1. WOOL
NATURAL PROTEIN FIBER

Do You Know ?

- *Which textile fiber is believed to be used first by mankind ?*
- *Have you ever thought of why do you feel warm when you wear woollens ?*
- *Unlike other fibers why do wool fiber stretches easily ?*

Let's find out answers to such questions & learn in detail about the wool fiber in this lesson

1.1 Introduction

Wool is hair on the body of sheep. Its scaly surface and wavy crimp makes it different from other types of fibres. These are composed of protein and so are included in natural protein fibres. The richest source of wool is sheep. This type of wool is soft, elastic and warm.

The pelts of sheep were among the first clothing worn by prehistoric man. It was probably used long before it was discovered that fibres could be spun into yarns or felted into fabric. Scientist believe that wool is in use from 6000 B.C. to 4000 B.C. Ancient shepherds in the first century AD discovered that Merino sheep could be bred to obtain good quality wool.

In India wild sheep were found on the plains of Ganga – Yamuna even before one million years ago. Fossils of sheep were also found in the ruins of Mohenjo daro. It is believed that the Aryans were the first people who reared sheep in Punjab, Tibet and Central Asia. In Mugal era sheep rearing was the main profession of poor peasants. Carpet industry was the main sector which was developed in these days.

Wool producing countries.

Many countries have sheep and produce wool, but four countries mainly Australia, New Zeland, South Africa and Argentina dominate the world trade in wool. These countries along with Uruguay are all in southern half of the world and export nearly all their wool to the countries of the northen hemisphere.

Other chief wool producing countries are Soviet Union, United States, China, India, British Isles.

Sheep is found nearly in all states of India. Jammu – Kashmir, Rajashtan and Gujarat produce more wool than Bihar, Andhra Pradesh, Himachal Pradesh and Maharashtra.

1.2 Types of Wool Fibers

Wool fiber is classified according to it's origin, quality and age of sheep. Some major types are as follows :

Picture No. 1.1 Merino Sheep

- **Merino wool :** It is the best quality wool obtained from Merino sheep. The fibre length of Merino wool is relatively short ranging from one to five inches, but the

fibre is fine and elastic. Merino fibre has the greatest amount of crimp of all wool fibres. It has maximum number of scales. Crimps and scales of Merino wool are the two main factors which contribute to its superior warmth and spinning qualities. These fibres produce the best type of woollen clothing.

Crimp is the natural waviness found in wool fiber.
It is responsible for the elasticity, bounce and resiliency in wool.

- **Lamb's wool :** The first fleece sheared from a lamb about six to eight months old is known as lamb's wool. It is also referred to as fleece wool or first clip. This wool is of very fine and soft quality. Lamb's wool is not as strong as fully developed wool of the same sheep.

Internet my friends

Find out information about various breeds of sheep which give wool fiber from different states of India.

- **Hogget wool :** Wool which is obtained from sheep twelve to fourteen month sold that have not been previously shorn is called as Hogget wool. These fibres are fine, soft, resilient, mature and have good strength.
- **Pulled wool :** When sheep are slaughtered for meat, their wool is pulled from the pelt. Such fibres are called Pulled wool. The fibres obtained are of inferior quality as these sheep are raised for meat, & also the roots of the fibres are damaged while pulling the fibres.
- **Wether wool :** Any fleece clipped after the first shearing is called Wether wool. It is generally older than fourteen months. These wool fibres contain soil and dirt. It is clipped from sheep older than fourteen months.
- **Taglocks :** These are obtained from torn, ragged or discoloured parts of fleece. It is low in quality and is used in producing cheap, coarse woolen fabric.

Fleece is a thick covering of wool on a sheep.

1.3 Manufacturing process of wool

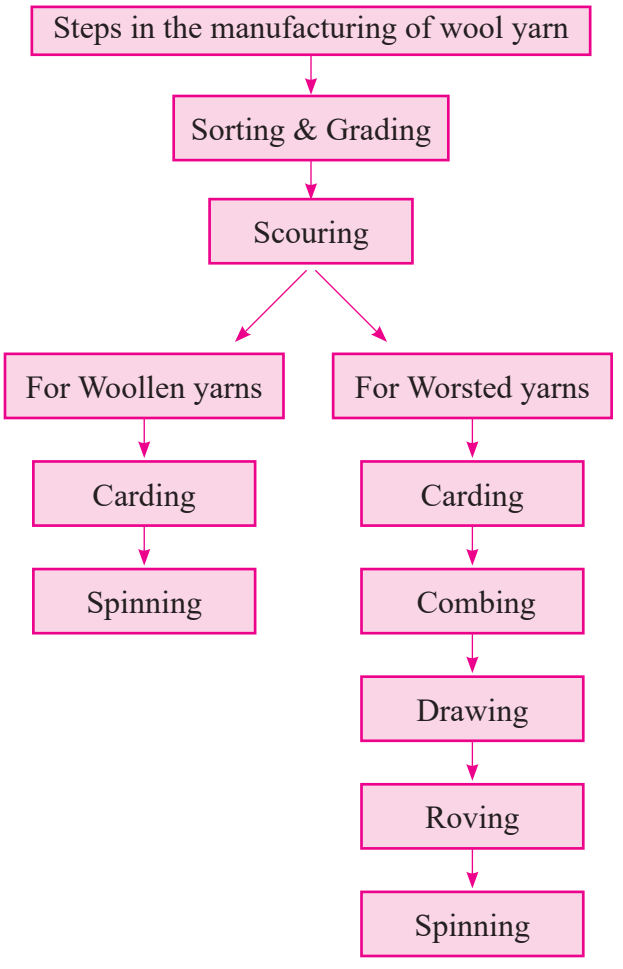
To Produce finest quality wool, manufacturer control production carefully and scientifically. Sheep are inoculated against diseases and fed nutritionally balanced diet.

Do You Know ?

The removal of sheep's hair is known as 'Shearing', because previously big scissors called shears were used for the purpose. Nowdays, electic razors are used.

Sheep are always sheared in spring season.

Chart No. 1.1



- **Sorting and grading :** Wool sorting is done by skilled workers. Fibres are graded by type, length, fineness, elasticity, strength, colour.
- **Scouring :** In raw state, wool contains oil and grease and other impurities In this step it is thoroughly washed to remove grease and impurities to obtain clean wool. It is cleaned with alkaline reagents, soap and hot water solution. During this process natural grease is removed and wool looses more than 30 percent of its weight.
- **Carding :** Wool fibres can be manufactured into two kinds of yarns, woollen and worsted. Manufacturing process for woollen or worsted yarns differ from this step onwards. Carding makes fibre arrangement somewhat in crisscross manner to provide fuzzy effect. Woollen yarn may be carded several times, but it is not combed. A short fibre is not taken out of the sliver and has slacker twist than worsted yarns. After carding process, woollen slivers go directly to spinning operation.
- **Woollen yarn :** In the manufacture of woollen yarns, wool fibres are passed through the rollers, covered with five wire teeth which revolve in the opposite direction. This action distangles the fibres and also removes some foreign matter or dust. Wool fibres tend to lie parallel after being brushed which is not desirable as it results in smooth yarn. Woollen yarns are some what fuzzy, hairy and rough. By use of oscillating device, one thin film or sliver is placed diagonally and overlapping another sliver. This makes fibre arrangement somewhat in crisscross manner to provide fuzzy effect and at the same time make them parallel to some extent. Woollen yarns may be carded several times, but it is not combed. Short fibres are not taken out of the silver and has slacker twist than worsted yarns. After carding process, woollen slivers go directly to spinning operations.
- **Worsted yarn :** In the manufacture of worsted yarn the wool fibres are distangled, straightened and made to lie parallel & made into sliver or a round rope.
- **Combing :** The carded wool undergoes combing processes. This process removes short fibres called **noils** from the sliver. It further straightens the remaining longer fibres called **tops**, and make them parallel. It also removes remaining impurities & then made into sliver.
- **Drawing :** Drawing is done only to worsted yarns. This process draws, drafts, twists and winds the stock. It makes slivers more compact and converts them into slubbers.
- **Roving :** It is the final stage before spinning. A light twist is imparted in this operation to hold thin slubbers intact.
- **Spinning :** Spinning puts in the required twist. The resultant yarn is wound on the spools.

Table No. 1.2

Difference between Woollen Yarn & Worsted Yarn

	Woollen yarn		Worsted yarn
1.	Made of short, curly fibres	1	Made of long, straight fibres
2.	Carded only	2.	Carded and combed
3.	Slack twist	3.	Tight twist
4.	Weaker yarns	4.	Greater strength than woollen yarns
5.	Fuzzy and thick	5.	Smooth and fine
6.	Soft yarns	6.	Harder than woollen yarn
7.	Used to makes warm fabrics	7.	Less warmer than woollen
8.	Yarns are used for making Sweaters, Blankets, Jackets	8.	Yarns are used for making tailored & dressy wear like suits, coats etc.

1.4 Properties of wool fibre

Microscopic Properties :

Under the microscope, the length of the wool fiber clearly shows scales like structure. These scales resembles the scales of fish or reptile scales and provide warmth, elasticity and felting properties to wool.

Microscopic characteristic of wool

- Scales are seen
- Uneven diameter
- Slight luster

For microscopic diagrams refer to practical no. 6.

Let's do it

Find out more information regarding scales of wool & discuss in your class.

Physical Properties :

- **Length :** Wool fibers vary in length from 1 to 20 inches. Most fibers are from 1 to 8 inches. Generally fine wools are shorter than coarse wools. Short wool fibers are 1 to 4 inches. They are termed as **Noils.** Long wool fibers are 4 to 8 inches. They are termed as **Tops.**
- **Luster :** Luster of wool varies considerably. Luster varies with origin, breed of animal and with climate. Many wools have excellent luster (carpet wool). Finest grades of wool do not have as high luster as the poorer grades. Since fine wool have more scales than coarse wools, reflection of light is less form these fibers.
- **Strength :** Strength of wool is much less than cotton and silk. It loses 10 to 20 % of its strength when wet. Due to this weakness it requires special care while laundering.
- **Elastic recovery and elongation :** Wool has excellent elasticity and extensibility. One might look upon wools' elasticity as a compensation for its relative weakness. This characteristic reduces the damage of tearing under tension and contributes to free body movements.
- **Resiliency :** The resiliency of wool is exceptionally good. It will readily spring back into shape after crushing or creasing.
- **Density :** The fiber is comparatively low in density and produces fabrics that are warm but comfortable. The density of wool is 1.30 – 1.32 gm/cc.
- **Moisture absorption :** Wool fibers are more hygroscopic than any of the vegetable fibers, and slightly more than silk. Due to this characteristic, wool can be dyed very easily in variety of shades.

You Should Know !

The scales present on wool fibres do not allow our body warmth to go out and also do not allow the outer cold air to reach our body. that is why we feel warm when we wear woolens.

Can you Tell ?

Why woollens are used for sportswear?
Woollens do not require frequent ironing why ?
Woollens can be dyed easily in variety of shades. Why ?
Hint : Answer to these questions lie in the property of wool.

Biological Properties :

- **Effect of mildew :** Being a protein fiber, wool is not ordinarily susceptible to mildew, but if left in a damp condition, mildew develops.
- **Effect of moth :** Wool protein is called as keratin. As wool is a protein & may be considered a modified food product, it is attacked very easily by several types of insects. Due to less resistance to moth, garments needs special precautions to prevent damage before storing for a season.

Thermal Properties :

Effect of Heat : Wool gets damaged and looses its softness and bounce due to heat. Warm water and moderate temp of iron should be used. Wool burns slowly in the presence of flame with a slight sputtering. Fibers burn with a smell similar to burning hair or feather and leaves crushable residue.

Heat conductivity : It has poor heat conductivity and hence are suitable in winter because they keep the body warm.

Can You Answer ?
Woollens should not be ironed with hot iron. Why ?
Sweaters and blankets are made up of wool. Why ?
Hint : Answer to these questions lie in the property of wool.

1.5 Uses of wool

Wool fibers are naturally crease resistant flexible, elastic, absorbent, warm and comfortable. Due to many such desirable properties it is widely used for apparel purposes.

- **Apparel Uses :** The most important use of wool is for apparel : Coats, jacket suits, dresses, skirts made from woven fabrics of varying weights. Wool is important in knitwear – especially sweaters, slacks, socks and for sportswear, caps, stockings, hand gloves, scarves etc. When blended with cotton, wool contributes warmth, resilience and drapability and cotton adds strength and reduces the cost of fabric. Blends of different synthetic fibers such as nylon, acrylic and polyester with wool are important for variety of end uses.

Picture No. 1.2 Apparel Uses

- **Household Uses :** In home furnishing area the major use of wool is in carpets and rugs. High quality curtains, blankets , upholstery fabrics are also made from wool fibers.

Picture No. 1.3 Household Uses

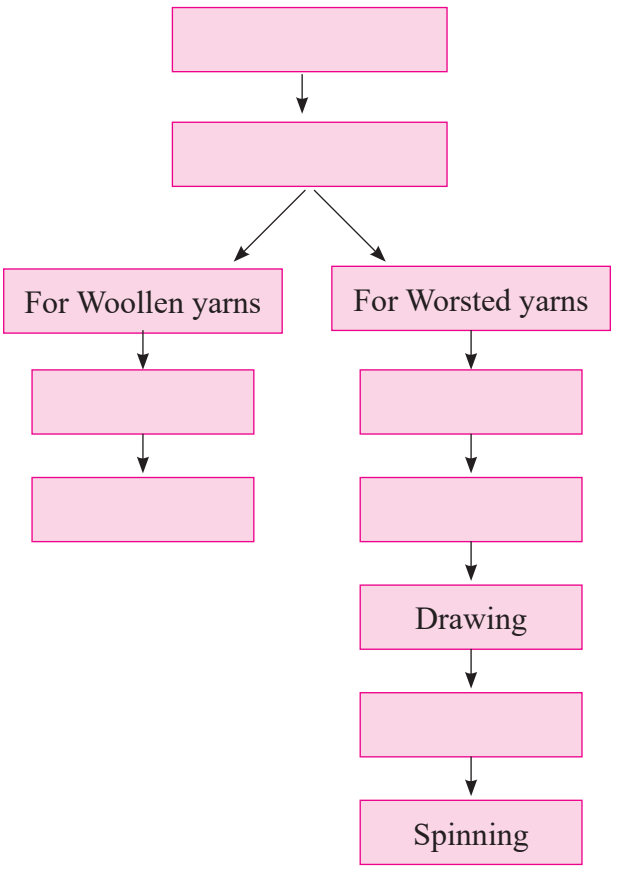
- **Industrial Uses :** Wool fiber is important in felts. These are used under heavy machinery to help decrease noise and for variety of other uses.
- **Miscellaneous Uses :** Felts are used for making rugs, hats, wallets, shoes & fancy articles like toys etc. Kashmiri rugs called **Namdas** are made from felt.

Picture No. 1.4 Namda Carpet

Use Your Brain Power

1. Can you complete steps in flow chart of wool manufacturing.

Steps in the manufacturing of wool yarn



Do You Know ?

abric made from wool. When heat moisture and pressure is applied to wool fibers they interlock with each other to form a sheet like fabric. This process is called as Felting and the fabric thus made is known as 'Felt'

2. Some terms are jumbled up below. Find out the correct word and write it in given space

1.	Distinct feature in microscopic appearance	C L S E A S	_____
2.	Short wool fiber	L S N I O	_____
3.	Best quality wool	E I O M R N	_____

3. Complete the given table :

Properties	**wool fiber**
Mircoscopic (appearance)	.....
Strength	.....
Elasticity	.....
Moisture absorption	.....
.....	Light in weight
.....	Easily affected by insects
Length	.....
Luster	.....

EXERCISE

Objective Type Questions

I. Match the pairs

A		B	
1.	Woollen Yarns	a.	Scales
2.	Warmth	b.	Fine & smooth
3.	Worsted yarns	c.	Alkaline wash
4.	Scouring	d.	Thick & Fluffy
		e.	Lubricants.

A		B	
1.	Tag locks	a.	12 to 14 months old sheep
2.	Merino wool	b.	Dead sheep
3.	Hogget wool	c.	Torn, ragged fleece
4.	Pulled wool	d.	6 to 8 months old sheep
		e.	Best quality wool

II. State Whether the following sentences are true or false.

1. Wool is hair of sheep.
2. Carding is alkaline washing of wool fiber.
3. Wool is natural cellulosic fiber.
4. Noils are short wool fibers.
5. Merino wool is inferior quality wool.
6. Lamb's wool is referred as first clip.
7. Tag locks are obtained from discolored, torn fleece.
8. Wool fiber is suitable in summer.
9. Pulled wool is superior in quality.
10. Woollen yarns are carded as well as combed.

Multiple Choice Questions

III. Select and write the most appropriate answer from the given alternative.

1. Wool protein is called
   a) Sericin b) Fibroin c) Keratin
2. Natural protein fiber
   a) Wool b) Cotton c) Linen
3. Felt fabric is made up of
   a) Cotton b) Wool c) Silk
4. Wool obtained from the dead sheep
   a) Merino wool b) Lamb's wool
   c) Pulled wool
5. Burning wool smells like burning
   a) Paper b) Hair
   c) Chemical
6. Under the microscope surface of wool shows
   a) Twist b) Spots c) Scales.
7. Resiliency of wool is
   a) excellent b) Poor c) Medium
8. Wool obtained from 12 to 14 months old sheep
   a) Lamb's wool b) Hogget wool
   c) Tag locks
9. Heat conductivity of wool is
   a) Poor b) Good c) Medium
10. Removal of hair from sheep is known
    a) Sorting b) Shearing
    c) grading

Short Answer Type Questions

- **State whether the following sentences are true or false and explain :**
  1. Wool has good resistance to mildew
  2. Wool has high wet strength
  3. Elasticity of wool is good.
  4. Woollen garments provide warmth
  5. Woollen garments are ironed with very hot iron.

- **Circle the odd word**
  1. Carding, Combing, Retting, Drawing
  2. Merino wool, Hogget wool, Taglocks, Lamb's wool

- **Name the following :**
  1. Short wool fiber
  2. Best quality wool
  3. Wool obtained from 6 to 8 months old lamb
  4. Name of wool protein
  5. Long wool fiber
  6. Wool obtained from 12 to 14 months old sheep
  7. Distinct feature in microscopic appearance of wool.
  8. Wool fiber obtained from dead animal
  9. Wool fiber obtained after first shearing
  10. Torn, ragged, discoloured wool fibers.
  11. Removal of the hair from sheep.

- **Differentiate between the following :**
  1. Woollen yarns and worsted yarns.

- **Give Reasons :**
  1. Woollen garments are used in winter.
  2. Wool should be ironed with low temperature.
  3. Special precautions are required while storing woollen for season.
  4. Woollens should be laundered with care.
  5. Woollens do not crease easily.
  6. Woollens are suitable for sportswear.
  7. Woollen can be dyed easily in variety of shades.

- **Answer in short :**
  1. What is felting ?
  2. Write biological properties of wool.
  3. Write Thermal properties of wool.
  4. Write about resiliency & moisture regain of wool.
  5. Explain microscopic appearance of wool.
  6. Write about length & luster of wool.
  7. Write Density & Elasticity of wool.
  8. Explain Merino wool.
  9. Explain Pulled wool.
  10. Explain Hogget wool.
  11. Explain Lamb's wool.
  12. Explain Scouring of wool.

- **Write short notes :**
  1. Uses of wool
  2. Explain carding & combing of worsted yarns

Long Answer Type Question

1. Explain types of wool fiber

Self-study / Study tour / Project

1. Visit a mendhi farm & observe machine shearing of sheep and write a report of your visit.
2. Gather information regarding mothproof bags & other moth repellents available in market.