopic and chemical tests.
- The chemical test sequence for addition of chemicals must be followed to avoid errors. The reason is that nylon and acrylic both get dissolved in meta-cresol - this can lead to incorrect inferences. Same is true for rayon and cotton. Rayon will also dissolve in 60% sulphuric acid leading to incorrect identification.

## Safety Tips

- Perform these tests under supervision of an expert only.
- Wear a laboratory coat to prevent any accident, such as spilling the chemicals.
- Hold the test tube with help of a holder only. Wash test tubes after use.
- Be careful when dealing with chemicals.
- Use individual droppers for different chemicals. Never interchange droppers and avoid accidents.
- Wear gloves to avoid any allergic reactions or burns.
- Tie up your hair.

## Portfolio Activity 4.2

You need to collect different cut pieces of fabric. For this you can request any family member to lend you old clothes for cutting small sample pieces. Try to collect one sample each of cotton fabric, silk fabric and any man-made fabric. Light a candle and hold the strip of sample with help of a tong or a plucker for safety. Take these strips of fabric close to the flame, burn the sample and record your observations in the given table and write in your portfolio.

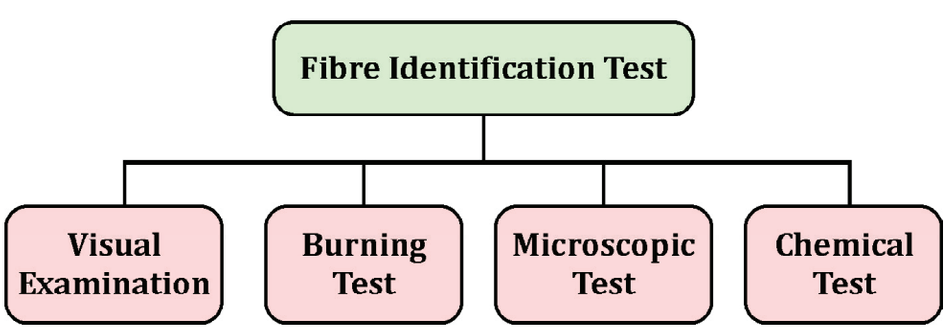
| Fibre Sample | Approaching flame | In flame | Removed from flame | Odour | Residue |
|---|---|---|---|---|---|
| Cotton | | | | | |
| Silk | | | | | |
| Man-made | | | | | |

## Know Your Progress 4.3

1. Identify the category of textile fibre on the basis of the observations:
   i. Burns readily in flame
   ii. Gives off an odour of chemical
   iii. Forms black bead like residue which is easily crushable
2. If you have to identify an unknown fibre, in which sequence will you use the following given chemicals:
   (a) Dimethyl formamide solution (b) Metacresol solution
   (c) 30-50% Sulphuric acid (d) 5% Sodium hydroxide
   (e) 85% Formic acid

**Fill your score _____ / 16**

## 4.6 THIS IS WHAT YOU HAVE LEARNT



## 4.7 LET US PRACTICE

1. If you buy a fabric from market and would want to know which fibre it is made up of, how will you identify it?
2. Visual examination is not a confirmatory test. Justify the statement.
3. Give details of chemical test for protein fibres.
4. What is the difference in inferences of burning test for natural and man-made fibres?

## 4.8 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 4.1**

i) cotton

ii) wool

iii) silk

iv) synthetic

v) silk

**Know Your Progress 4.2**

1. i. Visual Examination
   ii. Microscopic Test
   iii. Rayon
2. i. Appearance and Hand Feel
   ii. Wool
   iii. Convolutions

**Know Your Progress 4.3**

1. i. Cellulosic fibres
   ii. Synthetic fibres
   iii. Protein fibres
2. (c) (d) (e) (a) (b)

**Your final score is _____ / 30**

# PRACTICAL WORK

## Practical 4.1

### Microscopic Test

**Material required:** Visuals of longitudinal view of textile fibres for identification. Textile fibres to be identified are -

i. Cotton

ii. Rayon

iii. Wool

iv. Silk

v. Nylon

vi. Polyester

vii. Acrylic

**Procedure:** Recall the longitudinal views of fibres under the microscope. Identify the given fibres.

**Observation:** Record your observations in the given format

| Sample No. | Observation (Draw the longitudinal view seen) | Sample identified |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |

## Practical 4.2

### Burning Test

**Material required:** Fibre samples- cotton, rayon, wool, silk, acrylic, nylon, polyester, flame source (Bunsen Burner, Spirit Lamp), Tong / Forcets, Match Box, Beaker for water.

**Procedure:**

1. Hold the tiny pieces of fabric or yarns drawn out from the fabric, with a pair of tongs.
2. Slowly approach the flame and observe the burning behaviour.
3. Observe the smell and the residue formed.

**Observation:** Record your observations in the given format

| Sample No. | Observation | | | | | Sample identified |
|---|---|---|---|---|---|---|
| | Approaching flame | In flame | Removed from flame | Odour | Residue | |
| 1. | | | | | | |
| 2. | | | | | | |
| 3. | | | | | | |
| 4. | | | | | | |
| 5. | | | | | | |
| 6. | | | | | | |
| 7. | | | | | | |

Note: Remember the safety tips discussed in the lesson.

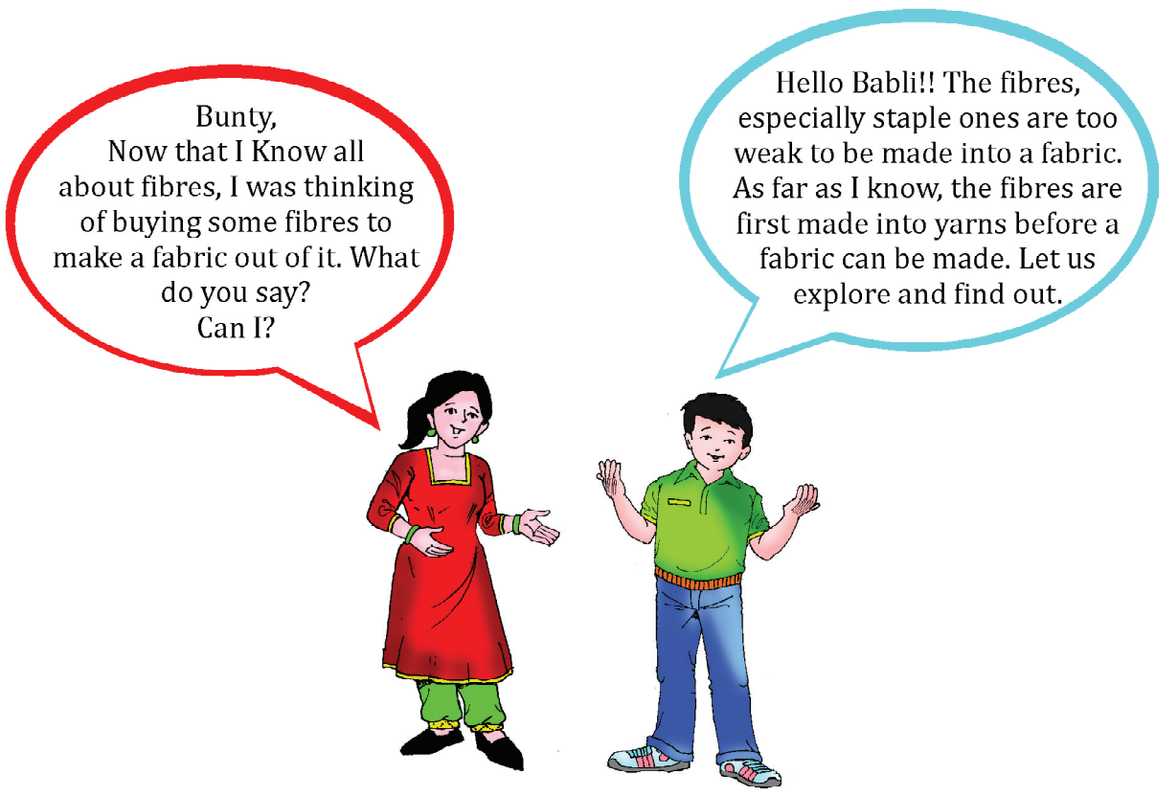
# 5. Yarn Construction and its Properties

KEYWORDS

- Yarn, Yarn twist
- Yarn crimp, Carding
- Combing, Reeling
- Worsted yarn
- Yarn number

**OBJECTIVES**

- define yarn;
- describe properties of yarn such as yarn twist, crimp, strength;
- relate yarn properties to the end product;
- explain process of manufacturing for cotton, wool, silk and worsted ;
- identify yarn thickness on the basis of the yarn numbering system.



## 5.1 WHAT IS A YARN?

Try and pull out a thread from a fabric. What do you find? You will find long strands coming out of it. Try and open them as given in the Figure 5.1. What do you find? You will find that those long strands are made up of bundles of short length fibres. This thread which is made up of fibres is called as a yarn. So, can we define yarn now? Yes.

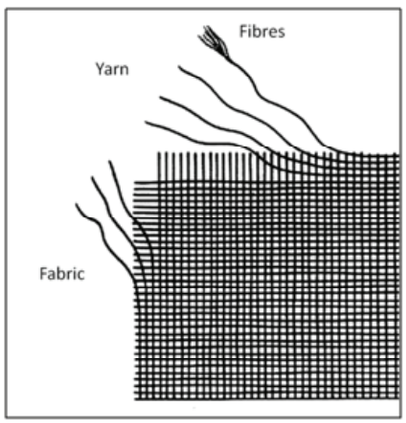
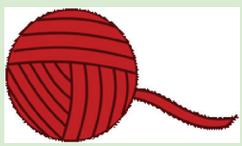



Fig. 5.1: Fabric formed by yarns and fibres
(Source:https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fupload.wikimedia.org)

**Yarn is an assemblage of fibres twisted together having substantial length and relatively small cross section**



### Do You Know?

What is a thread?

A thread is a long fibre made of different materials mostly used in sewing. It could be cotton, nylon, silk, polyester, rayon, or wool (Figure 5.2).

Thus, a thread is always a yarn, but a yarn may not always be thread

Fig. 5.2: Threads
(Source: www.google.co.in/imgres?imgurl=https%3A%2F%2Fcdn.pixabay.com)

## 5.2 WHAT ARE THE PROPERTIES OF YARN?

Properties of yarns affect the behavior of the fabric. The two main properties of yarn are - yarn twist and yarn count.

### A. Yarn twist

Take some long length fibres (You have read in the previous lesson that they are filament fibres!!). Now hold one end of the bunch of fibre strand. Revolve the other end with your other hand. What are you doing? Do you see any change happening? You are twisting the fibres together and will find that the fibres form a spiral position around the yarn central axis (Figure 5.3). So, yarn twist can be defined as -

Fig. 5.3: Twisted yarn
(Source: www.google.co.in/imgres?imgurl=https%3A%2F%2Fc1.staticflickr.com)

Yarn twist is the spiral arrangement of fibres around the axis of the yarn.

## B. Direction of twist

Twist binds the fibres together and increases the strength of the yarn. It is very much similar to the way the cotton wicks of lamps are made. Twist can be of two types, according to the direction in which the fibres are twisted. It can be 'S' twist or 'Z' twist (Figure 5.4).The Z twist is more common.

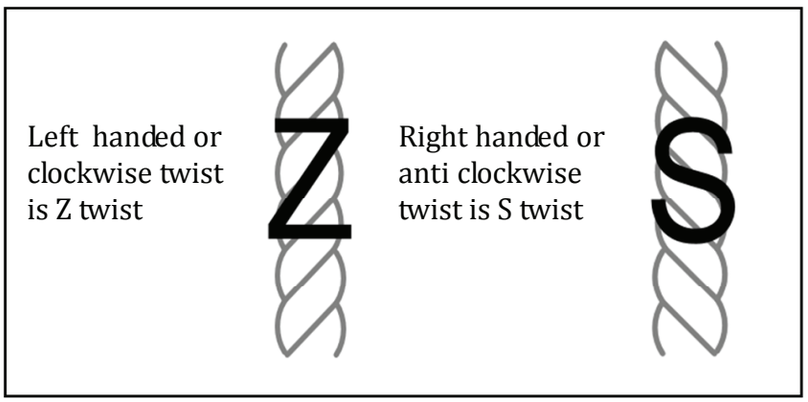



Fig. 5.4: S and Z twist

(Source:https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fupload.wikimedia.org)

## C. Amount of twist

Now, you have learned that fibres are twisted together to form a yarn. But, do you know that the amount of twist inserted can also vary?

The amount of twist inserted in the yarns is generally expressed as twists per inch (tpi)

Yarns with high amount of twist, have a higher tpi value and yarns with low amount of twist have a lower tpi value (Figure 5.5).

It you notice, the yarns used for making jackets and coats are much finer than the yarns used for making sweaters. Do you know how these finer yarns are made? The fineness of the yarn can be increased by inserting more amount of twist in it. Thus, we can say, higher the twist, the finer, stronger and compacter will be the yarns. The yarns with low twist tend to be soft, fluffy, warmer and have low strength.

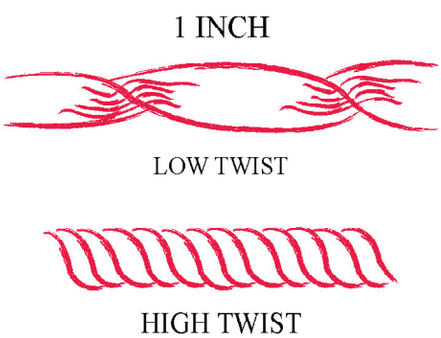



Fig. 5.5: Yarns with high and low twist

## Portfolio Activity 5.1

Take a hank (lachhi) of yarn. Gather it up and hold it in both hands. Keep the top in stationary position using one hand and rotate the lower part in clockwise direction using the other hand. What do you see? Repeat the same activity, by twisting the lower part in anticlockwise direction. Record your observations in box given below.

Anti- Clockwise twist

... ... ... twist

Clockwise twist

... ... ... twist

## Know Your Progress 5.1

1. Fill in the blanks with appropriate words
   - i. Fibres are twisted together to form a .....
   - ii. ..... is the spiral arrangement of fibres around the axis of the yarn
   - iii. 'Z' direction of twist is also called as .....handed twist.
   - iv. 'S' direction twist is also called as .....handed twist.
   - v. Finer yarns have ..... twist.
   - vi. Soft and fluffy yarns have .....twist.

**Fill your score _____ / 12**

## D. Yarn Crimp

Observe the yarns in Figure 5.6. Do you see any difference between them? Yes, yarn B appears to have a wave formation, whereas yarn A appears to be straight and smooth. This difference is because of the presence of crimp in the yarn B. Thus,

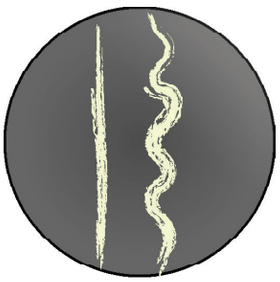


Fig. 5.6. Straight and crimped yarn

> Yarn crimp can be defined as the waviness along the length of the yarn.

Some natural fibres e.g. wool, have a natural crimp.

Fig. 5.7: Natural crimp in wool fibres

(Source:https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fc2.staticflickr.com)

> Wool, obtained from sheep has natural crimp

In synthetic fibres like polyester, nylon etc, crimp can be introduced by passing the filament between the rollers having teeth (Figure 5.8). Crimp in fibres helps in forming a compacter yarn. Wavy texture of the fibres helps them to entangle better with each another.

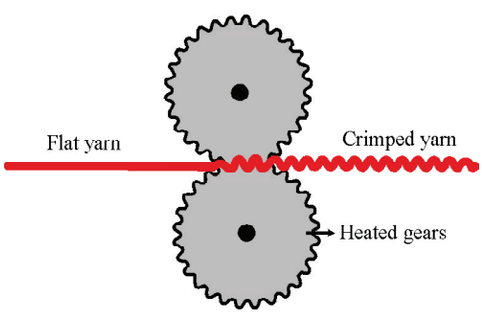



Fig. 5.8: Crimping of synthetic yarn

## 5.3 EFFECT OF YARN PROPERTIES ON THE END PRODUCT

Properties of yarns also affect the properties of end product. Twist of yarn can be used to create interesting effects.These are more visible when the yarn is converted to fabric. Effects can be made by having a combination of yarns with different twist levels (low, medium, high), or by using yarns with different direction of twist.

For example, Crepe yarns, which have high amount of twist, are used to make fabrics like chiffon, georgette, etc, which have crinkled surfaces.

## 5.4 HOW TO MAKE YARNS?

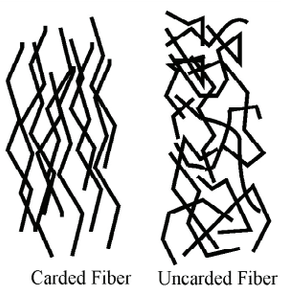
Do you know that making a yarn is a complex procedure and involves many processes?

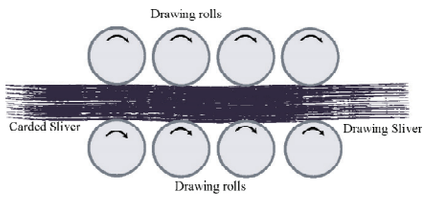
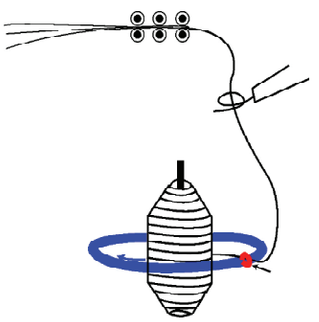
Various steps are involved in making a yarn. The fibres (both staple and filament) are made to pass through a series of machines, and are eventually converted into a yarn. We know that the fibres like cotton, wool, silk are obtained from different sources and the method of making yarn for each of these fibres is also different.

### A. Process of making cotton yarn

Harvested and collected cotton fibres are compressed and made in the form of bales which are large and compact cotton packages.

**Table 5.1 Process of making cotton yarn**

| S. No. | Process | Purpose | Pictorial Depiction |
|---|---|---|---|
| 1. | **Cleaning and opening** | Bales of cotton contain impurities and unwanted matter like seeds, dry leaves, lint, dirt etc. These impurities are removed during the cleaning operation. The bales are loosened and further disentangled by the process of opening. |  Figure 5.9 |
| 2. | **Carding** | The fibres sometimes get matted and stick to each other. Carding machine arranges the fibres in a parallel manner and removes the short length fibres that can not be used. The carded web of fibres is turned into a soft rope called **sliver**. |  Carded Fiber Uncarded Fiber Figure 5.10 |
| 3. | **Combing** | It is an optional step used for making high quality yarns which are smooth, fine and even. Carded slivers are combed to separate short fibres from the long fibres. It produces combed sliver, made up of longest fibres. |  Figure 5.11 |

| | | | |
|---|---|---|---|
| 4. | **Drawing** | Carded or combed slivers are pulled between the rollers, producing longer and thinner slivers. |  Figure 5.12 |
| 5. | **Spinning** | The drawn slivers are given the desired amount of twist and are further wound on packages. |  Figure 5.13 |
| 6. | **Winding** | Yarns are wound onto various packages of desired size, weight etc depending on the end use. Some of the common yarn packages for fabric construction are- balls, reels or bobbins, hanks, cones, etc |  Figure 5.14 |

## B. Process of making wool and worsted yarn

As you have read earlier, the wool fibre is obtained from sheep and other animals. The quality of the wool produced will vary according to the sheep's health, breed, diet, surroundings etc.Various steps are involved in making a woolen and worsted yarn.

(Source: https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fupload.wikimedia.org
https://www.google.co.in/imgres?imgurl=http%3A%2F%2Fwww.publicdomainpictures)

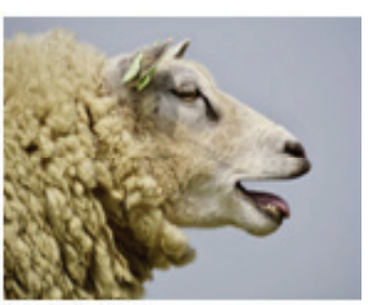
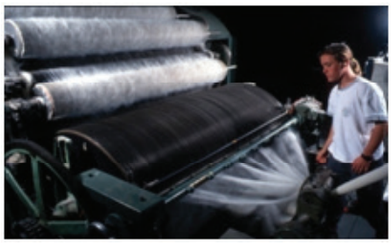
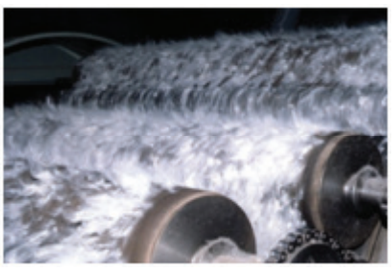
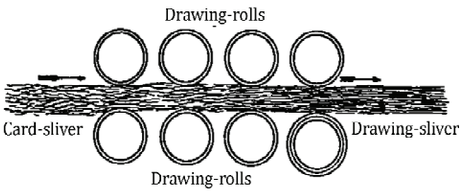




**Table 5.2 Process of making wool and worsted yarn**

| S. No. | Process | Purpose | Pictorial depiction |
|---|---|---|---|
| 1. | **Shearing** | Shearing is the process of removal of fleece by hand or by using chemicals and machines. |  Figure 5.15 |
| 2. | **Sorting and grading** | The fleece is sorted and graded according to colour, texture, fineness and length of the fibre. |  Figure 5.16 |
| 3. | **Scouring** | The fleece is then treated with warm, alkaline soap solution to remove grease, perspiration and other impurities. |  Figure 5.17 |
| 4. | **Carbonizing** | Dilute solution of sulphuric acid is used to burn away the vegetable matter, impurities (like seed, leaves, twigs etc) which are entangled in the fleece. |  Figure 5.18 |

| | | | |
|---|---|---|---|
| 5. | **Carding** | Carding is further done using wire teethed cylinders to remove the short length fibres and to further straighten the fibres. It also cleans up the fibres and separates them. |  Figure 5.19 |
| 6. | **Combing (Optional)** | This is an additional step required in case of worsted yarns. The step of combing further helps in making the fibres parallel to each other. In this process, the short length fibres along with impurities are further removed. |  Figure 5.20 |
| 7. | **Drawing (Optional)** | It is an advanced operation which is done only to worsted yarns. In this the yarns are made compacter and thinner. Combed slivers are further twisted in this process. |   Figure 5.21 |
| 8. | **Spinning** | The carded or combed slivers are further twisted, thinned and are wound on packages. |  Figure 5.22 |
| 9. | **Winding** | After spinning, a specific length of yarn is wound in the form of packages called balls, reels, hanks, cones, etc. The packages are made depending on the weight or length of yarn and its end use. |  Figure 5.23 |

(Source: https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fupload.wikimedia.org
https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fc1.staticflickr.com

**Recall!**

Effect of acid on wool (Lesson-2)

Wool can withstand the action of acids. Thus, dilute solution of sulphuric acid is safe to use during carbonizing process without damaging wool fibre.

**Do You Know!!**

Combing and drawing are additional steps required only for preparation of worsted yarns.

Short length wool fibres (less than 3") are used to produce **woollen yarns** and are spun without undergoing combing operation.

**Wool yarns** are fuzzy, thick, bulky and loosely twisted. They are used for making blankets, sweaters etc.

Fairly long length wool fibres (more than 3"), which have finer diameters are converted to **worsted yarns.** They are taken from the carding machine to the combing machine (Figure 5.24)

**Worsted yarns** are twisted tighter, are thinner and are used for making coats and other fabrics like gabardine, tweed etc.

Woollen Yarn

Worsted Yarn

Fig. 5.24

## C. Process of making silk yarn

Silk, as you have read, is obtained from the cocoons of the silk worm. The silk worm produces liquid secretions and spins it around itself. These secretions solidifies when it comes in contact with the air and forms a cocoon (Figure 5.25). Various processing steps are involved, which include:

Fig. 5.25: Cocoon with spun silk filament fibre

## Table 5.3: Process of making silk yarn

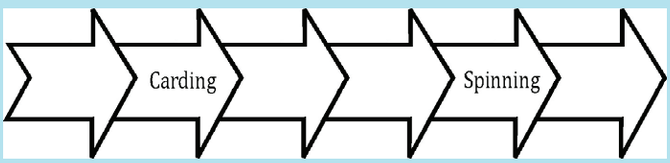
| S. No. | Process | Purpose | Pictorial depiction |
|---|---|---|---|
| 1. | **Sorting** | The cocoons are sorted according to size, colour, shape and texture. |  Figure 5.26 |
| 2. | **Softening of sericin** | Silk filaments are bound together by gummy substance called sericin. After sorting, cocoons are put through a series of hot and cold water to soften the sericin. This helps in unwinding of filament as a continuous thread. |  Figure 5.27 |
| 3. | **Reeling** | The cocoons are then brushed gently to seek out the ends the filaments. The ends of the silk filaments are combined and passed through a guide before winding them onto a reel. The method of unwinding the filament from the cocoon is called reeling. |  Figure 5.28 |
| 4. | **Throwing** | A slight twist is imparted to the silk filament strands. This is done to hold the filaments together. The yarn produced is called thrown yarn. | |
| 5. | **Spinning** | The filaments yarns are further given a twist to form the yarn. | |
| 6. | **Degumming** | Sericin gum remains on the silk fibre throughout reeling and throwing. However, before finishing, the gum is removed by boiling the silk yarn in soap and boiling water. Removal of the gum improves colour, hand, and texture of the silk while making it ready for dyeing, finishing etc. | |
| 7. | **Weighting** | Silk loses about 25% of its weight while degumming. In the process of weighting, this loss of weight is replaced through treatment by small amount of metals like tin, lead etc in water solutions. | |

(Source: https://www.google.co.in/imgres?imgurl=https%3A%2F%2Fupload.wikimedia.org)

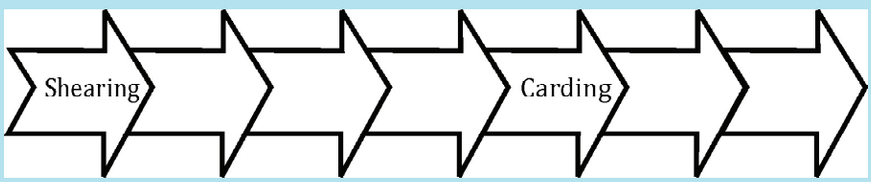
## Know Your Progress 5.2

1. Fill in the missing gaps in the arrows given, with respect to the steps involved in making cotton, wool and silk yarn.

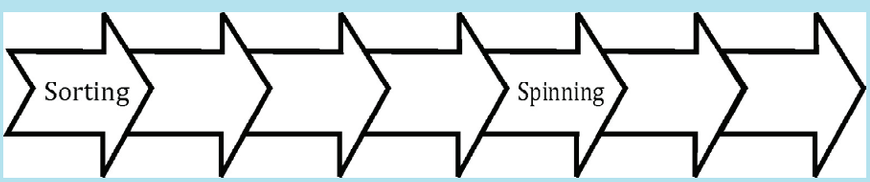
   i. Steps involved in making cotton yarn



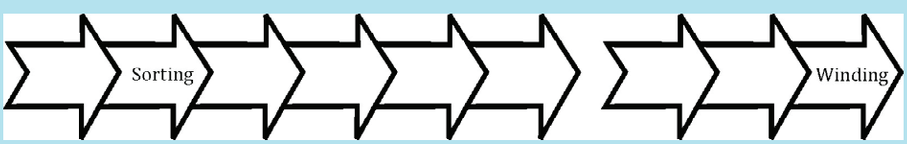

   ii. Steps involved in making wool yarn




   iii. Steps involved in making silk yarn




   iv. Steps involved in making worsted yarn




2. Give one word answers for the definitions given in column A.

| S. No. | Column A | Column B |
|---|---|---|
| i. | Process of removal of sericin gum from silk | |
| ii. | Method of unwinding the filament from the cocoon | |
| iii. | Process of removal of the cellulosic impurities from wool by treatment with acid | |
| iv. | An optional step for removing short fibres and making worsted yarns | |
| v. | Process of removal of fleece of the sheep | |

**Fill your score _____ / 10**

## 5.5 YARN COUNT/ YARN NUMBERING SYSTEM

**Yarn count is an indicator of the fineness or thickness of the yarn.**

It is a numerical expression of yarn. There are two systems- **direct and indirect.**

### A. Direct yarn number

Direct yarn number determines the weight of a fixed length of yarn. In this system, the length of the yarn is kept fixed, while the weight varies. This system is commonly used for filament yarns. **Denier** and **tex** are the two units which comprise direct yarn number.

- **Denier-** It is equal to the weight in grams of 9000 meters of the yarn. Silk and man-made fibre yarns are usually measured using the denier system.
- **Tex-** It is equal to the weight in grams of 1000 meters of the yarn.

In the direct system, the count of the yarn is directly proportional to the yarn diameter. That is, lower the number, finer is the yarn. For example, if a yarn A is 8 denier (8d), while the yarn B is 10denier (10d) , then the yarn B will be thicker than yarn A.

### B. Indirect yarn number

Indirect yarn number determines the length of a fixed weight of yarn. In this system, the weight of the yarn is kept fixed, while the length varies according to its fineness.There are many kinds of indirect yarn numbers which are commonly used for spun yarns. They are cotton, wool,worsted and metric count.

- Cotton count (Ne or s): It is the number of 840 yard hanks that weigh one pound.
  So, for example, 32s means that 32 hanks of 840 yards of cotton weigh one pound

**New Words!**

Hank- a coil or *lachhi* of cotton, wool or any other fiber which has been loosely wound

**Do You Know!!**

20s - Coarse yarns

20 to 60s - Medium yarns

60s -Fine yarns

Cotton sewing threads used for general purposes are 50s or 60s.

- Woolen count: It is the number of 300 yard hanks that weigh one pound.
- Worsted count: It is the number of 560 yard hanks that weigh one pound.

- Metric count: It is the number of 1km (1000metres) hanks that weigh 1kg. It is used for synthetic threads and is symbolized by Nm.

In the indirect system, the count of the yarn is indirectly proportional to the yarn diameter. Thus, high count means that the yarn is of greater fineness. For example, if a yarn C is 20s, while the yarn D is 40s, then the yarn D will be finer than the yarn C.

## Know Your Progress 5.3

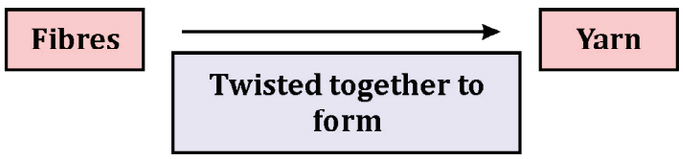
1. Write T for the statements that are true and F for those that are false.
   - i. Yarn with cotton count 20s are finer than yarns with count 60s.
   - ii. Denier and tex are two units which comprise direct yarn number.
   - iii. Yarn with 6 denier count is thicker than the yarn with 4 denier count.
   - iv. Yarn count is an indicator of yarn fineness or thickness.
   - v. In indirect count, the count of the yarn is directly proportional to the yarn diameter.

**Fill your score _____ / 10**

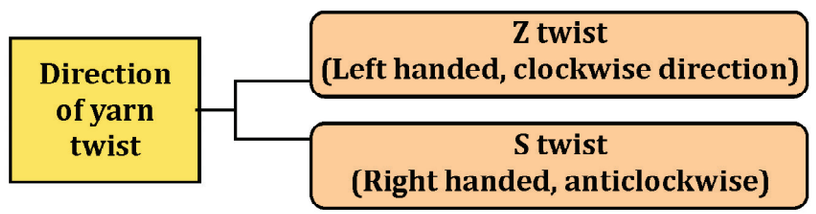

- Fuzz, dust generated during handling of short fibres while making yarn, may result in respiratory problems. Remember to wear mask while working.
- Accumulated dust, fiber lint should be cleaned frequently for upkeep and maintenance of the machinery.
- Ensure proper ventilation and clean surroundings.
- Wear safety goggles to prevent fiber dust penetration in eyes. In case of eye irritation, consult a doctor immediately.
- Remember to wash hands after work.
- Wear protective clothing and headgear to prevent contact of the fiber dust etc with the skin.

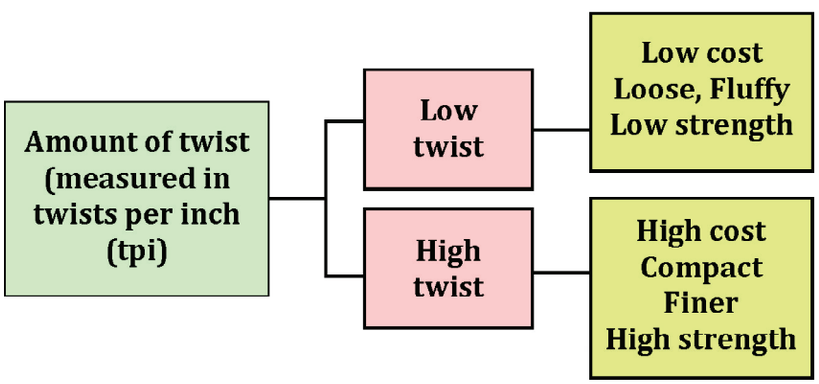
## 5.6 THIS IS WHAT YOU HAVE LEARNT

- Yarn

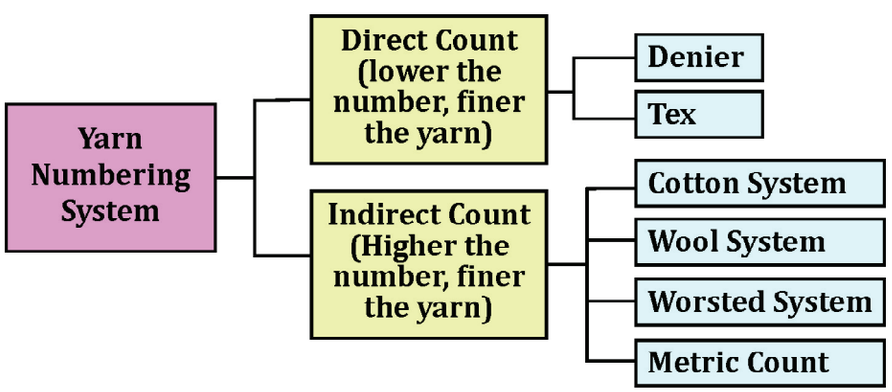



- Yarn properties

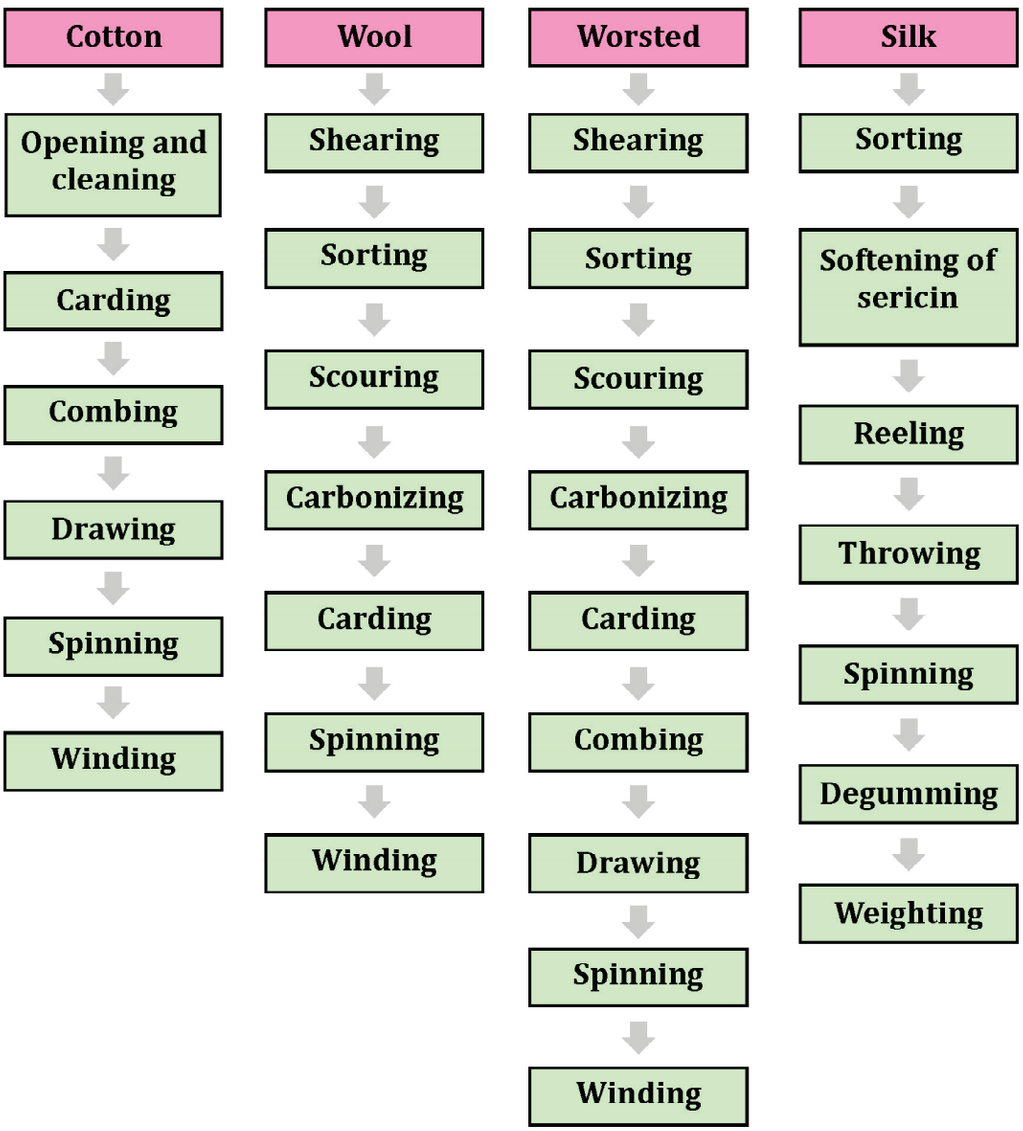



- Yarn count



- Steps in Yarn making




## 5.7 LET US PRACTICE

1. Differentiate between the following:
   - i. S and Z twist
   - ii. High twist and low twist yarn
   - iii. Wool and worsted yarn
   - iv. Direct and indirect yarn count
2. Explain the process of making cotton yarn.

3. What are the steps involved in making silk yarn. Explain them in detail.
4. Justify the following statements:
   i. Yarn twist can be used as a tool to create interesting variations in fabrics.
   ii. Worsted yarns are smoother and stronger than woolen yarns.
   iii. Indirect yarn count is indirectly proportional to the yarn diameter.

## 5.8 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 5.1**

1. Fill in the blanks
   i. Yarn ii. Twist
   iii. Right iv. Left
   v. High vi. Low

**Know Your Progress 5.2**

1. Fill in the missing gaps in the arrows given, with respect to the steps involved in making cotton, wool and silk yarn.
   i. Cleaning and opening, Combing, Drawing, Winding
   ii. Sorting, Scouring, Carbonization, Spinning, Winding
   iii. Sorting, Reeling, Throwing, Degumming, Weighting
   iv. Shearing, Scouring, Carbonization, Combing, Drawing, Spinning
2. Give one word answers for the definitions given in column A.
   i. Degumming ii. Reeling
   iii. Carbonization iv. Combing
   v. Shearing

**Know Your Progress 5.3**

1. Write T for the statements that are true and F for those that are false.
   i. False ii. True
   iii. True iv. True
   v. False

**Your final score is _____ / 43**

# PRACTICAL WOK

## Practical 5.1

Collect some cotton, wool, worsted and silk yarns from the market. Paste the samples and record your observations in the portfolio in the given format.

| | Feel* | Appearance ** | Sample of yarn |
|---|---|---|---|
| Cotton yarn | | | |
| Wool yarn | | | |
| Worsted yarn | | | |
| Silk yarn | | | |

*Feel- Rough, smooth
**Appearance- Fuzzy, hairy, uniform, shiny, dull

# 6. Yarn and its types

KEYWORDS

- Spun yarn, Filament yarn
- Single yarn
- Ply yarn, Cord yarn
- Novelty Yarn
- Blended yarn

**OBJECTIVES**

- classify yarns as spun or filament (multi filament and mono filament);
- describe novelty yarns such as slub, spiral, knot, chenille and boucle yarns;
- explain the concept of yarn blending.

You have learnt what a yarn is. Write the definition of yarn here-

_____

## 6.1 CLASSIFICATION OF YARNS ACCORDING TO LENGTH

A yarn is an intermediate product that is made from fibres and is used to manufacture fabrics. Yarns can be made either from short length staple fibres or from filament fibres. There are two types of yarns, i.e., spun yarns and filament yarns (Fig.6.1).

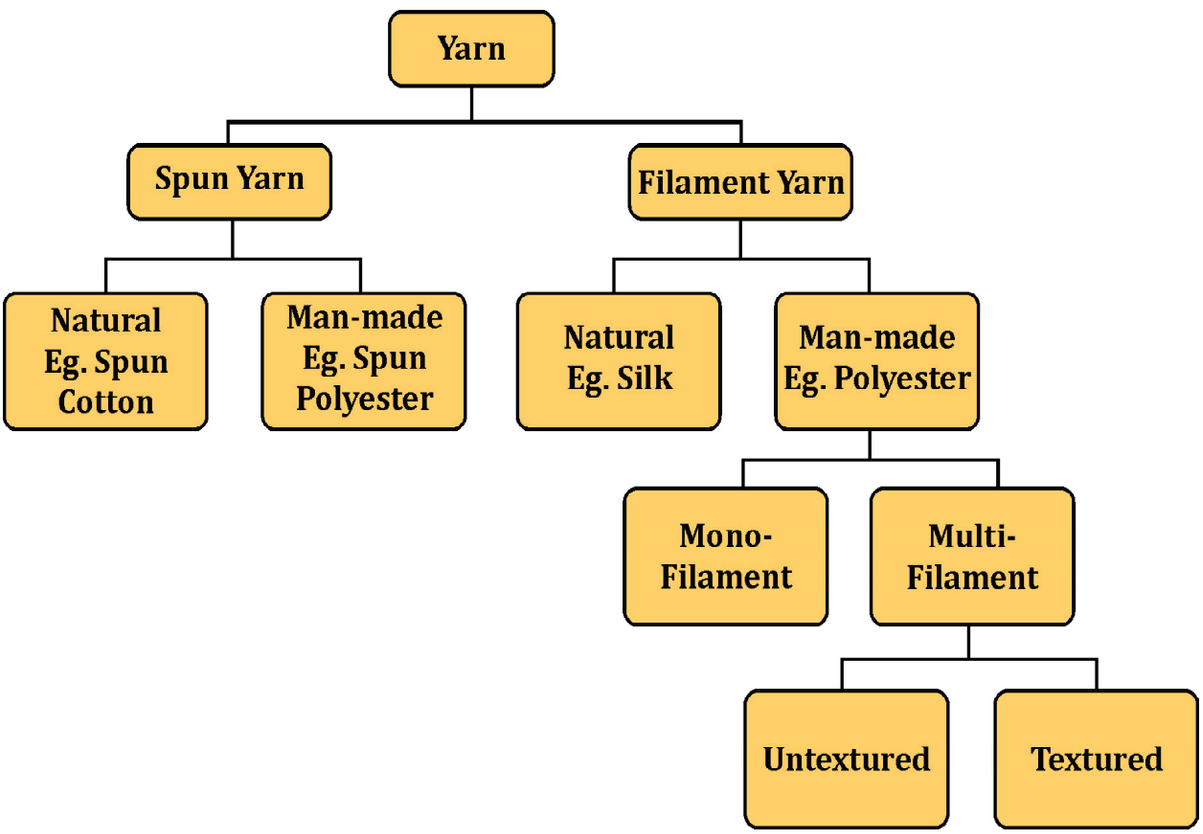



Fig. 6.1: Classification of Yarns according to Length

### A. Spun Yarn

It consists of staple fibres assembled and bound together by twist (Fig. 6.2). All natural fibres are staple in length except silk which is a filament fibre. The manmade fibres are made staple by cutting them into short lengths

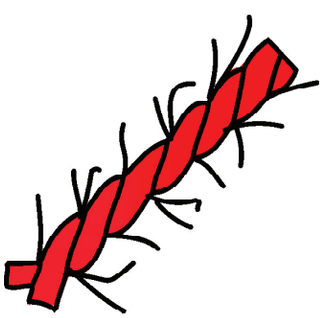


Fig.6 2: Spun Yarn

## B. Filament Yarn

Filament Yarn are long continuous fibre strands of indefinite length (Fig. 6.3). They can be either monofilament (one fibre) or multifilament (a number of filaments). Filaments may be smooth or textured (crimped in some way) (Fig. 6.4).

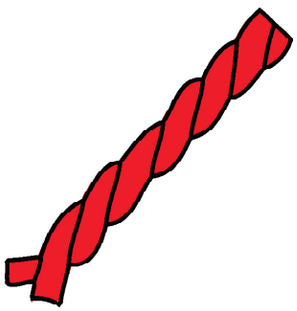


Fig.6.3: Filament Yarn

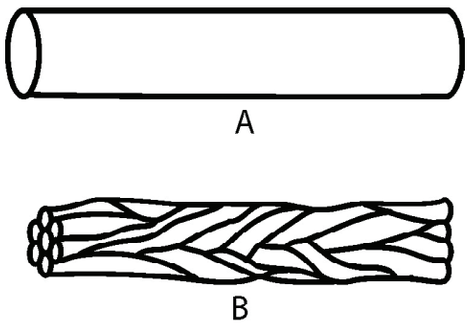



Fig. 6.4: A. Mono Filament Yarn B. Multi Filament Yarn

Now we know that the major difference between spun and filament yarn is the length of the fibres used. But there are some other differences as well. These are presented in the Table below.

**Table 6.1: Spun Yarn vs. Filament Yarn**

| Spun Yarn | Filament Yarn |
|---|---|
| • Short fibres twisted into continuous strand, has protruding ends<br>• Dull, fuzzy look<br>• Good absorbency | • Long continuous, smooth, closely packed strands<br>• Smooth, lustrous<br>• Poor absorbency |

### Know Your Progress 6.1

1. Match the fibres in Column A with their description in Column B

| A | B |
|---|---|
| 1. Filament fibres<br>2. Short fibres<br>3. Mono filament<br>4. Multifilament<br>5. Silk | i. Spun yarn<br>ii. Long continuous, smooth, closely packed strands<br>iii. Natural filament<br>iv. Single filament<br>v. Textured or un textured<br>vi. Cotton spun yarn |

**Fill your score _____ / 10**

## Portfolio Activity 6.1

Collect five fabric samples, take out their yarn and untwist them. Determine whether the yarn is spun or filament. Use the table given below to record your observations and paste the samples in your Portfolio.

| S. No | Spun Yarn/ Filament Yarn | Sample |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

## Portfolio Activity 6.2

Collect samples of following yarns (thread reels) from the market. Paste them in your portfolio.

| S. No | Yarn | Yarn sample |
|---|---|---|
| 1. | Mono Filament Yarn | |
| 2. | Cotton Spun Yarn | |
| 3. | Multi Filament Yarn | |
| 4. | Natural Filament Yarn | |
| 5. | Polyester Spun Yarn | |

## 6.2 CLASSIFICATION OF YARN ACCORDING TO YARN STRUCTURE

Let's understand how yarns can be classified according to their structure. Yarns may be classified as simple and complex or novelty yarns (Fig.6.5).

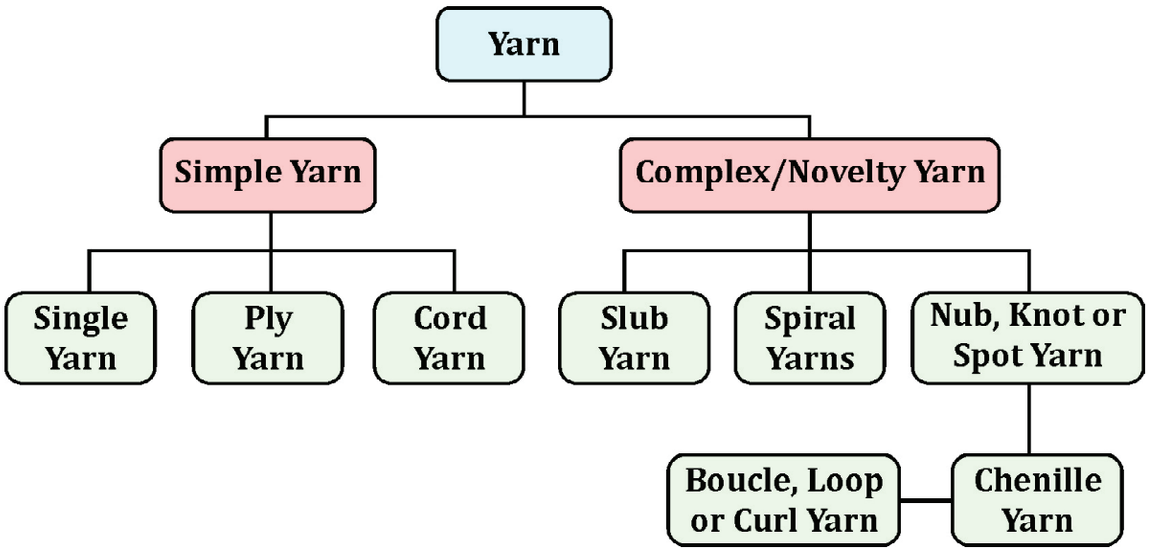



Fig. 6.5: Classification of Yarn according to Yarn Structure

## 6.3 SIMPLE YARN

A simple yarn is alike throughout. A novelty yarn has unlike parts; it is irregular at regular intervals. Simple yarns are classified as single, ply and cord (Fig.6.6).

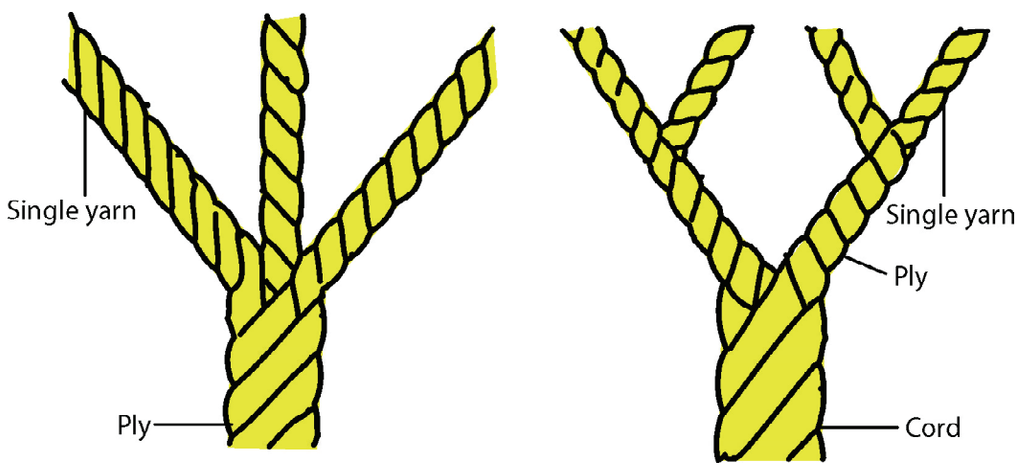



Fig. 6.6: Single, ply and cord yarns

**A Single yarn** is the product of the first twisting operation that is performed by the spinning machine.

**A ply yarn** is made by a second twisting operation, which combines two or more singles. Each part of the yarn is called a ply. For example two ply, three ply, four ply (Fig. 6.7). Plying tends to increase the diameter, strength and quality of the yarn. The direction of twisting is designated as S or Z, just as in single yarns. Normally the folding twist is in the opposite direction to that of the single yarns.

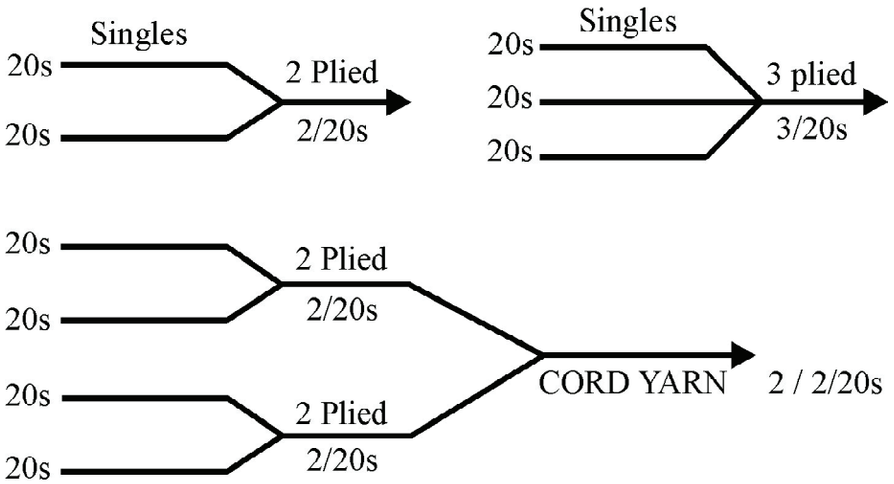



Fig. 6.7: Ply Yarn

A **cord yarn** is made by third twisting operation which twists ply yarns together (Fig. 6.8).

**Know Your Progress 6.2**

**Fill in the blanks**

(i) When two or more single yarns are twisted together, it is known as ..... yarns.

(ii) When two or more ply yarns are twisted together, they are known as ..... yarns.

(iii) Simple yarns are classified as ....., ..... and .....

(iv) Cord yarns are made by..... twisting operation.

**Fill your score _____ / 10**

## 6.4 COMPLEX/ NOVELTY YARNS

Novelty yarns may be defined as yarns that are irregular at regular intervals. The spinning process can produce decorative effects by varying the amount of twist or by twisting yarns of different diameter. Novelty yarns are composed of core, effect and binder (Fig 6.9).

- **Core -** It provides the structure and strength to the novelty yarn.
- **Effect -** It creates the decorative effect.
- **Binder -** It binds the base and effect yarn if required.

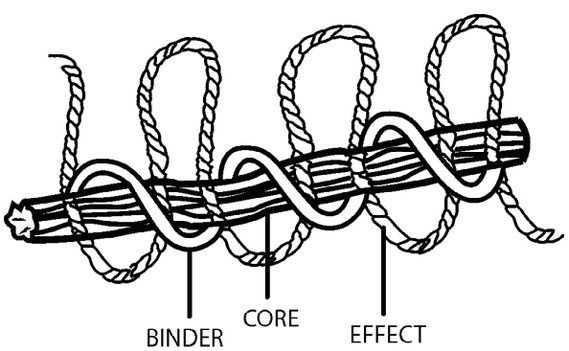
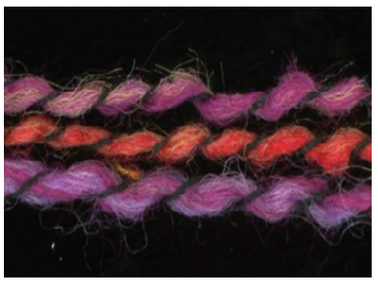
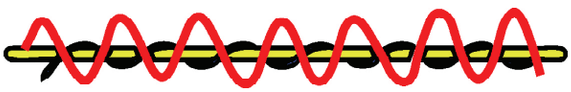



Fig 6.9 Components of Novelty yarn

Novelty yarns can give fabrics almost limitless textural effects of various colour combinations (Table 6. 2).

**Table 6.2 Complex/Novelty Yarns**

| S. No | Complex/Novelty Yarns | |
|---|---|---|
| 1. | **Slub yarns** – have soft, untwisted areas at frequent intervals throughout their length. They may be single or ply yarn varying in amount of twist at intervals.<br>  <br>Fig. 6.10: Slub Yarn |  <br>http://www.msyarn.com/english/slub_yarn.htm |
| 2. | **Spiral yarns** – are made by winding a coarse yarn over a fine yarn.<br>  <br>Fig. 6.11: Sprial Yarn |  <br>http://clothing120.weebly.com/blog/archives/10-2014 |
| 3. | **Nub, Knot or Spot yarn** - are made by twisting the effect ply around the core ply many times within a very short space, causing bumps or knots at intervals.<br>  <br>Fig. 6.12: Knot Yarn |  <br>http://www.msyarn.com/english/knot_yarn.htm |

| | | |
|---|---|---|
| 4. | **Chenille yarn** – The term chenille is French for caterpillar. The effect is achieved by a core of two yarns plied together and firmly holding short tuffs of soft-twisted yarns between the twists. The result is a yarn with a velvette like effect.<br>  <br>Fig. 6.13: Chenille Yarn |  <br>https://www.yarn-paradise.com/velvet-chenille-burgundy |
| 5. | **Boucle, loop or curl yarn** - is accomplished by allowing one of the piles to remain slack during the twisting operation causing it to twist on itself and form a loop. It resembles karakul wool.<br>  <br>Fig. 6.14: Boucle Yarn |  <br>http://www.stitchpiecenpurl.com/boucle.htm |

## 6.5 END USES OF NOVELTY YARNS

Do you know that fabrics manufactured from novelty yarns are not only used in apparel, but also in home textiles? Yes, novelty yarns are used for making dress material, clothes, scarves, curtains, rugs and furnishing fabrics. It improves the appearance of the fabric. Also, these yarns improve the texture and feel. The lustre may be improved by using metallic yarns. Novelty yarns provide us a huge variety of surface ornamented fabrics at a low cost (Fig 6.15).

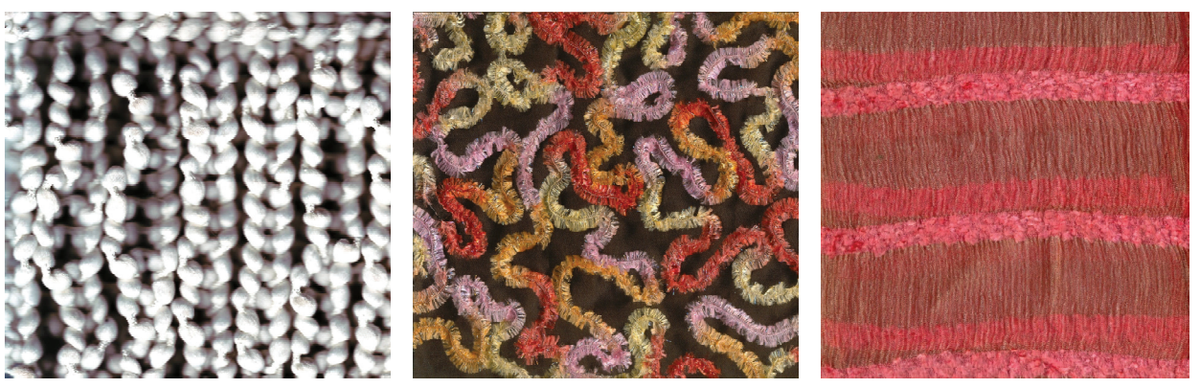


Fig. 6.15 Fabrics manufactured using novelty yarns

Source: https://www.slideshare.net/fancyyarns/fancy-yarns-final

### Limitations of Novelty yarns

Novelty yarns are weak and have poor abrasion resistance. Fabrics manufactured from novelty yarns are generally not durable. Thus, they should be avoided for manufacturing those fabrics where durability and long wear is required.

**Know Your Progress 6.3**

Fill in the blanks

(i) Novelty yarns are used to produce……..effects.

(ii) Examples of complex yarns are……..and ……..

(iii) Slub novelty yarn has soft ……..areas at frequent intervals.

(iv) Chenille yarn creates ……like effect.

(v) Boucle yarn resembles…… wool.

**Fill your score _____ / 10**

## 6.6 YARN BLENDING

Do you know that yarn can also be manufactured by mixing natural and manmade fibres? Yes, that is possible by blending of fibres. You must have heard names like terrycot and cotswool. They are made from more than one type of fibre. While spinning of yarn two types of fibres are mixed, pulled and twisted together to form a blended yarn. A blend is a mixture of fibres, twisted together into a yarn. Do you know why two fibres are mixed together? Blending is done for several reasons:

- To improve spinning, weaving, and finishing efficiency.
- To obtain better texture, hand, or fabric appearance.
- For economic reasons.
- To produce fabrics with better performance. This is an important reason for blending. In end uses where durability is very important, nylon or polyester blended with cotton or wool provide strength and resistance to abrasion. Polyester when blended with cotton contributes to strength and wrinkle resistance while cotton produces comfort and absorbency. When polyester is added to wool it gives strength and wool gives warmth, resiliency and absorbency.

## Do you Know

Some Commonly Available Blended yarns

- Terrycot- Polyester and Cotton
- Terrywool- Polyester and Wool
- Cottonsilk- Cotton and Silk
- Cotswool- Cotton and Wool
- Polyviscose- Polyester and Viscose
- Cottonspandex- Cotton and Spandex

## Portfolio Activity 6.3

Collect five samples of blended yarns available in market. Paste the sample and record composition of yarns in your portfolio.

| S. No | Blended Sample | Composition |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

## Portfolio Activity 6.4

How will you communicate with a shopkeeper while collecting the blended yarn? Write the conversation you had with the shopkeeper while collecting samples of blends.

Shopkeeper: How Can I help you?

You: Have you got any blended yarns?

Shopkeeper: Yes, we have

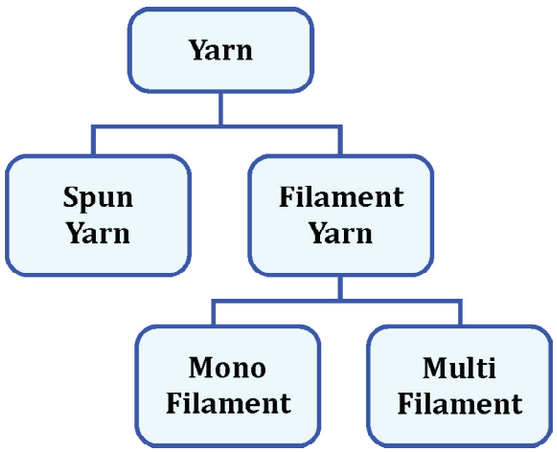
You:

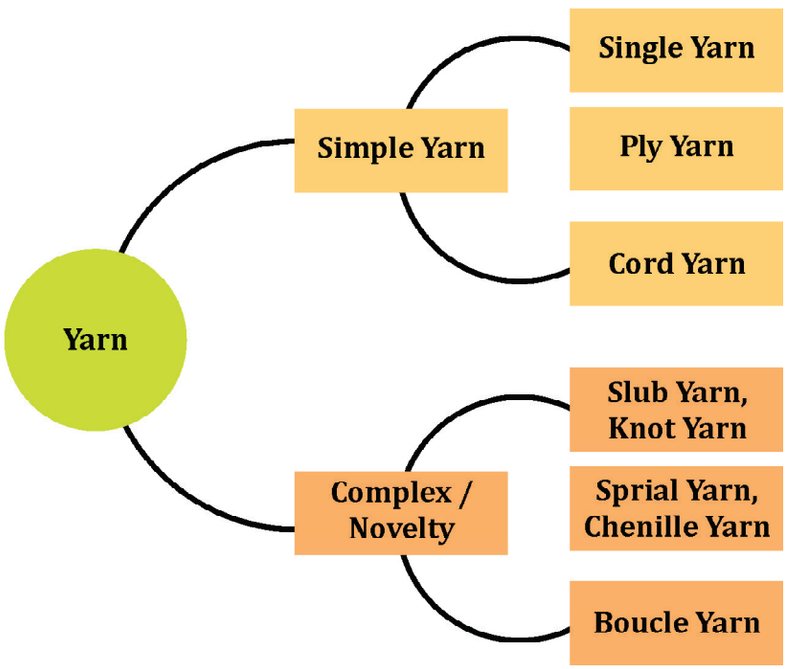
Shopkeeper:

You:

Shopkeeper:

## 6.7 THIS IS WHAT YOU HAVE LEARNT




## 6.8 LET US PRACTICE

1. Differentiate between the following:
   i. Simple and Complex yarn
   ii. Spun and Filament Yarn
2. Draw a Schematic diagram to represent 3 ply, 6 ply and cord yarn.
3. List out various novelty yarns. Discuss their end uses and limitations.
4. What are the benefits of yarn blending.

## 6.9 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 6.1**

| A | B |
|---|---|
| 1. Filament fibres<br>2. Short fibres<br>3. Mono filament<br>4. Multifilament<br>5. Silk | i. Long continuous, Smooth, closely packed strand<br>ii. Spun yarn<br>iii. Single filament<br>iv. Textured or Un textured<br>v. Natural Filament |

**Know Your Progress 6.2**

(i) Ply

(ii) Cord

(iii) Single, Ply, Cord

(iv) Third

**Know Your Progress 6.3**

(i) Decorative

(ii) Slub/Boucle/Chenille/Knot/Spiral

(iii) Untwisted

(iv) Velvet

(v) Karakul

**Your final score is _____ / 30**

# PRACTICAL WORK

## Practical 6.1

From given ten yarn samples find out whether the yarn is simple or complex by untwisting them record your observation whether simple, single, ply or cord. Record your observations and draw the diagram in your portfolio.

| S. No | Yarn sample | Observations | Diagram |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |

## Practical 6.2

Let's make ply/cord yarns. Follow the steps described below. Paste sample of yarns and draw the diagram in your portfolio.

| S. No | Yarn | Method | Sample | Diagram |
|---|---|---|---|---|
| 1. | 2 Ply | **Two ply or double ply** yarn can be made by twisting two separate single yarns or one long single strand plied by holding both ends together | | |
| 2. | 4 Ply | **Four ply** are also known as cable yarns. These are usually made by plying two strands of two-ply yarns together. | | |
| 3. | Cord Yarn | Cord yarn is a multiple strand yarn. Take 2 or 4 ply yarns and twist together. These are generally used for making ropes | | |

## Practical 6.3

Identify 5 textile products which are made from novelty or complex yarns. Click their pictures using your phone camera and paste them in your portfolio.

| S. No | Name of Textile Product | Pictures |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

# 7. Emerging into Fabric

KEYWORDS

- Fabric
- Weaving
- Knitting
- Non-woven
- Lace, Net

**OBJECTIVES**

- describe the methods of fabric construction;
- differentiate between various methods of fabric construction;
- identify different types of weaves.


Different fabrics - different uses. So how do you select the right fabric? What do you need to know?

## 7.1 FABRIC

Fabric is a compact structure made by arrangement of fibres and yarns.

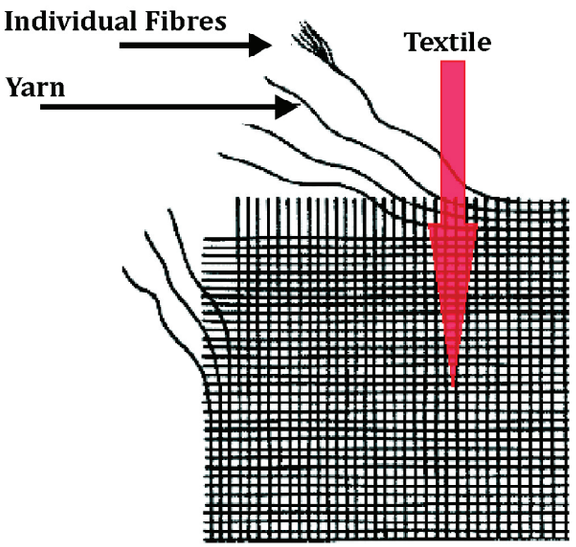



Fig. 7.1: Fabric

Fabrics can be constructed by various methods. Figure 7.2 shows you the different methods in a pictorial form that will make it easy for you to remember.

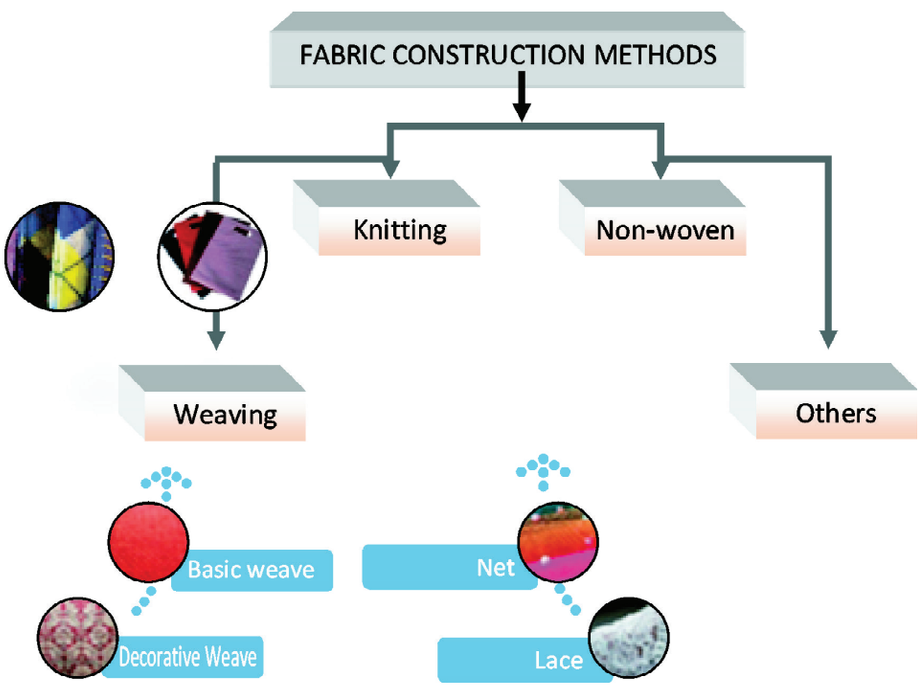



Fig. 7.2: Fabric construction methods

## 7.2 WEAVING

In weaving, fabric is made by interlacing two sets of yarns at right angles to each other.

*Fabric made by weaving is called woven fabric.

Have you ever seen a 'folding bed' being made? On the frame, one set of tape is fixed lengthwise. Another set of tapes are interlaced width wise over and below the previous set of tapes. This kind of an interlacement gives an even check effect. The weaving of a fabric is also done in a similar way, except for the fact that yarns are used for interlacing and a loom* is used to hold the thread instead of a frame.

Loom is a device for making fabric by weaving yarn.

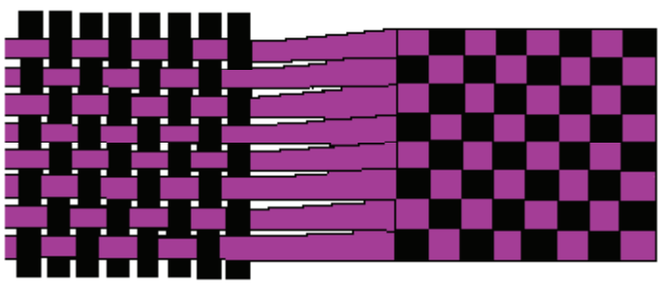


Fig. 7.3: Construction of folding bed

### Common terms in weaving

There are some weaving terms which are frequently used, few of them are labelled in Fig. 7.4

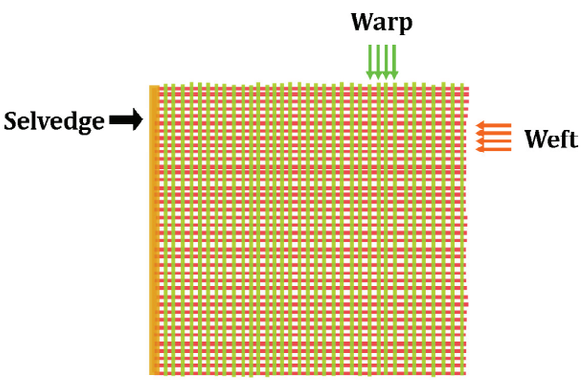



Fig. 7.4: Weaving terms

**Warp:** These are also called as ends or TANA. These yarns runs in length wise direction of the fabrics and are parallel to the selvedge.

**Weft:** These are also called as picks/fillings or BANA. They are perpendicular to the warp yarns.

**Selvedge:** These are the edges that run parallel to warp yarns. It gives strength to the edges of the fabric.

**Thread Count:** It is referred as the total number of warp and weft yarns per square inch of a woven fabric. Fabrics with higher thread count have higher durability than those with lower thread count.

You must have seen dhoti and dupatta, they are the examples of woven fabrics.

## 7.3 TYPES OF WEAVES

Clothes that you use in daily lifehave different woven designs which is due to different types of weaves used in them.

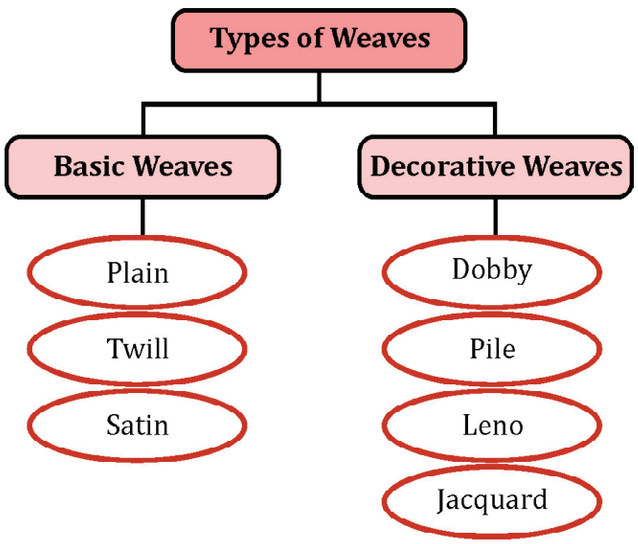
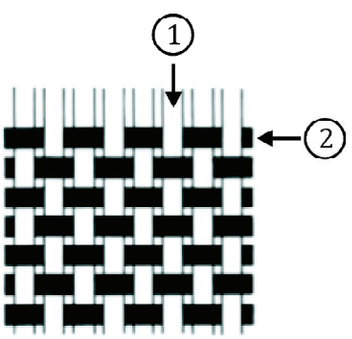


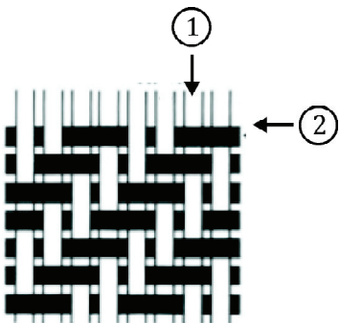
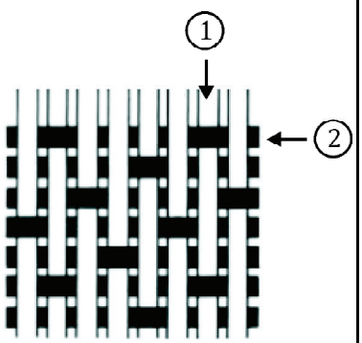

Fig. 7.5: Types of weaves

### A. Basic Weaves

Let us now find out more about the basic weaves, their characteristics, how it is made and the fabrics that made with different weaves. The details are in table 7.1 below.

**Table 7.1: Basic weaves**

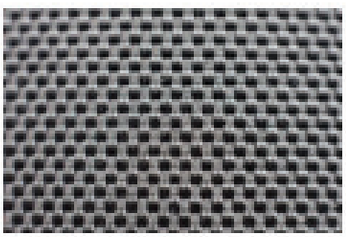
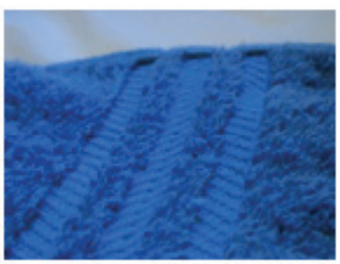
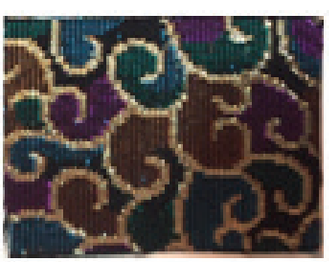
| Basic Weaves | Characteristics | Weave image | Types | Fabric |
|---|---|---|---|---|
| **Plain Weave** | • It is the simplest and inexpensive weave.<br>• Weft yarn goes alternately under and over the warp yarns<br>• Closer the yarns, higher will be the thread count |  <br>1. Warp<br>2. Weft | • Rib Weave<br>• Basket Weave | Dupatta, saree |

| Basic Weaves | Characteristics | Weave image | Types | Fabric |
|---|---|---|---|---|
| **Twill Weave** | • It has a clear diagonal line on the front side of the fabric.<br>• It is a very strong weave |  <br>1. Warp<br>2. Weft | • Herringbone<br>• Diamond<br>• Right hand<br>• Left hand<br>• Pointed | Denim-jeans fabric, gabardine-suits and coat fabric. |
| **Satin Weave** | • It has a beautiful shiny surface<br>• Warp yarns are more visible than fillings on the right side of the fabric.<br>• These visible yarns are called floats.<br>• It is not as strong as plain or twill weave. |  <br>1. Warp<br>2. Weft | • Sateen weave | Chenille fabric, shantoon. |

## B. Decorative weaves

In the previous section, you have learnt about the basic weaves. But we see many fabrics which have complex patterns on them. These are made by using decorative weaves. Let us find more about these weaves. You can see all the details in Table 7.2

**Table 7.2: Decorative weaves**

| Decorative Weaves | Characteristics | Images | Fabrics |
|---|---|---|---|
| **Dobby** | • Contain simple geometric designs.<br>• More textured than plain weave. |  | Dresses, shirts, handbags |
| **Pile** | • Produce fabrics with raised surface.<br>• Extra sets of warps or filling yarns are woven over ground fabric to form loops.<br>• loops may be left uncut, or they may be cut to expose yarn ends |  | Velvets, towels, corduroy, carpets |
| **Leno** | • Also known as Gauze weave<br>• two warp yarns are twisted around the weft yarns<br>• provide a strong yet sheer fabric |  | Dresses |
| **Jacquard** | • Used to create complicated designs<br>• detailed images of objects such as flowers and birds can be made |  | Brocade for dress, saree, curtains. |

## 7.4 KNITTING

Have you seen your mother making sweaters? There is normally one ball of yarn which is interlooped to get a fabric. This technique is called knitting.

Fig. 7.6: Knitting

In construction of knitted fabric, loops are formed. New loops are drawn through these previously formed loops.

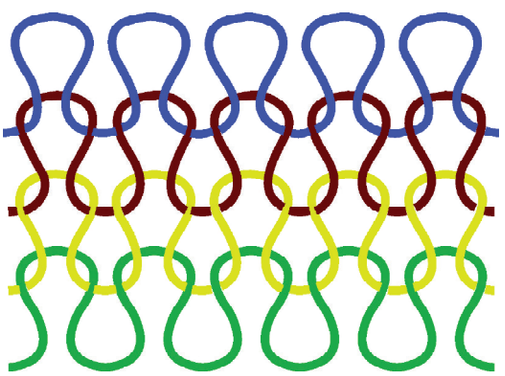


Fig. 7.7: Loop Formation

- Course: The series of loops that are connected horizontally are called as courses.
- Wales: The series of loops that are connected vertically are known as wales.

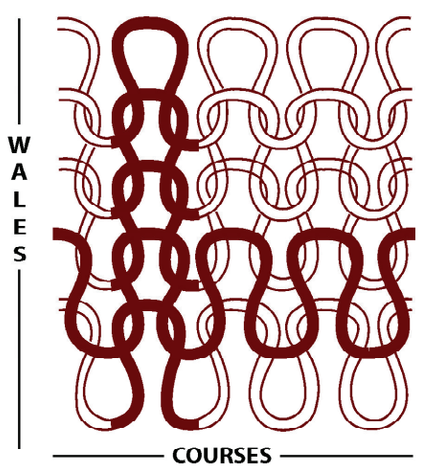



Fig. 7.8: Courses and Wales

Knit fabrics are mainly used for hosiery products such as t-shirts, socks etc.

(a) (b)

Fig. 7.9: (a) Knitted t-shirt (b) Knitted socks

## 7.5 NON-WOVEN FABRICS

These fabrics are made directly from fibres without weaving or knitting. Fibres are held together by mechanical forces, resin or heat. The starting materials for non-woven fabrics are fibres (staple and filament).

(a) (b) (c)

Fig. 7.10: (a) Non-woven fabric (b) Non-woven bags (c) Non-woven mask

## 7.6 OTHERS

### A. Net

They are open-mesh fabrics with geometrical shapes. Net fabric has open spaces between the yarns. You notice it being used very commonly for mosquito nets and now-a-days in dresses also.

(a) (b) (c)

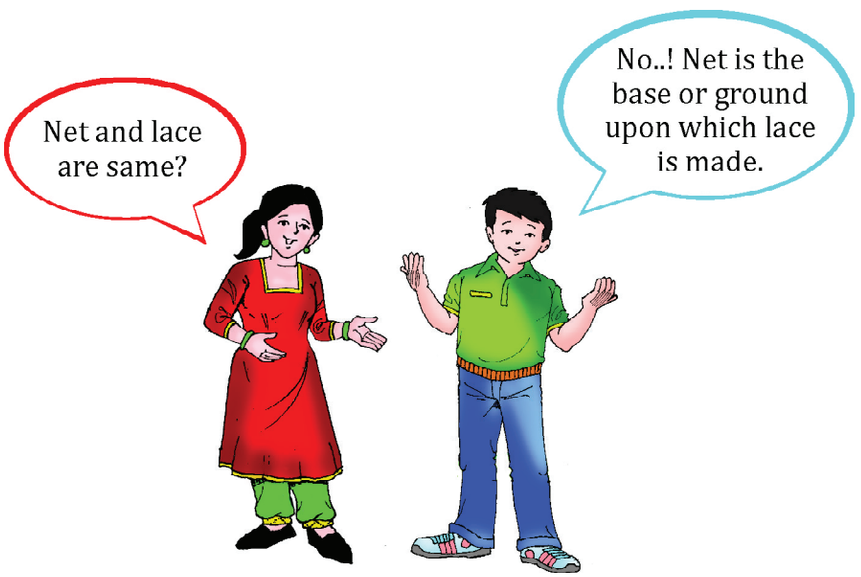
Fig. 7.10: (a) Mosquito net (b) and (c) Net fabric

## B. Lace

Lace is a fabric which consists of decorative designs. Beautiful designs can be created through lace making. It is a very important trimmings that is used to decorate a garment.

(a) (b) (c)

Fig. 7.11: (a) Lace top (b) Lace dress (c) Lace fabric

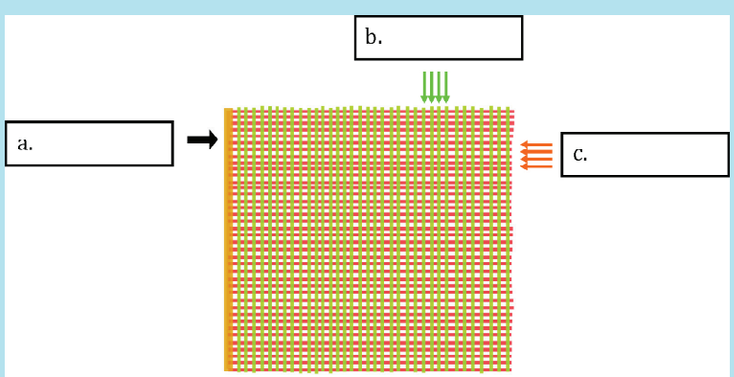



## 7.7 DIFFERENCE BETWEEN WEAVING AND KNITTING

| S. No | Weaving | Knitting |
|---|---|---|
| 1 | Fabric is produced by interlacing minimum two sets of yarns | Fabric is produced by interlooping minimum one yarn. |
| 2 | Requires a loom | Requires knitting needles or a machine |
| 3 | Horizontal and vertical yarns are called weft and warp respectively | Horizontal and verticals loops are called courses and wales respectively |
| 4 | Example: dupatta, saree | Example: T-shirt, socks |

## Know Your Progress 7.1

1. Fill in the blanks with suitable answers:-
   i. Interlacement of two sets of yarns at right angle is called _____.
   ii. The process in which only one set of yarns is interlooped to get a fabric is called _____.
   iii. Total number of yarn per square inch of fabric is _____.
   iv. Non-wovens are directly made from _____.
2. Select and write correct answer:
   (i) Minimum ____ set of yarns are required for weaving.
   a. 1 b. 2
   c. 3 d. 4
   (ii) Horizontal lines in knitted fabric are known as _____
   a. Warp b. Wales
   c. Courses d. Weft
   (iii) Open-mesh fabrics with geometrical shapes are called _____
   a. Non-woven b. Knitting
   c. Net d. Lace
   (iv) Decorative weave with raised surface is _____.
   a. Rib weave b. Leno weave
   c. Satin weave d. Pile weave
   (v) Weave which has clear diagonal lines on the front side of fabric is _____.
   a. Twill weave b. Jacquard weave
   c. Satin weave d. Basket weave
3. Label the diagram given below



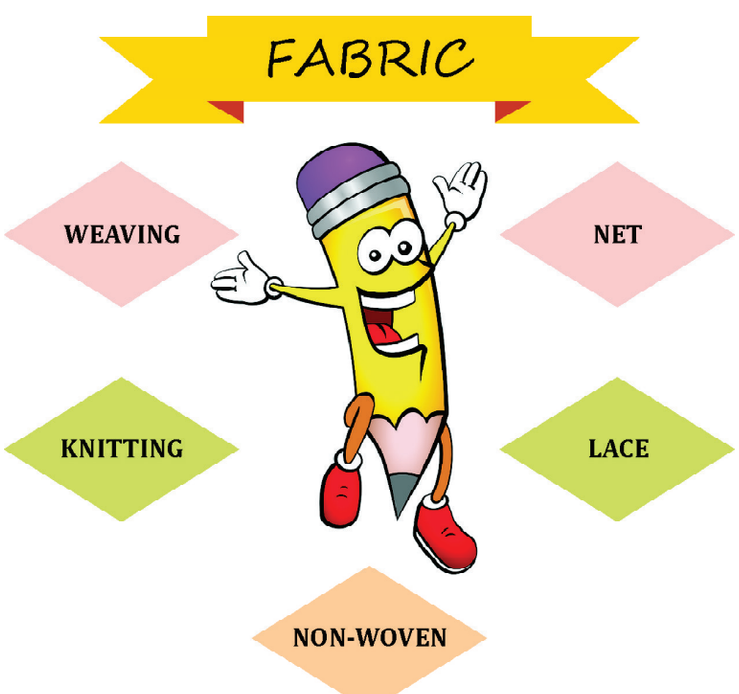

**Fill your score _____ / 22**

## Portfolio Activity 7.1

Collect 10 fabric samples and paste them in your portfolio. Identify the correct category and record them in the given table.

| S. No. | Samples | Weaving | Knitting | Non-woven | Lace | Net |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

## 7.8 THIS IS WHAT YOU HAVE LEARNT



## 7.9 LET US PRACTICE

1. Define the following terms in one line each
   a. warp b. wales
   c. selvedge d. pile weave
2. Write 3 differences between weaving and knitting.
3. Explain twill weave with the help of a diagram.
4. Non-woven are different from weaving and knitting. Support your answer with reasons.

## 7.10 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 7.1**

1. (i) Weaving (ii) Knitting
   (iii) Thread count (iv) Fibres
2. (i) b (ii) c
   (iii) c (iv) d
   (v) a
3. (a) Selvedge (b) Warp (c) Weft

**Your final score is _____ / 22**

## PRACTICAL WORK

### Practical 7.1

Take plain sheets of paper 8 x 8" size in two colours. Make the following weaves:

a. Plain waeave
b. Twill weave
c. Satin weave

Paste these sheets in your Portfolio.

# 8. Fabric Finishes

KEYWORDS

- Textile finish, Routine finishes
- Special finishes
- Scouring Bleaching
- Mercerisation
- Calendering Water proofing

**OBJECTIVES**

- explain the importance of finishes given to fabrics;
- classify finishes according to their properties;
- describe the effect of applying basic and special finishes on fabrics.

## 8.1 WHAT IS A FINISH?

Have you seen a fabric that comes from a loom? It is generally rough to feel, dirty with stains and is known as 'greige' (pronounced as gray) cloth. The 'markin' fabric which we buy for making quilt covers is off-white and is a gray fabric. Whereas most of the other fabrics that we buy from a shop are smooth, neat and clean. Why and what happens in between? Yes, a finish has been applied. Therefore, we can say that

> A finish is anything that is done to a fabric after weaving or knitting, to change it's appearance, hand and performance.

When a finish is applied, say on cotton, it might become shinier, stronger or resist shrinking on washing. Similarly, other finishes may make the fabric softer or stiffer; water or stain resistant; coloured or designed.

'Gray goods' is the term used for fabrics that come directly from the loom and is not given any finish.

Textile finishes are important as they-

- improve the appearance of the fabric through dyeing and printing;
- improve the texture/feel of the fabric- make it softer, crisper;
- make the fabric more useful or suitable for end use- crease resistance, waterproof, fireproof, mothproof;
- improve the draping ability of fabrics.

## 8.2 CLASSIFICATION OF FINISHES

Finishes can be classified as:

a) Temporary and Durable

b) Routine (Basic) and Special

Routine finishes are applied to almost all fabrics with an aim to improve their appearance. Special finishes are applied with a specific purpose or end use in mind.

We come across the problem of fabric losing its stiffness after washing or the fabric crushing badly after wearing. What do you do in such a case? You starch the fabric and iron it after every wash. This is called a temporary finish. That means, these finishes last only till washing or drycleaning but some finishes stay on the fabric for its entire life, eg., resistance to crease or the wash 'n' wear finish. These are not affected by washing, drycleaning or ironing. These finishes are called durable finishes and they cannot be applied at home. Some of the finishes which are durable could also be special or routine.

## Know Your Progress 8.1

1. Fill in the blanks with the appropriate words-
   i) A finish is applied to the fabric to improve its _____, _____, and _____
   ii) Finishes can be classified as temporary or _____ and routine or _____.
   iii) A finish that is applied after every wash is called _____ finish.
   iv) When a finish is applied to almost all fabrics it is termed as _____ finish.
   v) The rough, dirty and stained fabric received from a loom is called _____.

2. **Select the most appropriate answer-**
   i) What does finishing do to a fabric?
      a) Turns yarn into fabric
      b) Turns fibre into yarn
      c) Recycles a fabric used earlier
      d) Adds value to the fabric after manufacturing
   ii) Finishes on fabrics
      a) improve the feel of the fabric
      b) decrease cost
      c) improve yarn count
      d) make a fabric finer

**Fill your score _____ / 20**

## 8.3 SOME COMMON FINISHES

Let us now discuss the basic characteristics of different finishes that can be applied on a fabric.

### A. Routine Finishes

#### i) Scouring/cleaning

Fabrics received as gray cloth have a lot of impurities such as oils, waxes and dirty stains acquired during construction of the fabric, naturally present in them. Complete removal or cleaning of these impurities is important before applying any other finish. This cleaning is called scouring and is done to all fabrics with the help of soap solutions and chemicals. After cleaning, the fabric becomes smooth, neat and more absorbent.

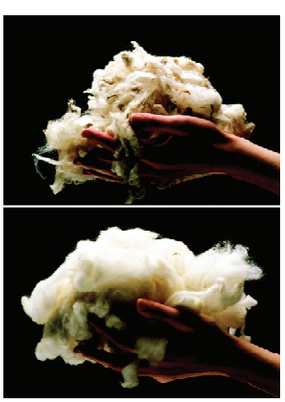


Fig. 8.1: Scouring - cleaning of cotton fibres

### ii) Bleaching

Fabrics made using natural fibres, are not white in colour. To remove the natural colour and make them white bleaching is done. This is also necessary in case of discolouration or stains occurred during manufacturing process. Suitable bleaching agents are used to remove the colour from the fabric. Bleaching is done for cottons, woollens and silks. Synthetics do not need bleaching as they are naturally white. Bleaching has to be done very carefully as the chemical which can destroy the colour may also damage the fabric to some extent. Hydrogen peroxide is a universal bleach which can be applied to all kinds of fabrics.


Fig. 8.2: Common Bleach

### iii) Stiffening

Stiffening means the fabric which is generally limp becomes stiff when a stiffening agent is applied. How do you stiffen your cotton clothes at home? Yes, you use maida starch or rice water. For stiffening silk, gums are used. Stiffening gives body, smoothness and lustre to the fabric. This practice is sometimes used to cheat the customer. You must have observed that sometimes if you rub a fabric between your hands, some white powder comes out and the rubbed fabric becomes limp. It is because the fabric has been over starched. Many time inferior fabrics are over starched to look dense and better.

Fig. 8.3: Starched cuff

### iv) Calendering

Calendering is a mechanical finish. It is essentially an ironing process that adds sheen to the fabric.

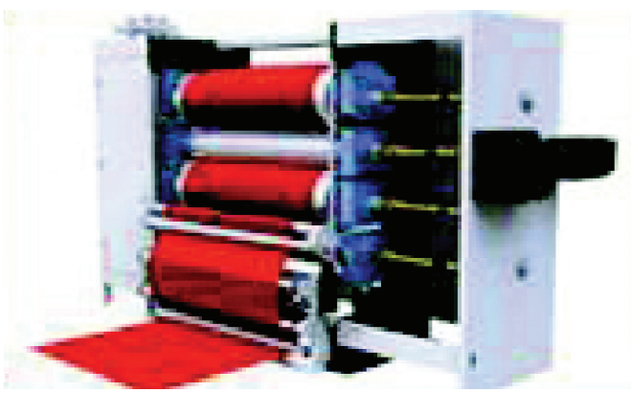


Fig. 8.4: Calendering

## B. Special Finishes

### i) Mercerisation

Cotton is a dull, rough fabric and shrinks after washing. Mercerization is done by stretching the fabric and passing it through chemicals (sodium hydroxide). After mercerization the fabric becomes strong, lustrous and dyes well as it is now more absorbent. This finish also prevents the shrinking of the fabric in the later stages. It is a durable finish. Now-a-days this finish has become almost a routine finish for all cottons. Threads used for stitching are also mercerized.

**Do you know!**

Few cotton fabrics shrink, when you soak then overnight.

This is because they are not mercersied.

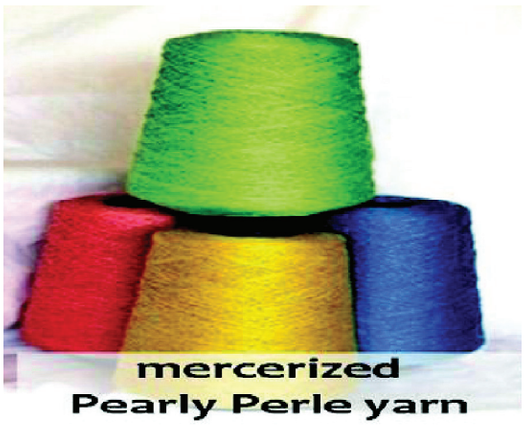



Fig. 8.5: Mercerized Yarn

### ii) Water proofing

Fabrics to be used as raincoats, umbrellas, and tents have to be treated with chemicals to give them a property which makes them water proof. The finish is called waterproofing and it is a durable finish.

Fig. 8.6: Waterproof finish

### iv) Dyeing and Printing

In the market, you see fabrics in plain colours or colourful designs apart from white ones. This process is called dyeing and printing. Dyeing gives a solid colour to the fabric whereas printing is an application of dye at specified areas to create a design.

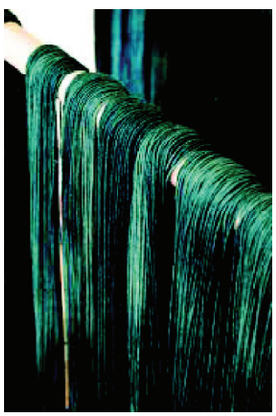


Fig. 8.7: Dyeing yarns

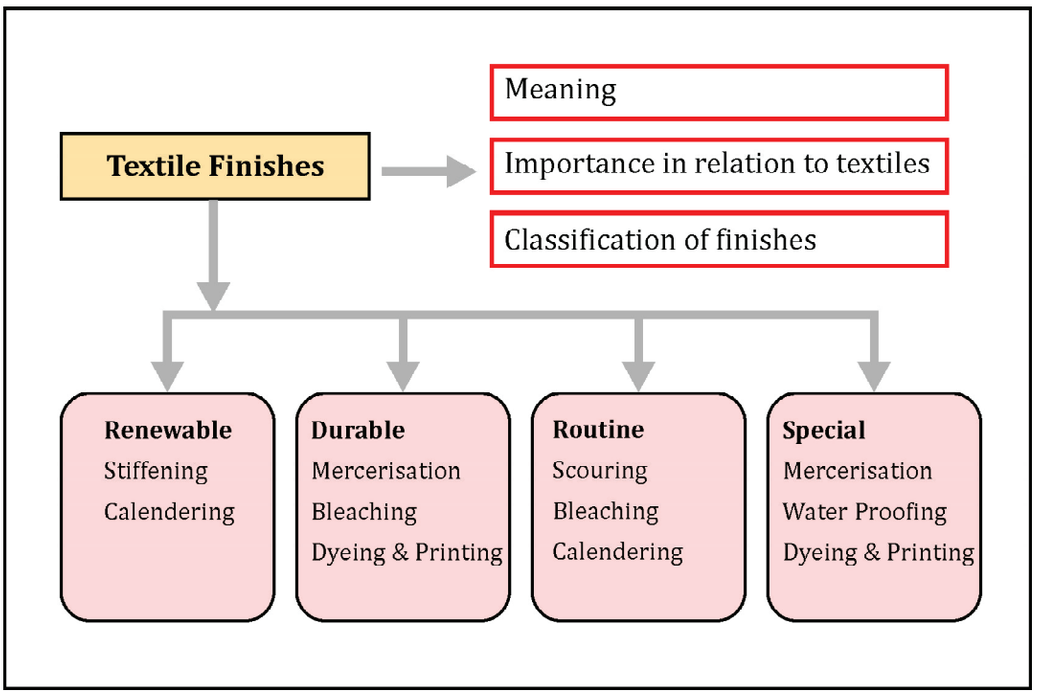
Fig. 8.8: Printing

## Know Your Progress 8.2

1. Write T for the statements that are true and F for those that are false.
   - i) Scouring is a finish used to clean the fabric.
   - ii) Bleaching has no damaging effect on fabric.
   - iii) Threads can also be mercerised.
2. Fill in the blanks by choosing correct words from the bracket.
   - i) Mercerisation is a _____ finish. (temporary/durable)
   - ii) Water proofing is a _____ finish. (routine/special)
   - iii) Calendering is a process of _____. (ironing/washing)
3. Name the finish required to achieve the following qualities in the fabrics.
   - i) a) Strong and lustrous cotton b) It should dye well.
     Finish required .....
   - ii) a) Fabric should not absorb water b) Water should not be able to pass through it.
     Finish required .....
   - iii) a) Fabric becomes stiff b) It develops a crisp hand feel
     Finish required .....
   - iv) a) Natural colour of fabric is removed b) Fabric becomes white
     Finish required .....

**Fill your score _____ / 20**

## 8.4 THIS IS WHAT YOU HAVE LEARNT




## 8.5 LET US PRACTICE

1. What is textile finish? Why is it necessary to apply on fabrics?
2. How does a gray fabric differ from a finished fabric?
3. Describe any two basic finishes and their application.
4. The sewing thread Ritu bought had the label 'mercerised'. Give the advantages of 'mercerisation'.
5. 'Dyeing is finishing with colour'. Explain.

## 8.6 ANSWERS TO KNOW YOUR PROGRESS

**Know Your Progress 8.1**

1. (i) appearance, hand and performance
   (ii) basic, special
   (iii) temporary
   (iv) routine
   (v) gray goods
2. (i) d

(ii) a

**Know Your Progress 8.1**

1. (i) T
   (ii) F
   (iii) T
2. (i) durable
   (ii) special
   (iii) dyeing
3. (i) merecrization
   (ii) water proofing
   (iii) stiffening
   (iv) bleaching

**Your final score is _____ / 40**

## Portfolio Activity 8.1

1. Visit following places in your area where
   A. Dyeing of thread or fabric is done.
   B. Printing of fabric is done.
   C. Starching of fabric or garment is done.
   D. Any other places where other finishes are done.
2. Write your observations as per the following table:

| S. No. | Type of finish | Type of fibre/ fabric used | Finishing agents used | Any other on site information |
|---|---|---|---|---|
| A | | | | |
| B | | | | |
| C | | | | |
| D | | | | |

3. Find out the following safety measures-

- What is source of water used in finishing?
- How they ensure the quality of the raw material like starch/ chemical?
- Where they throw the effluent (remaining water after use)?
- What precaution they take for themselves while indulging in finishing work?
- What is source of information to know the procedure and chemical etc?
- Do they know some organization to have safety certification for different finishes?
- What health risks they may have while working in current situations?

# PRACTICAL WORK

## Practical 8.1

Take any cotton garment (pillow case, shirt, handkerchief) from your home and starch it using rice water / arrow root solution / ready to use starch.

1. Dry the article
2. Iron it
3. Record the procedure that you have used