Clothes are as important as food and shelter. You use them for covering, protecting and even decorating yourself. You must be having different types of clothes for different occasions like your casual attire, office wear, party dresses, your night suit and so on.

Clothes are made from fabrics and today many types of fabrics are available in the market. Do you know what these fabrics are and how they are made? How do they come in so many different varieties? Why do some fabrics shine more than the others? Why are some fabrics light in weight whereas others are heavy? In this lesson you will find answers to these and many other related questions.

OBJECTIVES

After studying this lesson you will be able to:

- state the meaning and establish the scope of fabric science;
- define the term fibre and classify fibres according to their origin and length;
- explain the properties and uses of different types of fibres and;
- identify a fibre type by means of a physical test.

22.1 SCOPE OF FABRIC SCIENCE

Just look around you and pinpoint all the fabrics in your room. You will find that you are not only wearing a fabric, but also sitting on it and perhaps, have a piece of fabric hanging on the wall as a wall hanging or as curtains on the doors. This
means that fabrics not only make your clothes but are also used at home and outside. Can you think of some more uses of fabric? Yes, you are right. Some of the other uses of fabrics at home are in the kitchen as napkins, in the bathroom as towels, on the beds, sofas, and even on our floors as carpets. Fabrics also offer many uses in industry, medical field and even in automobiles.

What is a fabric?

A fabric is any piece of cloth.

A study of all the aspects of a fabric is called fabric science and it explains the behaviour of a fabric under different conditions.

You must have realised that different fabrics are not only different in their appearance but also in their properties, uses and their care procedures. Silk is smooth and shiny, cotton is smooth but dull. Wool is rough, but keeps you warm and cotton is cool to wear. Cotton can be washed easily but needs to be ironed after washing for a neat look. Nylon and polyester also are washed very easily and need almost no ironing after washing. Silk is either dry cleaned or washed with gentle soaps. These and many more concepts of fabrics are explained in fabric science. The market today is flooded with variety of fabrics in all types of colours, textures and designs. They all vary in their price range as well. To be an intelligent consumer, an exposure to fabric science is important as it helps us to understand a fabric better.

22.2 FIBRE

Have you ever wondered what makes a fabric? Find out yourself. Pull out a thread from a fabric and then open it out. You will find that this thread is made of small hair like strands twisted together. This single hair like strand is called a fibre. In other words, the basic unit of a fabric is a fibre.

22.2.1 Classification of Fibres

1. Fibres come as short fibres and long fibres and their length is an important property of fibres. To see a short fibre, take a ball of cotton and pull out fibres from it. Notice that these fibres are quite small. Now try and pull out fibres from a nylon fabric. These, you will see, are longer fibres. The short fibres are called staple and the long ones are called filament.

2. Fibres also can be classified according to their origin. Some fibres are obtained from natural sources i.e. from plants, animals or minerals. These are called natural fibres. The other fibres are manmade.
(i) **Vegetable Fibres**

Fibres that come from plants are called vegetable fibres and can be obtained from different parts of a plant. You must have seen the white cotton fibres growing on plants. These are the seed hair fibres. Cotton is an example of seed hair. Similarly, fibres can be obtained from the stem of a plant e.g. jute and flax, and from the leaves like pineapple fibres. Fibres are also obtained from the outer covering of a fruit, like coir from coconut husk. All the plant fibres are made up of cellulose.

(ii) **Animal Fibres**

Can you name the animals which give us fibres? Sheep is the most common animal whose hair is used as wool. Some other animals are camel, goat, and rabbit. Silk is also an animal fibre. It is the secretion of an insect called the silkworm. Do you know that silk is the strongest natural fibre? The animal fibres are made up of proteins.
(iii) Mineral Fibres

Natural fibres obtained from the minerals are called mineral fibres, e.g., asbestos. You must have seen sheets of asbestos being used as rooftops. Can you think of other uses of asbestos? It is used by firefighters as clothes because it is fireproof.

Natural fibres are usually staple fibres with the exception of silk which is a filament fibre.

(b) Manmade Fibres There is another class of fibres called the manmade fibres. As the name suggests these fibres are not obtained directly from nature but made by using chemicals. Manmade fibres are of two types:

1. Regenerated fibres
2. Synthetic fibres

Let us find out more about man-made fibres.

(i) Regenerated fibres

These are made from natural raw material e.g., cellulose, (waste cotton fibres or wood pulp) or protein depending upon the fibre to be made. This natural raw material is regenerated with the help of chemicals. Rayon is a regenerated cellulose fibre.

(ii) Synthetic fibres

On the other hand Synthetic fibres are obtained from chemical substances and are totally synthetic in nature, e.g., Nylon, Polyester, Acrylic (Cashmilon). Manmade fibres are generally filament fibres. Of course, they can always be cut in to small pieces to form staple fibre, if required.
Let us put the two classifications together:

![Diagram showing the classification of fibres based on length and origin.]

**Fibre**

**On the Basis of Length**
- **Staple** (Short)
  - Cotton
  - Jute
  - Wool
- **Filament** (Long)
  - Silk
  - Nylon
  - Polyester
  - Rayon

**On the Basis of Origin**
- **Natural**
  - Plant
    - Cotton
    - Jute
    - Flax
    - Coir
  - Animal
    - Silk
    - Wool
  - Mineral
    - Asbestos

- **Manmade**
  - Regenerated
    - Rayon
  - Synthetic
    - Nylon
    - Polyester
    - Acrylic
1. The missing words in the following sentences are hidden in the wonder box. The words are written downwards, across and sideways. Find and encircle these words and complete the sentence.

### WONDER BOX

<table>
<thead>
<tr>
<th>X</th>
<th>S</th>
<th>Y</th>
<th>Z</th>
<th>B</th>
<th>A</th>
<th>C</th>
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<tbody>
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<td>I</td>
<td>A</td>
<td>K</td>
<td>D</td>
</tr>
</tbody>
</table>

a) A fabric is any piece of ______
b) Short fibres are called ______ and long fibres are called ______.
c) Fibres are the ______ ______ of a fabric.
d) Fibres can be classified into natural and ______.
e) Manmade fibres can be ______ or synthetic.
f) Wool is a ________ fibre obtained from ________.
g) Polyester is a __________ fibre.
h) Cotton comes from the __________ of a plant.

2. Match column A with column B

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Rayon</td>
<td>i) Synthetic fibre</td>
</tr>
<tr>
<td>b) Cotton</td>
<td>ii) Stem fibre</td>
</tr>
<tr>
<td>c) Silk</td>
<td>iii) Regenerated fibre</td>
</tr>
<tr>
<td>d) Nylon</td>
<td>iv) Natural cellulosic fibre</td>
</tr>
<tr>
<td>e) Wool</td>
<td>v) Leaf fibre</td>
</tr>
<tr>
<td>f) Jute</td>
<td>vi) Animal fibre</td>
</tr>
<tr>
<td>g) Asbestos</td>
<td>vii) Animal secretion</td>
</tr>
<tr>
<td></td>
<td>viii) Mineral fibre</td>
</tr>
</tbody>
</table>
Table 22.1: Properties of Fibres

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>It is staple fibre, generally coarser fabrics like cloth, blankets, etc., are made of raw cotton. May appear dull and lack lustre.</td>
<td>Dull, wavy and rough fibre.</td>
<td>Good conductor of heat and keeps it warm.</td>
<td>Strong fibre, becomes weaker when wet.</td>
<td>The creases hang out.</td>
<td>Wrinkles and creases very easily.</td>
<td>Summer wear for shirts, sportswear, and sweaters. Due to high costs and lining, it is used for coats, blankets, and men’s ties, scarves, etc.</td>
<td></td>
</tr>
<tr>
<td>Rayon</td>
<td>Filament fibre, so can be obtained in any desired length.</td>
<td>Smooth, shiny and straight, so does not show dirt easily.</td>
<td>Poor conductor of heat.</td>
<td>Poor conductor of heat.</td>
<td>Wrinkles and creases very easily.</td>
<td>Wrinkles and creases very easily.</td>
<td>Summer wear-knitted into fabric, ready-to-go, books, etc. But it is quickly damaged while washing.</td>
<td></td>
</tr>
<tr>
<td>Silk</td>
<td>It is filament fibre and longest of all natural fibres.</td>
<td>Soft and smooth fibre.</td>
<td>Poor conductor of heat.</td>
<td>Poor conductor of heat.</td>
<td>Wrinkles and creases very easily.</td>
<td>Wrinkles and creases very easily.</td>
<td>Summer wear-knitted into fabric, ready-to-go, books, etc. But it is quickly damaged while washing.</td>
<td></td>
</tr>
<tr>
<td>Polyacetyl (Cotton)</td>
<td>Same as rayon.</td>
<td>Smooth and shiny, resistant to dirt and easy to wash.</td>
<td>Poor conductor of heat.</td>
<td>Poor conductor of heat.</td>
<td>Wrinkles and creases very easily.</td>
<td>Wrinkles and creases very easily.</td>
<td>Winter wear, very popular for making coats, ties, and home furnishings.</td>
<td></td>
</tr>
</tbody>
</table>

Characters

Cotton: Length of the fibre as rayon.
Rayon: It is a man-made fibre.
Silk: It is a filament fibre, so it can be obtained in any desired length.
Polyacetyl (Cotton): Same as rayon.
Acryllic (Cotton): Same as rayon.

Properties

1. Length of the fibre: The length of the fibre can vary, with cotton being the longest of the natural fibres.
2. Appearance: The appearance of the fibre can affect how it looks and feels.
3. Moisture absorption: The ability of the fibre to absorb moisture can affect its feel and performance.
4. Heat conduction: The fibre's ability to conduct heat can affect its temperature and comfort level.
5. Strength: The fibre's strength can determine how well it can withstand wear and tear.
6. Resilience: The fibre's resilience can affect how easily it can be washed and how well it can hold its shape.
7. Uses: The fibre's uses can depend on its properties and how it is used.
22.4 IDENTIFICATION OF FIBRES

The vast variety of fabrics available today, makes their identification important. You know that variety is created by using different fibres in combination. Knowledge of the fibre content of a fabric is therefore necessary to know its suitability, use and care. Sometimes you may have been cheated by an imitation fibre, like a fabric looking like silk but turning out to be artificial silk or imitation silk. Labels and salespersons are not always able to guide you.

Burning test is a simple and reliable test and can be done alongwith the visual inspection of the fabric. It can help you to choose the fabric according to your requirements. The burning test does not identify the fibre in particular but indicates its group. Cotton, flax and rayon will have similar results when burnt as they are all basically cellulosic in nature.

a) Visual Inspection

You can identify a fabric by its appearance but accuracy in identifying comes through experience. The appearance properties of different fibres given earlier in this lesson can help you in identifying a fabric e.g., Silk is smooth, shiny and fine. Cotton is also smooth but looks dull, wool is most definitely rough.

b) Burning Test

To conduct the burning test, take a small piece of fabric (2 x 2cm) and hold it with a pair of forceps. Then do the following:

![Fig. 22.6](image-url)
## Introduction to Fabric Science

### TEXTILES AND CLOTHING

**Table 22.2: Burning Test of Fibres**

<table>
<thead>
<tr>
<th>Name</th>
<th>Residue</th>
<th>Odour</th>
<th>Approaching Flame</th>
<th>Removed From Flame</th>
<th>Odour Removed From Flame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose fibre – Linen</td>
<td>Light, feathery, grey in colour</td>
<td>Light, fluffy, very small amount</td>
<td>Does not shrink</td>
<td>Burns, continues burning, shows an afterglow</td>
<td>-do-</td>
</tr>
<tr>
<td>Cotton, Linen</td>
<td>Flame does not appear</td>
<td>Flame does not appear</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Cellulose fibre – Rayon</td>
<td>Flame does not appear</td>
<td>Flame does not appear</td>
<td>Curls away from the flame.</td>
<td>Burns slowly and melts</td>
<td>-do-</td>
</tr>
<tr>
<td>Rayon</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>Synthetic or chemical odour.</td>
</tr>
<tr>
<td>Protein fibre – Wool</td>
<td>Small black bead, brittle, crushable</td>
<td>-do-</td>
<td>Curls away from the flame.</td>
<td>Burns slowly and melts</td>
<td>-do-</td>
</tr>
<tr>
<td>Silk</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>Synthetic or chemical odour.</td>
</tr>
<tr>
<td>(b) Manmade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellulose fibre – Rayon</td>
<td>Flame does not appear</td>
<td>Flame does not appear</td>
<td>Curls away from the flame.</td>
<td>Burns slowly and melts</td>
<td>-do-</td>
</tr>
<tr>
<td>Rayon</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>Synthetic or chemical odour.</td>
</tr>
<tr>
<td>Protein fibre – Wool</td>
<td>Small black bead, brittle, crushable</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>Synthetic or chemical odour.</td>
</tr>
<tr>
<td>Silk</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>Synthetic or chemical odour.</td>
</tr>
<tr>
<td>Synthetic – Polyester</td>
<td>Irregular black beads, hard but crushable</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>Irregular black beads, hard but crushable</td>
</tr>
<tr>
<td>Nylon</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Acrylic</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
</tbody>
</table>

### INTEXT QUESTIONS 22.2

1. Choose the correct answer. Give reasons for your choice.
   
   i) Which of the fabrics is most suitable for winters?
      
      a) Cotton      b) Nylon      c) Wool      d) Polyester
Introduction to Fabric Science

Reason ..........................................................................................................................
..................................................................................................................................

ii) Which is the strongest fibre?
    a) Silk    b) Nylon    c) Acrylic    d) Polyester
Reason ..........................................................................................................................
..................................................................................................................................

iii) Which fabric will require least ironing after washing?
    a) Cotton    b) Rayon    c) Silk    d) Polyester
Reason ..........................................................................................................................
..................................................................................................................................

iv) When cotton burns the odour is that of-
    a) Burning paper    b) Burning hair
    c) Acid    d) Chemical
Reason ..........................................................................................................................
..................................................................................................................................

v) Synthetics, when brought near the flame will-
    a) Curl away    b) Melt and shrink
    c) Catch fire but not melt    d) Remain unaffected.
Reason ..........................................................................................................................
..................................................................................................................................

vi) Residue of burnt rayon is
    a) Hard bead-like, not crushable
    b) Crushable bead-like
    c) Light grey, feathery
    d) Fluffy, small amount.
Reason ..........................................................................................................................
..................................................................................................................................

3. Give Reasons
   i) Cotton is suitable for summer wear and undergarments.
   ii) Nylon is used for making ropes
   iii) Nylon garments are uncomfortable in summers.
WHAT YOU HAVE LEARNT

FABRIC SCIENCE

FABRICS
- CLOTHES
- HOUSEHOLD ITEMS
- INDUSTRY
- MEDICAL USE
- AUTOMOBILES

Basic Unit

FIBRE

PROPERTIES
- LENGTH
- APPEARANCE
- ABSORBENCY
- CONDUCTIVITY
- STRENGTH
- RESILIENCE

IDENTIFICATION

CLASSIFICATION

BURNING TEST

On Basis of LENGTH
- Staple
- Filament

On Basis of ORIGIN
- Natural
  - Plant
  - Animal
  - Mineral
- Manmade
  - Regenerated
  - Synthetic
INTRODUCTION TO FABRIC SCIENCE

TERMINAL EXERCISES

1. Define a fabric and elaborate on its various uses.
2. Classify fibres on the basis of their origin.
3. Name the fabric which is suitable for summer wear and state its important properties.
4. How will you identify a rayon fibre?
5. Distinguish between natural and manmade fibres.
6. Complete the following flow chart:

   Fibre (on the basis of origin)

   Natural
   (i)
   Plant
   (ii)  (iii) Synthetic
       (iv)

ANSWERS TO INTEXT QUESTIONS

22.1

WONDER BOX

```
X S Y Z B A C E G R
B Y E D U F H J L E
A N A I I Y A A H G
S T A P L E C S H E
E H N D A D H H N
E E I S I O M E A
D T M E N N O L E A R
H I A E G A H P N A
A C L M B A K I M T
I Y O C L O I H A E
R G O A O A S H D D
A M D U C O C Q E R
R P A A K G T R Y A
B S R T S E I A K D
```
2. a) and (iii)  
b) and (iv)  
c) and (vii)  
d) and (i)  
e) and (vi)  
f) and (ii)  
g) and (viii)

3. (i) Manmade (ii) Animal (iii) Mineral (iv) Regenerated

22.2

1. i) c, because wool is bad conductor of heat  
   ii) b, because it has excellent resistance to rubbing and does not lose strength when wet  
   iii) d, because it has excellent recovery from creasing and wrinkling  
   iv) a, because it is cellulosic in nature  
   v) b, because it is made up of chemicals  
   vi) d, because it has cellulose as its raw material

2. i. It is cool and absorbant.  
ii. It is the strongest fibre.  
iii. Nylon does not absorb moisture.

For more information

Log on to http://www.fabriclink.com/fabriccare.html