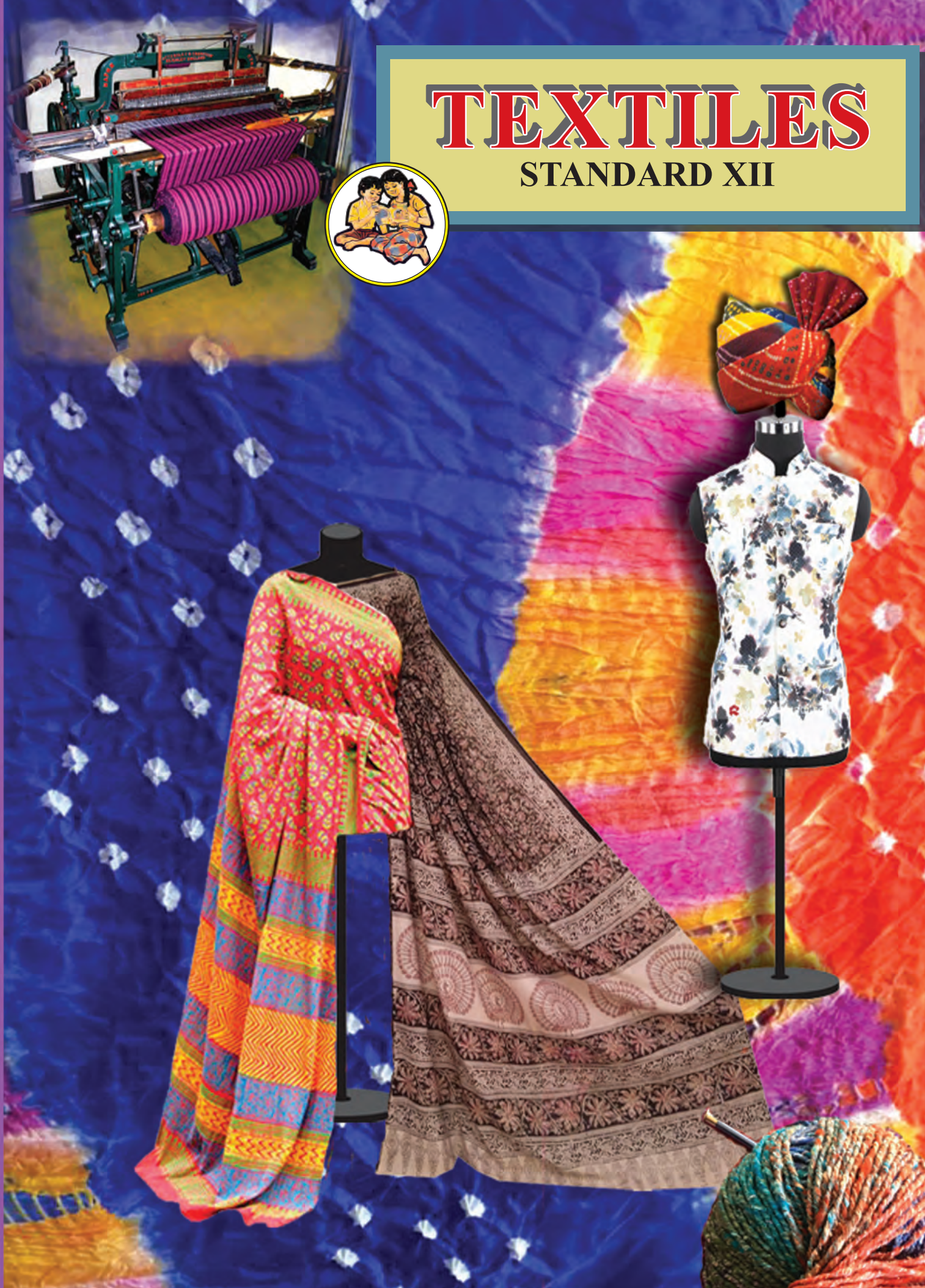

TEXTILES

STANDARD XII

The Constitution of India

Chapter IV A

Fundamental Duties

ARTICLE 51A

Fundamental Duties- It shall be the duty of every citizen of India–

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities, to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

(k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

The Coordination Committee formed by GR No. Abhyas - 2116/(Pra.Kra.43/16) SD - 4
Dated 25.4.2016 has given approval to prescribe this textbook in its meeting held on
30/01/2020 and it has been decided to implement it from the educational year 2020-21.

TEXTILES

STANDARD XII

**Maharashtra State Board of Secondary and Higher Secondary Education,
Pune - 411 004**

S3N8N6

Download DIKSHA App on your smartphone. If you scan the Q.R.Code on this page of your textbook, you will be able to access full text. If you scan the Q.R.Code you will be able to access audio-visual study material relevant to each lesson, provided as teaching and learning aids.

First Edition : 2020
Reprint : 2022

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The Constitution of India

Preamble

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

NATIONAL ANTHEM

Jana-gana-mana-adhināyaka jaya hē
Bhārata-bhāgya-vidhātā,

Panjāba-Sindhu-Gujarāta-Marāthā
Drāvida-Utkala-Banga

Vindhya-Himāchala-Yamunā-Gangā
uchchala-jaladhi-taranga

Tava subha nāmē jāgē, tava subha āsisa māgē,
gāhē tava jaya-gāthā,

Jana-gana-mangala-dāyaka jaya hē
Bhārata-bhāgya-vidhātā,

Jaya hē, Jaya hē, Jaya hē,
Jaya jaya jaya, jaya hē.

PLEDGE

India is my country. All Indians are my brothers and sisters.

I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders respect, and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their well-being and prosperity alone lies my happiness.

INTRODUCTION

Dear Students,

It gives me immense pleasure to render you the copy of Textiles Text Book for XIIth standard in an interesting format. The syllabus is upgraded with inclusion of uncommon man-made fibres and their ever increasing use in our daily life, chapters regarding Dyeing & Printing and Fashion designing are also included to broaden the base of textiles for students.

The Textbook is designed for students who wish to gain a basic knowledge about various aspects of textiles, their previous glorious history and current trends prevailing. The emphasis has been on providing you a glimpse of the different fields related to textiles for you to pursue the study further or to make a career out of it.

The Textbook is in continuation with the one for XIth standard and takes on from where the previous book left. It includes protein fibres, man-made fibres and their innovative uses; various types of fabric constructions and finishes applied to them and their care in terms of laundry & dry cleaning. A whole chapter has been devoted to various types of dyes & prints and the traditional dyeing & printing still popular in India & abroad. A chapter on Fashion Designing has been included with an eye on introducing you to the global world of Fashion and the various job opportunities available there.

The practical part included in the syllabus is in accordance with the theory chapters. It aims at providing the students the applied knowledge about the various aspects of textiles given in the theory chapters. Fibre and weave identification will supplement the knowledge they gain through the chapters regarding various fibres and fabric construction. Body measurements, drafting & pattern making, variation in necks, sleeves etc. and colour schemes are included to initiate the students into the world of Fashion Designing. Tie-n-dye and printing of samples will make them aware of the art & science of dyeing & printing.

The writing committee, artists and other technical persons have been working as a team to provide you a book which is rich in illustrations, tables, charts, photographs, quiz & riddles, innovative exercise, historical facts and interesting anecdotes to keep you engrossed throughout. This book also has a QR code which will supplement additional knowledge and practice tests to the students.

The book has glossary, bibliography and websites provided at the end for authenticity as well as for you to get more information about the subject if desired.

I would like to thank the team of writers, expert reviewers, artists, technical persons and Maharashtra State Bureau of Textbook Production & Curriculum Research for the timely production of the Textbook in an excellent form.

We all hope that this book will enable you to gain knowledge along with fun and will help in developing love and respect for the subject. We wish you all the best for your future educational and professional career.

(Vivek Gosavi)
Director
Maharashtra State Bureau of Textbook
Production and Curriculum ResearchPune

Pune
Date : 21 February 2020
Bharatiya Saur : 2 Phalguna 1941

FOR THE TEACHERS

Dear Teachers,

It gives us immense pleasure to hand over this new textbook on Textiles for the XIIth standard to you all.

This book is in continuation with the textbook for XIth standard. The previous book dealt with introduction to the world of textiles, fibres – their classification and properties, natural cellulosic fibres, yarns etc. This book includes natural protein fibres – their types, manufacturing process, properties and uses, man-made fibres – their uses and the latest trends prevailing, various fabric construction methods and a chapter on finishes. A chapter regarding laundry and dry cleaning gives a basic knowledge of the kind of reagents used for these processes and their significance. Two new chapters have been added – one on Dyeing & Printing and the other on Fashion Designing. The objective behind these was that the students learn to appreciate the art and aesthetics of dyeing, printing and fashion as well as to make them aware of the technical knowledge required for these and the various opportunities for further studies or jobs that these two fields offer.

The practical part includes basic knowledge of body measurements, drafting &pattern making. It also includes weave making and weave identification. Fibre identification in the form of microscopic and burning tests is also there. Making samples of tie-n-dye and different forms of printing is included to make students aware of the art & science of dyeing & printing. Practical about various colour schemes, variations in necks, sleeves, skirts etc. will give students an idea about the type of work Fashion designers do.

The book has been written in a very simple language in a communicative style. Special efforts have been made to make the book student friendly by incorporating coloured photographs, illustrations, charts, tables, diagrams and various boxes providing historical or other interesting facts as well as challenging the students to think and correlate what they have learnt. There are lots of activities and innovative exercises for the students. The emphasis throughout has been on making the concepts clear to the students.

The last chapter on Fashion Designing has a number of technical terms in French language. A student desiring to pursue a career in Fashion Designing must know the basic terminology prevailing in the field and so they have been mentioned as such. However special efforts have been made to provide the correct pronunciations of them as well as their meanings in as simple a language as possible.

The QR code can be helpful to students and teachers alike to get further information, summary, videos, additional photos, additional exercises and different types of questions. This will surely help us to incorporate technology in the field of teaching-learning.

The Board of studies, authors, reviewers, artists, technical persons and office staff have put in a lot of effort to make the book aesthetically appealing, technically correct and academically interesting. They also need to be applauded to get it ready in time.

Hope you all will enjoy and appreciate this book and use it for effective teaching – learning from the current academic year.

STUDENT'S LEARNING OUTCOME

No.	Unit	Learning outcome
1	Wool	• Explains historical information of the wool fibers, and countries producing wool fiber. • Understands the manufacturing process of wool fiber. • Studies the properties of wool fiber. • Understands the uses of wool fiber and it's applicability in day to day life.
2	Silk	• Explains historical information & importance of silk since ancient times. • Explains countries producing silk fiber. • Understands the manufacturing process of silk fiber. • Studies the properties of silk fiber. • Understands the use and types of silk fiber and it's applicability in day to day life.
3	Speciality fibers & Man made mineral fibers	• Get insight into the variety of speciality fibers available to us from various animal sources. • Understands the scope, uses, properties of the new speciality fibers. • Understands the special characteristics of speciality fibers & how it has enhanced it's sale power. • Obtain information regarding raw materials, properties & uses of man made mineral & metallic fibers.
4	Viscose Rayon	• Throws light on development of manmade fibers. • Understands the basic concepts in the manufacture of man made fibers. • Studies raw material used in the manufacture of viscose rayon. • Studies properties of viscose rayon fiber. • Understands the uses & applicability of viscose rayon fiber.
5	Nylon and polyester	• Studies raw material, used in the manufacture of nylon & polyester fibres. • Studies the properties of nylon & polyester fibres. • Understand the uses & applicability of nylon & polyester fibres.

6	Fabric construction	• Explains the basic concept used in weaving. • Understands the basic structure of a hand looms & working of hand loom. • Understands the classification of weaves. • Explains Basic weaves & Novelty weaves, their characteristics & uses. • Understands the non woven fabric construction.
7	Finishes	• Understands the concept of finishing. • Highlights the need of finishing. • Explains types of finishes. • Obtain information regarding basic finishes. • Obtain information regarding special purpose finishes.
8	Laundry Reagents & Dry cleaning	• Understands various laundry reagents & their function in laundry. • Understands the concept of Dry cleaning. • Explains use of Grease absorbent & Grease solvents for Dry cleaning.
9	Dyeing & Printing	• Highlights the importance of the rich heritage of Indian dyeing industry. • Gains information about various dyes used on textiles. • Understands various techniques of printing. • Takes Pride on achieving the skills regarding dyeing & printing. • Gains information regarding various traditional techniques of printing on textiles.
10	Fashion Designing	• Throws light on the world of fashion designing of modern times. • Understands various basic concepts used in fashion designing. • Learns Elements of Arts & Principles of Design and their relation to fashion designing. • Explain scope of fashion designing in modern India. • Acquires basic skills required for fashion designing.

CONTENTS

THEORY

PRACTICALS

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

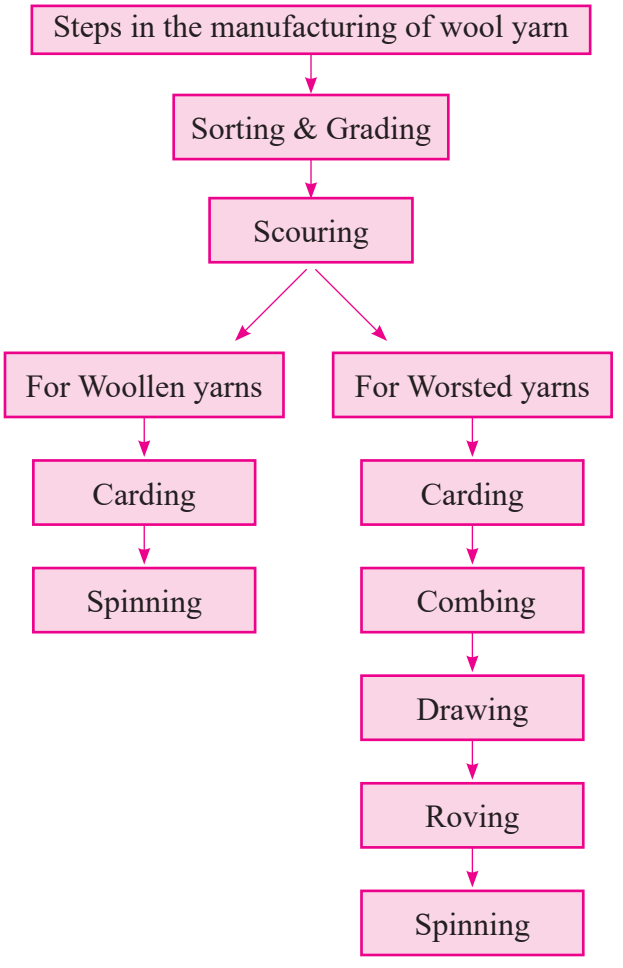
To Produce finest quality wool, manufacturer control production carefully and scientifically. Sheep are inoculated against diseases and fed nutritionally balanced diet.

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.

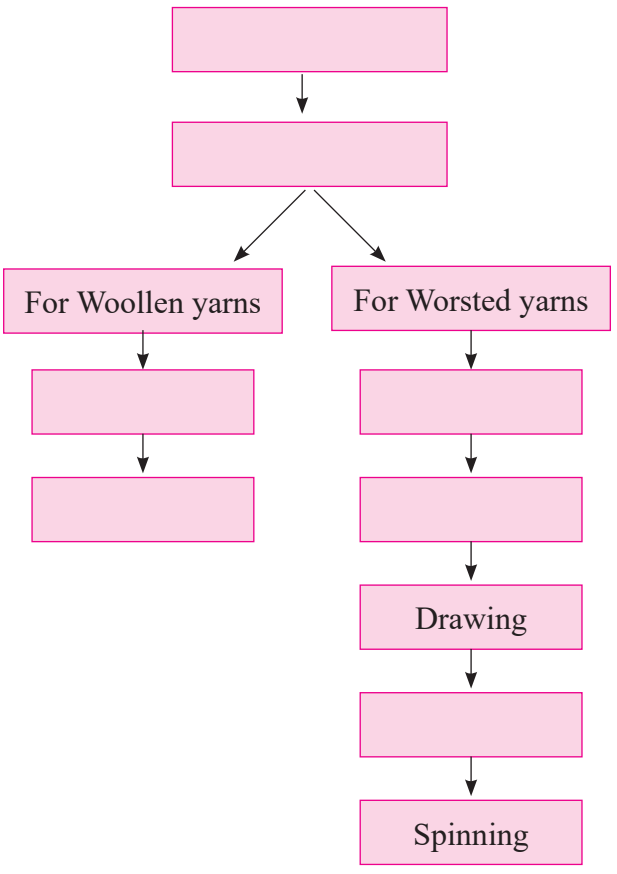
Picture No. 1.4 Namda Carpet

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'

Use Your Brain Power

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

Steps in the manufacturing of wool yarn



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.

2. SILK
NATURAL PROTEIN FIBER

Can you answer ?

Which fiber is mostly used for producing traditional textiles in India ?

What is the source of silk fiber ?

Have you ever worn silk garments ? How is it different from cotton garments ?

Have you read the chinese tale of silk fiber?

Let's learn more about silk fiber in this lesson.

2.1 Introduction

Silk is a natural protein filament – It is solidified protein secretion produced by certain caterpillars. This fiber has maintained a position of great prestige and is considered a luxury fiber. It is often called **'Queen of fabrics' :**

In old English, Silk was **Sioloc.** The name is thought to have originated from the Greek Seres, meaning the people from Eastern Asia, namely Chinese.

History records the Chinese as the first people who knew how to raise silk worms and manufacture Silk and make cloth from the filament which silk worm spins into a cocoon. It was discovered in China about 2600 B.C. About 1765 B.C. the mulberry tree was cultivated to provide food for the silkworm. For approximately 2000 years China successfully held the secrete of silk and maintained virtual monopoly of the silk industry. About 300 A. D. Japan obtained the formula and today is the chief producer and exporter of quality silk. Gradually silk production spread across Asia into India and eventually Persia, Southern Europe, Spain, Italy, France.

In India, the references regarding the use of silk fabrics from the ancient times have been recorded in the scripts of Manusmruti, Ramayana, Mahabharata and Rigveda. It is believed that silk industry developed in India approximately from 140 B.C.

Internet my Friend

Find out history of silk fiber regarding chinese Empress **Siling-Chi,** wife of Emperor **'Huang-ti'**, and discuss it in your class.

Picture No. 2.1 : Processing of Silk in Ancient China

- **Silk producing countries**

Japan was the first country producing silk in large quantities by using scientific methods of cultivating silkworms on farms as well as in factories. Today Japan has been ranked highest in the production of silk. Other silk producing countries are China, India, Korea, Iran, Spain, Italy, France, Austria, Turkey, Greece, Syria, Bulgeria, Brazil, Poland Russia, Peru and Indonesia.

Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal, Assam, Manipur, are the chief silk producing states in India. Apart from these states, silk is also produced in Kashmir, Himachal Pradesh, Uttar Pradesh, Nagaland etc.

A Peek into History - Silk Route

Silk Route is ancient trade route linking China with the West, that carried goods and ideas between the two great civilizations of Rome & China. Silk went westward and wools, gold, silver went East.

The Silk Route stretched from

China→India→Mesopotamia→Egypt→ The African continent→Greece→Rome & even upto Britain.

The old Silk Route through Lhasa. Sikkim & eastern India used to cross through **Nathula Pass**. The other side of Nathula Pass is Chumbi valley of Tibet.

This mountainous pass is one of the oldest trading border post connecting India & Tibet.

2.2 Manufacturing of Silk Fibre

- **Cultivated Silk**

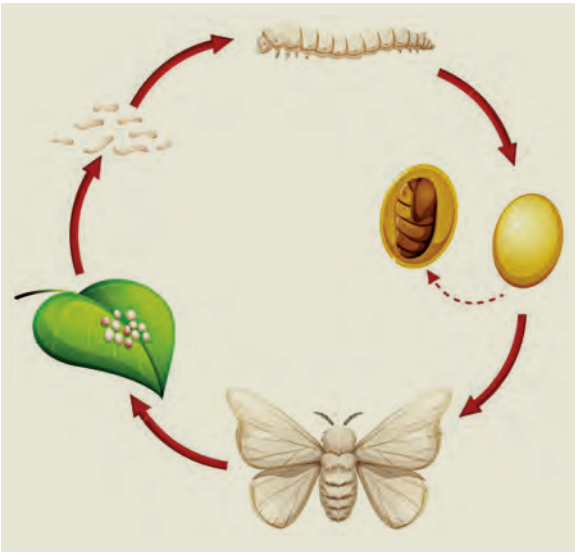
This type of silk is called cultivated Silk. Since the discovery of the silk filament as well as fabrics, silkworms have been bred for the sole purpose of producing silk. **The technique of rearing of silk worms for the productions of cocoons for their filament is called sericulture.** It is produced by species of moth called **Bombyx Mori.** These worms are fed only on mulberry leaves.

Picture No. 2.2 – Mulberry Plantation

Flow Chart No. : 2.1
Steps in Manufacturing Process of Silk Fiber

Sericulture
↓
Filature operation
↓
Degumming
↓
Weighting

- **Life cycle of the silk worms (Sericulture):** Silk worm lives for very short time, only about two months. During this period, it passes through four stages of development – i) eggs, ii) worm, (caterpillar), iii) cocoon and iv) moth. Under scientific breeding, silk worm may be hatched three times a year.
- **Eggs :** The female moth lays 350-400 eggs on special cards and die. Eggs is about the size of pinhead. The cards are examined and infected eggs are burned and only healthy eggs are allowed to hatch.



Picture No. 2.3 Life –cycle of silk worm

Picture No. 2.4 Eggs on special cards

- **Worm or Caterpillar or Larvae :-** The egg develops into larva or caterpillar or Silkworm. A tiny white worm about one fourth inch long is hatched from each tiny egg. The larva requires careful nurturing in the controlled atmosphere for approximately 20 to 30 days. During this period it is fed five times a day on chopped mulberry leaves. After four sheddings of skin or moltings, the worm reaches full growth. At this stage it is smooth grayish white caterpillar about $3 \& \frac{1}{2}$ inches long. At the end of 30 days, the worm shrinks somewhat in size and become pinkinsh and transparent. It ceases to eat and attaches itself to a piece of straw and begins to spin cocoon.

Picture No. 2.5 Silk Worm

- **Cocoons :** Two filaments are ejected from the mouth of the silkworm. It secretes a protein like substance and with a bending motion, the filament is spun around the worm in the form of figure '8". The worm completes the cocoon in about 3 days. The filament is in the form of double strand made up of **fibroin**, which is held together by a gummy substance called **sericin.** The filaments harden when exposed to air. The worm is caught inside the cocoon and remains there for a few days. This is called the 'Pupa' stage.

Picture No. 2.6 Cocoons

Picture No. 2.7 Pupa

- **Moth :** The Pupa turns into a moth. The moths emerge from cocoon by secreting an alkaline liquid that dissolves the filament and thus piercing the cocoon and breed. The female moth then lay eggs and die. Their cycle of life is completed.

Picture No. 2.8 Moth

If moth is permitted to emerge from the cocoon, the silk filament is broken into short pieces. Therefore, the cocoons are steamed or are subjected to hot air to kill the Pupa inside the cocoon. This process is called as **stoving**. Few cocoons are left aside for life cycle to continue.

- **Filature :** Once the cocoons are obtained from the silk worm, they are sorted out according to colour, size shape and texture. In the next step sericin from the silk filament is softened to permit the unwinding of the filament. As a single filament of silk is too fine; 3 - 10 cocoons are carefully unwound together to form a composite strand of silk. This process is called as **Reeling**. During the next operation desired amount of twist is given to composite strand of silk to make it into a silk yarn. This process is called **Throwing** and the silk is called as Thrown silk.

Picture No. 2.9 Filature Operation

- **Degumming :** Thrown silk threads still contain some sericin. It must be removed to bring out natural luster and the soft feel of the silk. The process of elimination of gum or sericin is known as **degumming.** It is generally carried out before dyeing process of silk. Detergent, warm water & alkaline reagents are used for degumming process. Approximately 25% of the weight is lost by the degumming process.

Picture No. 2.10 Degumming

- **Weighting :** The manufacturer buys silk by weight. Silk fibres become expensive after degumming as it results in weight loss. This loss in weight is compensated by weighting of silk. Silk fabrics are treated with metallic substances to make up for the weight loss. Weightings is done during the dyeing process or done after it. In addition to lowering the cost it gives crispness, firmer body and feel to the fabric. Weighted silk loses the natural elasticity and deteriorates when exposed to sunlight, perspiration and dry clearing. weighting of silk is considered undesirable in countries like Japan and India. It is carried out only for low quality silk (known as kora silk) in India.

Table No. 2.2
Difference between Degumming & Weighting

Degumming		Weighting	
1.	The removal of the gum 'Sericin' from the silk yarn or fabric.	1.	Increasing the weight of silk yarn or fabric.
2.	Approximately 25% of weight of silk is lost due to this.	2.	This is done to compensate for the weight loss due to degumming.
3.	This is done to bring out the natural lustre and smoothness of silk	3.	This makes the silk fabric crisp and improves its draping quality.
4.	This is done with the help of detergent and water.	4.	This is done with the help of metal salts.
5.	Usually done before dyeing process.	5.	Usually combined with dyeing process or done after it.

2.3 Properties of Silk Fiber

Microscopic Properties :

Cultivated degummed silk viewed longitudinally under a microscope resembles a smooth transparent rod. (For Diagram of microscopic appearance of Silk, refer to practical No. 6)

Microscopic characteristic of silk

- Smooth cylindrical fiber
- Highly lustrous
- Very fine
- Gum spots may be seen.

Physical Properties :

- **Length :** Silk is the only filament fiber. Silk filaments are very fine and long. They frequently measure about 900 – 1200 meters and can be as long as 2800 meters.
- **Luster :** Silk has high luster, after the sericin has been removed. Because of its exceptional lustre, Silk is known as 'Queen' of fabrics. Wild silk has less luster than cultivated silk.
- **Strength :** Silk is the strongest of the animal fiber. It loses 15 – 25 % of its strength when wet. Due to it's low wet strength it demands special care while laundering.
- **Elastic recovery and elongation :** Silk is very elastic fiber, but compared to wool its elasticity is slightly less.
- **Resiliency :** Silk has better resiliency than cellulosic fibres but less than wool and man-made fibres.
- **Moisture Absorption :** Silk has high moisture regain. Due to this property silk can be dyed and printed in brilliant colors.
- **Density :** Silk fiber is less dense than cotton, linen and wool. Density of silk is 1. 25 – 1 . 34 gm/cc. Medium density of silk makes fabric light in weight.

Can you tell ?
We usually wear silk clothes for parties & marriages why?
Special precaution is required while washing silks. Why?
We have seen that our grannies or mother wrapping heavy silk sarees in cotton fabric with napthalene balls while storing it for season. What do you think is the reason ?
We iron silks on low temp. What do you think is the reason?
Hint : The answer lie in the properties of the fiber

Biological Properties :

- **Effect of mildew :** Silk being a protein fiber is the least damaged by mildew, but it is attacked if left in a damp condition for a period of time.
- **Effect of moth :** Being a protein fiber it is easily damaged by moth. silk has good resistance to the clothes moth but carpet beetles will eat it. So while stroring silk, care needs to be taken & some kind of insecticide should be used.

Thermal Properties :

- **Effect to Heat :** Silk is easily affected by heat. We can not use hot iron or water for silk. When approached to the flame silk will ignite and continues to burn with a smell of burning hair of feather. It leaves crisp, brittle bead.
- **Heat conductivity :** Silk has low heat conductivity. It is not a good conductor of heat. This makes it a suitable wear for winter season.

2.4 Wild Silk

There are several types of caterpillars other than Bombyx Mori, which spin cocoons. Silk obtained from such cocoons is known as wild silk.

Picture No. 2.11 Wild silk yarn

following species of silk worm are used in producing wild silk.

1) Antheraea Mylitta – Tassar silk
2) Antheraea Assamensis – Muga silk.
3) Philosamaea Risini – Eri silk.

Picture No. 2.12 Eri Silk

Picture No. 2.13 Tussar Silk

Instead of mulberry leaves, these silk worms live on oak or castor leaves. The silk produced is irregular and coarse. It is also hard to bleach or dye. The tannin in the oak leaves gives tan colour and it is generally woven with the naturally coloured thread. Wild silk is less lustrous than cultivated silk, as only low percentage of sericin is removed in degumming process. It is washable and less expensive.

Table No. 2.3

Difference between cultivated silk and Wild silk

Cultivated Silk		Wild Silk	
1.	Obtained from silk worm called Bombyx Mori.	1.	Obtained from other wild species of silk worms.
2.	Silk worms eat leaves of only mulberry tree.	2.	Silk worms eat leaves of castor or oak tree.
3.	Very smooth, lustrous and delicate	3.	Not so smooth, lustrous or delicate
4.	Cream or off white in colour	4.	Darker in colour.

2.5 Spun Silk

Short lengths or staples or inferior silk filaments, obtained from waste material are carded and combed and are spun together like cotton, linen or wool yarns. These yarns are known as spun silk.

There are various sources of staple silk.

i) Pierced cocoons from which moths have cut their way and emerged.

ii) Double cocoons produced when two silk worms spin their cocoons too close together.

iii) Floss brushed from cocoons before reeling and coarse and uneven fibre at the beginning and end of each cocoon.

iv) The machine waste or scrap left from the operation like reeling and throwing.

Spun silk is less lustrous than reeled silk and not as strong or elastic. As the yarns are made from staple fibres, spun silk fabrics tend to become more fuzzy. It is less expensive than reeled silk. Spun silk is used for shantung and pile fabrics, for dress trimmings, linings, as insulating materials.

Table. 2.4

Difference between Cultivated Reeled Silk and Spun Silk

	Cultivated Reeled Silk		Spun Silk
1.	Obtained from unbroken good quality cocoons.	1.	Obtained from damaged cocoons.
2.	Continuous, long filament.	2.	Fibres are staple in length.
3.	Very smooth, lustrous and strong.	3.	Not very smooth, lustrous and strong.
4.	More expensive	4.	Less expensive
5.	Used for making expensive party wear.	5.	Used for making lining material and blends.

2.6 Uses of Silk

Silk in universally accepted as a luxury fiber and has been the "Queen of fabrics" for centuries. Silk has a unique combination of properties not possessed by any other fiber. Silk fabrics are luxurious in appearance and feel. It is a very strong fiber in relation to its filament fineness. It is very elastic and wrinkle resistant. Because of its absorbency, it is appropriate for warm weather wear, because of its low heat conductivity it is also appropriate for cold weather wear. Silk dyes and prints readily to beautiful, brilliant shades. It is adaptable to a variety of fabric construction from very sheer chiffon to heavy, rich beautiful brocades and velvets.

- **Apparel uses :**

Silk is used primarily in apparel items and high fashion items. It is worn in festivals and traditional ceremonies, weddings. It is used for bridal wear, kurtas, tie, scraf, sarees men's jacket etc.

Picture No. 2.14 Apparel Uses of Silks

- **Household uses :**

In furnishing silk is often blended with other fibers to add a soft luster to the furnishing fabrics. Silk blends are often used in window treatments and rich luxurious upholstery fabrics. Occasionally, beautiful and expensive handmade rugs will be made of silk.

Picture No. 2.15 Household Uses

- **Miscellaneous Uses :**

Silk threads are used for embroidery purposes. Silk is also used for making fancy articles like head ornaments, hand bags, bows, ribbons, decorative articles etc.

Picture No. 2.16 (A) Miscellaneous Uses

Picture No. 2.16 (B) Miscellaneous Uses

Do You Know This ?

Silk.... Nature's luxury fiber in nine languages

Spanish	**- Seda**	**Latin**	**- Sericum**
Chinese	**- Si**	**French**	**- Soie**
Italian	**- Seta**	**German**	**- Seide**
Korean	**- Soi**	**Japanese**	**- Kinu**

English - Silk

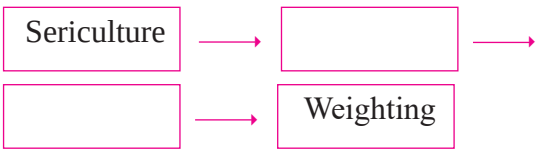
Table No. 2.5

Properties common to protein fibers

	Properties	Importance to consumer
1.	Good moisture regain & low heat conductivity	Suitable in both cold & humid climate
2.	Low wet strength	Special precaution is required while washing & during stain removal
3.	Medium Density	Light weight fabrics
4.	Harmful effect of alkali	Neutral soaps or mild alkaline soaps are recommended for laundry
5.	Low resistance to moth	Needs special precautions while storing for season

Use Your Brain Power

1. Map the silk Route of ancient time
2. Complete the flow chart



3. Can you write the correct sequence of the life cycle of the silk warm

   1) Pupa 2) Egg, 3) Moth,
   4) Stoving, 5) Caterpillar

4. Complete the given table :

Properties of silk fiber

Properties	Silk
Microscopic	
	Filament fibre
Luster	
Strength (Tenacity)	
Elasticity	
Resiliency	
Moisture absorption	
	Light weight
Effect of Mildew	
Effect of Moth	
	Easily attcated by heat
Heat Conductivity	

EXERCISE

Objective Type Questions

Match the Pairs

I.			
	A		**B**
a.	Sericulture	1.	Staple length
b.	Filature	2.	Bombyx Mori
c.	Wild silk	3.	Throwing
d.	Spun silk	4.	Muga silk
		5.	Artificial silk
II.			
	A		**B**
a.	Degumming	1.	Steaming of cocoons
b.	Stoving	2.	Twisting
c.	Weighting	3.	Unwinding
d.	Throwing	4.	Metallic salts
		5.	Removal of sericin

II. State whether the following sentences are true or false :

1. Silk is the strongest of animal fiber
2. Luster of silk is low
3. Heat conductivity of silk is low
4. Wild silk is dark in colour as compared to cultivated silk
5. Silk gum is called as fibroin
6. Cultivated silk is obtained from Bombyx Mori.
7. Silk is the only natural filament fiber.
8. Silk has medium moisture regain.
9. Silk makes light weight fabrics
10. Silk is affected by moth.

III. Select and Write the most appropriate answer from the given alternatives:

1. Natural filament fiber _____
   a) Cotton b) Silk c) Wool
2. Burning silk smells like _____
   a) Hair b) Paper c) Plastic
3. In silk manufacturing process that follows after sericulture is _____
   a) Weighting b) Degumming
   c) Filature
4. Process which removes sericin from silk filament _____
   a) Reeling b) Degumming
   c) Throwing
5. Luster of silk is _____
   a) High b) Low c) Medium
6. Process by which twist is given to silk filament _____
   a) Reeling b) Throwing
   c) Sericulture
7. Absorbency of silk is _____
   a) medium b) poor c) good.
8. Source of silk filament is _____
   a) Rock b) Caterpillar
   c) Plant
9. Under the microscope silk appears like _____
   a) Transparent rod b) Scaly
   c) Twisted
10. Density of silk is _____
    a) High b) low c) medium
11. Silk is easily damaged by _____
    a) Air b) moth c) mildew
12. Silk is mainly used for _____
    a) Medical purposes b) Industrial purposes c) Apparel purposes.
13. Silk protein is called _____
    a) Fibroin b) Tannin c) Pectin

14. Silk Gum is called _____
    a) Wax b) Sericin c) Fibroin

15. Fiber termed as 'Queen of fabrics' _____
    a) Cotton b) Wool c) Silk

16. Bombyx Mori species of moth is fed on _____
    a) Mulberry leaves
    b) Oak leaves c) Mango leaves

Short Answer Type Questions

- **State whether the following sentences are true or false & explain**

1. Silk is a natural cellulosic fiber.
2. Silk has low wet strength.
3. Under the microscope silk appears twist.
4. Silk is easily affected by mildew.
5. Silk is used for party wear.

- **List in order the steps involved in the manufacture or silk filament.**

- **Circle the odd word and explain.**

1) a) Degumming b) Retting
   c) Weighting d) Stoving

2) a) Muga silk b) Eri silk
   c) Cultivated silk d) Tussar silk

3) a) Caterpillar b) Pupa
   c) Tree d) Moth

- **Name the following**

1. Silk gum
2. Silk filament protein
3. Species of moth producing cultivated silk
4. Food for Bombyx Mori
5. Process of steaming of cocoons to kill silk worm
6. Removal of sericin from silk filament.
7. Silk obtained from damaged cocoons
8. Process by which twist is given to silk.
9. Process for which metallic salts are used.
10. Silk worm lying inside the cocoon.
11. Silk worm winding filament around it's body to encase itself.
12. The process of unwinding the filament from cocoon.

- **Differentiate between :**

1. Cultivated Reeled silk and Spun silk
2. Cultivated silk and wild silk
3. Degumming and Weighting

- **Give Reasons :**

1. Silk is called 'Queen of fabrics'.
2. Special care is required while storing silk for season.
3. Hot iron should be avoided for silk.
4. Degumming is done for silk.
5. Weighting is done for silk.
6. Silk should be washed carefully.
7. Stoving is done to produce cultivated silk.

- **Answer in short :**

1. What is sericulture ?
2. Which are the Countries producing silk ?
3. What is wild silk ?
4. What is spun silk ?
5. What is cultivated silk ?
6. What is Degumming ?
7. What is weighting ?
8. Write thermal properties of silk ?
9. Write biological properties of silk ?

10. Explain microscopic properties of silk?
11. Write about moisture regain & resiliency of silk
12. Write about Density & length of silk
13. Write about luster & Elasticity of silk
14. Draw microscopic appearance of silk with diagram.

- **Write short notes :**

1. Sericulture
2. Wild silk
3. Spun silk
4. Uses of silk

Long Answer Type Question

1. Describe the life cycle of silk worm.

Self-study / Study tour / Project

- Visit sericulture plant near to your place & write a report.
- Collect samples of cultivated silk & wild silk and compare properties with your class.

3. SPECIALITY FIBRES AND MAN-MADE MINERAL FIBRES

Do You Know

Apart from Silk and Wool, which other fibres are included in the category of NaturaI Protein Fibres?

Is sheep the only animal which provides wool ?

Do you know any other animal which provides wool like fibres to be made into textile products?

Apart from sheep, there are a number of other animals like certain rabbits, goats, camels etc. whose body hair is used as wool fibre. These fibres are actually of a superior quality than regular sheep wool. They are available from special types of animals and hence are popularly known as **Speciality Fibres.** They are of two types –

1. The coarse long outer hair : used for interlining, upholstery and some types of coats.
2. Soft and fine hair : used in luxury apparels like coats, sweaters, shawls, suits and dress fabrics.

Some interesting facts !

Speciality Fibres are very soft and lustrous.

They have better capacity of providing warmth.

They are available in smaller quantities and so are usually very expensive.

The fibres are gathered by hunting or domesticating the animals or collecting fleece from live animals.

These fibres do not have much crimp and felting properties.

Table No. 3.1 Other animals providing wool like fibre

Name of the animal	Place where found
1. Goats – a. Mohair	Originally from Angora district in Turkey. Now South Africa and USA.
b. Cashmere	Originally from Kashmir, India. Now in many countries.
2. Llamas	Mainly South America.
3. Alpaca	Mainly South America.
4. Vicuna	Mainly South America.
5. Camels	North Africa, Middle East and China.
6. Rabbits -Angora	Originally from Angora district in Turkey. Now raised all over the world. More popular in Europe.
7. Musk Ox	Northern regions like Canada, Alaska.

A few examples of speciality fibres are as follows –

3.1 Speciality Fibre - Angora

This is a speciality fibre obtained from Angora rabbits. These rabbits are one of the oldest types of domestic rabbit, and are bred for the long fibers they provide which are known

as **Angora wool** . There are at least 11 distinct breeds of Angora Rabbits.

The fibres are very fine, fluffy and slippery. They are long and pure white in colour. They are especially suitable for making baby clothes because of two reasons –

a. The fibres are extremely smooth and soft.

b. They do not cause allergies.

A peek in history.

Angora is supposed to be named after Ankara, in Turkey but strangely, this species of rabbits are not found there anymore.

Europe has raised Angora rabbits for their fibre for centuries and French people made it popular.

Pic. No. 3.1 Angora Rabbit

Pic. No. 3.2 Angora Wool

3.2 Speciality Fibre - Mohair

This is a speciality fibre obtained from Angora goat. Angora goats are a breed of domestic goats which were found in Angora district in Asia Minor in ancient times. Nowadays, South Africa and USA are the largest producers of this speciality fiber.

Mohair is considered to be a luxury fibre. It has silk like lustre. It has smoothness better than other wool fibres. It is durable and resilient. Because of its exceptional luster and sheen, it is nicknamed as **"Diamond fibre"** and is often used in making blends with other fibres to add these qualities to the final product. It is used mainly for making scarves, hats, sweaters, coats, socks and home furnishing like carpets. Because of its resemblance with human hair, it is also used for making wigs and hair pieces.

Origin of Mohair.

The word Mohair is derived from the Arabic word Mukhayyar which means "fabric made from hair of goat".

Pic. No. 3.3 Angora Goat

Pic. No. 3.4 Mohair fabric

3.3 Speciality Fibre - Cashmere

This is also a speciality fibre obtained from Cashmere goat . These goats are of Indian origin. This fibre is six times finer than human hair. It is stronger, lighter, softer and approximately three times warmer than regular wool. It is used to produce high quality fabrics.

The fabrics made from this fibre are warm, have a buttery touch and have beautiful draping quality. This fibre is used to produce coats, hosiery, blazers, jackets, gloves, sweaters, socks, scarves etc.

It is majorly produced in China, Mongolia, Iran, India, Afghanistan and Turkey.

Something interesting!

The cashmere goat is a special type of goat originally found in Kashmir. The word ***Cashmere*** is an anglicisation of the word Kashmir. Today, this goat is bred in many different countries.

Pic. No. 3.5 Cashmere goat

Pic. No. 3.6 Cashmere sweater

3.4 Speciality Fibre - Vicuna

Vicuna speciality fibre is obtained from a South American camelid called Vicuna that lives in hilly areas of Peru. Vicunas are cousins of llamas.

Vicuna fibre is popular because of its softness, fineness, beauty and ability to retain heat. As it is sensitive to chemicals, it is never dyed and is used in its natural cinnamon colour. This fibre is in high demand in international market and is one of the most expensive wools in world because of the following reasons –

- The number of these animals is very limited.
- The fibre can be gathered only once in two or four years.
- Vicunas are not domestic animals. They have to be captured live from the hilly areas, sheared and then released back to the wilderness. If they are kept in captivity, they starve themselves to death!

This fibre is used for making high end woollen clothing like sweaters, socks, suits, dress, jackets, shawls, scarves etc.

Some interesting facts about Vicuna!

The pronunciation of the name is ***Vikunia*** or ***Vaikunia.***

It is the national animal of Peru. It is so protected and cherished that in olden times only royalty was permitted to wear clothing made from vicunas.

Before some years the number of vicunas had reduced drastically due to poaching but thanks to the strict laws made by the Peruvian government, now the number has grown more.

The fibre is very expensive and a pair of vicuna socks can cost up to $1000.

Pic. No. 3.7 Vicuna animal

Pic. No. 3.8 Vicuna sweater

Internet my friends

Find out about other speciality fibres, their origin, main characteristics and uses.

5 Man-made Mineral Fibres – Glass Fibre

Glass fiber (or glass fibre) is a **material consisting of numerous extremely fine fibers of glass.** Many ancient civilizations used to make and use glass fibre but those fibres were thick and used for decoration only. Mass manufacture of glass fiber was only made possible with the invention of finer machine tooling.

Do You Know ?

Glass fibre is a popular substitute for asbestos because it does not create any health hazard like asbestos. In many areas of our life, glass fibre has replaced asbestos.

Nowadays, glass fibre is used extensively in many fields.

Raw Materials : The main raw materials for making glass fibre is Sand, Silica and Lime stone.

Properties : It has certain special properties which make it a very useful material for industrial purpose as well as household purpose. Glass fibre is strong, flexible, non conductor of heat, electricity or sound. One major advantage of glass fibre is that it is non-combustible i.e. it does not catch fire. Because of this property, it can be used in place of asbestos.

Uses :

- Glass fibre and fabrics are used for thermal insulation, electric insulation, sound insulation in various machines.
- It is light weight and strong and so used for making aeroplane parts and car bodies.
- It is used to reinforce concrete (known as GFRC) and so extensively used in making buildings, roads and translucent roofing panels.
- It is used to reinforce plastic also (known as GFRP) and the resulting material has varied uses like doors, showers, swimming pools, bath tubs, helicopter blades, tent poles, water slides, boats, surf boards, tanks, pipes, handles of equipment, traffic lights etc.
- One important use of glass fibre is as curtains. In many countries, it is mandatory to have curtains made from glass fibre in public places like auditoriums, hospitals etc.

Internet my friends

Find out the full forms of GFRC and GFRP from internet. Also find out other uses of these materials.

Pic. No. 3.9 Tent poles

Pic. No. 3.10
Water slides

Pic. No. 3. 11
Surf boards

Pic. No. 3.12 Glass curtains

3.6 Man-made Mineral Fibres - Metallic Fibres

Metallic fibres are nearly 3000 years old. In fact, the first man-made fibers used in textiles were not nylon or rayon but silver and gold. Historically, the **metallic** thread was constructed by wrapping a metal strip around a **fiber** core (cotton or silk), often in such a way as to reveal the color of the **fiber** core to enhance visual quality of the decoration. As they are used directly for weaving into a fabric, they are technically **Metallic Yarns** and not fibres.

Such yarns made of gold and silver have been in use since ancient times as decoration in the clothing for royalty and noble people. Many of such elegant textiles can be found in museums around the world.

In India, these metallic yarns are known as Zari. They are used for weaving and embroidery the most intricate designs and attractive patterns.

Zari work means weaving zari yarns into fabrics while Zardozi means surface embroidery on fabrics.

Most of the Indian traditional textiles about which you learnt in XI standard are having zari as their core component. The leading Indian markets for zari products are Kolkata in east, Mumbai & Nagpur in the west; Jaipur, Amritsar, Delhi & Varanasi in north and Mysore, Bangalore, Salem, Chennai, Madurai, Kanchipuram & Kumbakonam in the south. Surat nowadays is the world's largest producer of all types of zari threads, ribbons, borders, laces etc.

A peek in history.

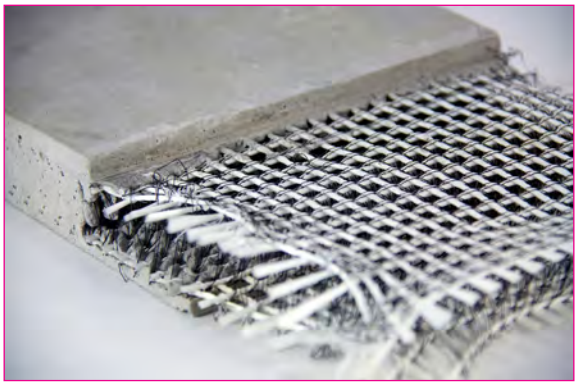
It is believed that the word **Zari** originated in a village by the same name in ancient Persia (Iran of today) where artisans used to weave gold and silver threads onto silk fabrics. The art was brought to India around 1700-1100 BC- the period of ***RigVeda***. However it really flourished during the Mughal era. It has now been recognised by the Government of India as one of the most ancient forms of handicraft.

Care & Maintenance.

Zari fabrics need special care in handling and storage. They have to be wrapped in muslin cloth to avoid friction and effect of natural elements. They can get damaged if washed at home and so need to be dry cleaned. Spray of perfumes should be avoided as it may tarnish the metal.

Pic. No. 3.13 Zari saree

Pic. No. 3. 14 Brocade



Pic. No. 3. 15 Metal reinforced concrete

The zari threads are mainly of three types –

1. **Real Zari** : Made from pure gold and silver. Nowadays made to order only as it turns out to be very costly.
2. **Imitation Zari** : This is copper wire coated with silver. This is cheaper than real zari. It can get dull or tarnished if proper care is not taken.
3. **Metallic Zari** : A metallic film is coated with polyester on both sides and then cut into thin strips and used as yarn. This known as **Mylar**. This is cheaper, lighter and more durable. The polyester coating saves the metal from getting tarnished and so this type of zari maintains its original look for a longer period of time.

Do You Know ?

In modern times, metallic yarns have made their way into fields other than textiles. Iron, steel and other metal yarns are used for building constructions, for making roads, bridges, ports, airports, tunnels, mines, in pre-cast concrete (like Glass fibres). They not only provide strength but also make the building more flexible thus making it earthquake proof

Use Your Brain Power !

I. Who am I ?

1. I am a wool like fibre available from a type of rabbit _____
2. I am a man-made mineral fibre used for making tanks and pipes. _____
3. I am polyester coated metallic yarn. _____
4. I am the largest producer of zari in world. _____
5. I am also known as Diamond Fibre. _____
6. I am the national animal of Peru. _____

II. Make meaningful words from the following jumbled words :

1. I N V A U C - _____
2. R A I M H O - _____
3. L Y R M A - _____
4. O A R N G A - _____
5. E M C E H A S R - _____

EXERCISE

Objective Type Questions

1. Match the following :

	A		B
1.	Angora goat	a.	Domestic animal
2.	Metallic zari	b.	Angora
3.	Electric insulation	c.	Wild animal
4.	Vicuna	d.	Glass fibre
5.	Baby clothes	e.	Polyester coated
		f.	Mohair

2. Select and write the most appropriate answer from the given alternatives for each question :

1. The most expensive wool in the world
   a. Angora b. Mohair c. Vicuna
2. This is known as Diamond Fibre.
   a. Angora b. Mohair c. Vicuna
3. Fibre being used as a substitute of asbestos
   a. Angora b. Glass fibre
   c. Metallic fibre
4. Fibre used to reinforce plastic
   a. Angora b. Glass fibre
   c. Metallic fibre
5. Biggest producer of zari in the world
   a. Nagpur b. Chennai c. Surat

3. Write whether the given sentences are True or False :

1. Cashmere fibre is obtained from a type of goat.
2. Imitation zari does not have metal in it.
3. Glass fibres are used for making car bodies.
4. Metallic fibre is used for building construction.
5. Mohair is obtained from a type of rabbit.

Short Answer Type Questions

1. Give Reason:

1. Mohair is known as “Diamond fibre”.
2. Angora is used for making baby clothes.
3. Vicuna is the most expensive wool in the world.
4. Glass fibre is used for making car and aeroplane parts.
5. Perfume should not be sprayed on zari fabrics.
6. Angora, mohair, vicuna etc. are called “Speciality fibres”.

2. Write short notes on the following :

1. Uses of glass fibre
2. Vicuna fibre
3. Types of zari
4. Uses of Angora
5. Other uses of metallic fibre
6. Cashmere
7 GFRP
8. Metallic zari

Self Study Project

- **Find out about the various other speciality fibres available in the world.**
- **Find out the various fields of life where man-made mineral fibres are being used nowadays.**

4. VISCOSE RAYON

Do you know?

Why do we like to wear silk clothes on special festive occasions?

Do you know of any other fibre which is near to silk in its looks and feel?

Have you ever wondered which fibre apart from cotton is used for making diapers, sanitary napkins and medicinal gauze?

Besides the natural fibres available to us, there are a number of other types of fibres made by mankind which we use for various purposes in our daily life, one of them is viscose Rayon.

The basic premise for making a man-made fibre is like that of a silkworm –

A. A solution is created by mixing and melting different chemicals.

B. This solution is then passed through tiny holes to get thin streams of the liquid on the other side.

C. These streams solidify to become filament which are then converted into yarns.

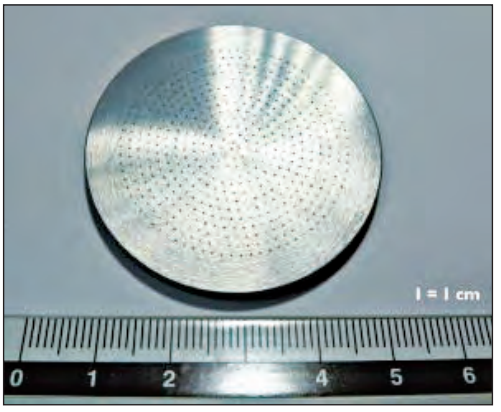
You should Know ?

A special device called spinneret was invented for making man-made fibres. It is made of steel and consists of number of tiny holes. The prepared solution is passed through the holes of this spinneret with pressure. It emerges on the other side in form of thin streams, which harden to become fibres.

A peek in the History!

As population grew, its demand of clothing also grew. The natural fibres were unable to meet this increasing demand as their production was limited and seasonal. This led scientists to find ways of creating fibres. The first written comment concerning the potential of creating man-made fibre is found in Robert Hooke's 'Micrographia' published in 1664. However, not until the 19th century did scientist actually make artificial fibres.

These new fibres are barely 140 years old but because of their durability, ease of maintenance and many other good qualities have become very popular in a short time. They have replaced natural fibres to a large extent and have become an integral part of our daily life. They are known as Man-made Fibres or Synthetic Fibres.



Picture no. 4.1 Spinneret

A great advantage of man-made fibres is that the manufacturer can decide many of the properties of these fibres –

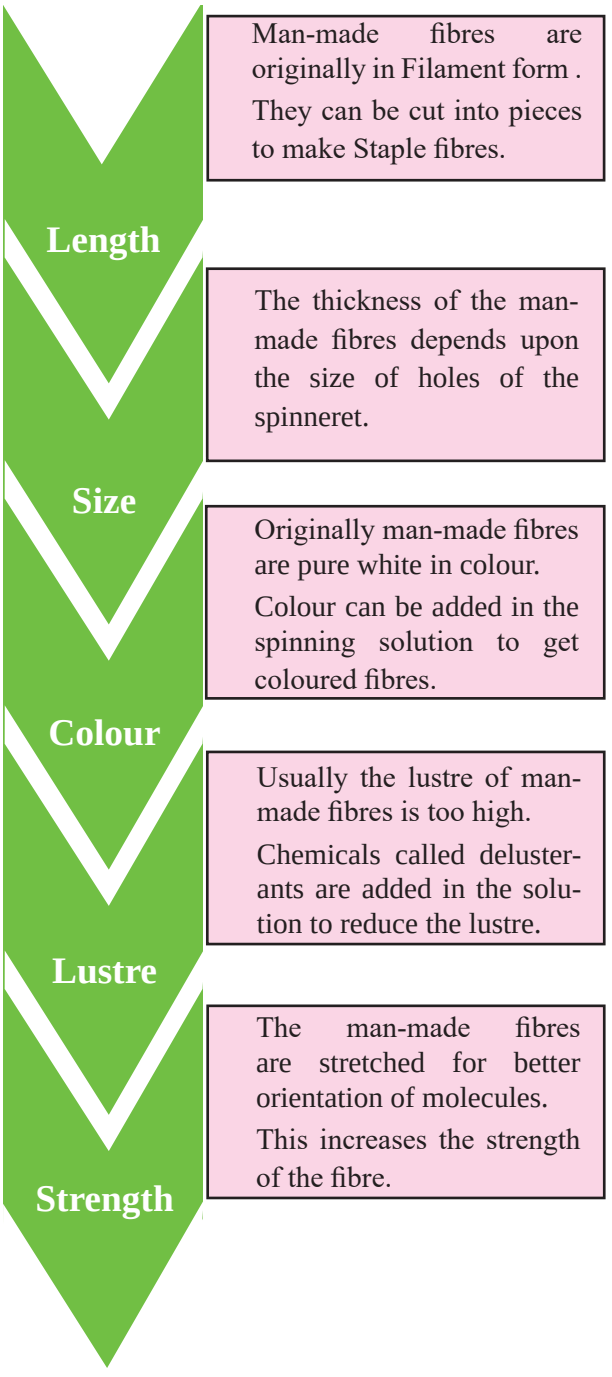
4.1 History of Rayon

Everybody liked to own and wear silk clothes because of their beauty but silk has

been very costly right from the time it was discovered. It was considered as a fabric for royalty because common men could not afford it. Scientists have been trying since a long time to make a cheaper substitute of silk. Count Hilaire de Chardonnet was the first person to successfully make such a fibre.

The Rayon produced by Count Hilaire de Chardonnet is now of historical importance only. The chemical used by him i.e. nitrocellulose is highly combustible and so large scale production of this rayon can be hazardous.

Chart No. 4.1 Controllable Properties of man-made fibres.



The beginning!

It was **Count Hilaire de Chardonnet,** a French chemist who produced the first man-made textile fibre in 1884 from nitrocellulose. This fibre was known as **Artificial silk.** In 1924 it was named as **'Rayon',** which means reflecting sunlight.

Amongst all the rayons, nowadays Viscose Rayon is the one which is produced and used maximum. The **viscose** process was discovered by the English scientist **C.F Cross and E.J Bevan** in 1892. The name viscose was derived from the word viscous, which means a thick liquid like honey. In this book, we will be studying about Viscose Rayon only.

You should Know ?

Rayon is the generic name of the family of fibres produced by same methodology but using different chemicals. There are many types of rayons like :

1. Nitrocellulose Rayon
2. Viscose Rayon
3. Cuprammonium Rayon
4. Acetate Rayon
5. Polynosic Rayon etc.

4.2 Making of Viscose Rayon

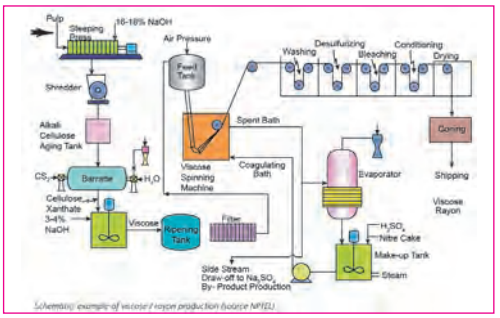
The principle raw material for viscose rayon is cellulose, obtained from **wood pulp and cotton linters.** As the raw material is cellulose, rayon is also known as **Regenerated Cellulosic Fibre.**

The cellulose is purified and treated with different chemicals and made to go through a number of processes to get a thick, orange

coloured liquid which looks and flows like honey. This is known as **Viscose Solution** (see Picture no. 4.2). This liquid is aged for some time, filtered and then it is ready to be converted into fibres.

Picture No. 4.2 Viscose Solution

The Viscose rayon spinning solution solidifies in water medium and hence, the process is known as Wet spinning method. The spinneret is fitted on the side of a water bath known as Spinning Tank having warm acidic water and streams of the spinning solution emerge into that water. By the time they reach the other side of the water bath, they coagulate to form Viscose filament fibres. These fibres are then collected on spools for further treatments.



Picture No. 4.3 Wet Spinning

4.3 Properties of Viscose Rayon

Microscopic Properties:

The longitudinal appearance of regular viscose rayon exhibits uniform diameter and internal parallel lines called **striations.** If the fibre has been delustered, it will have a grainy pitted appearance. Bright fibre is relatively transparent (For diagram of microscopic appearance of Viscose Rayon, refer to Practical No. 6)

Physical Properties:

1. **Length:** The length of viscose rayon fibre can be controlled as it is a man-made fibre. It is manufactured as a filament fibre but can be cut to staple length.
2. **Lustre:** Rayon fibre is highly lustrous and can cause glare to eyes. To control its lustre, delusterants like Titanium dioxide are added in the viscose solution.

Can you guess?

1. Rayon fabrics frail at knees and elbows. Why?

   Hint : Answer lies in the strength and elasticity of the fibre.
2. Rayon fibres are used in making diapers and sanitary napkins. Why?
3. Rayon is used in blended fabrics in place of cotton. Why?

   Hint: Answer lies in the texture and moisture absorption of the fibre.

3. **Strength:** It is a comparatively weak fibre and in wet condition, the strength decreases further. Therefore it should be handled carefully while using or laundering.
4. **Elasticity:** The elasticity of viscose rayon is low.
5. **Texture :** Very smooth and soft.
6. **Resiliency:** Rayon fabrics have low resiliency. The fabric creases easily and frequent ironing is required.
7. **Moisture Absorption:** The moisture absorption of viscose rayon is higher than those of natural cellulosic fibres such as cotton and linen. It loses 50% of its strength when wet and therefore requires special care while laundering.

8. **Density:** The density of viscose rayon is 1.5gm/cc which is similar to that of the natural cellulose fibres. It produces fabrics which are heavy in weight.

Biological properties:

1. **Effect of mildew:** Being a cellulose fibre it is harmed by mildew if left damp, but is not affected by it in dry condition.
2. **Effect of moth:** Viscose rayon is resistant to the damage caused by most moths and insects but can be damaged by silverfish.

Thermal properties

1. **Effect of heat:** Hot water for washing or hot iron while ironing will damage viscose rayon.
2. **Heat Conductivity:** It is a good conductor of heat.

Can you give reason?

Rayon fabric is considered very suitable for summer wear. Why?

Hint : Answer lies in the moisture absorption and heat conductivity of the fibre.

4.4 Uses of Rayon

Rayon fibres are absorbent, soft and comfortable. Fabrics made out of this fibre have good drapability. Rayon fibres are used in apparel, home furnishing, medical, surgical products and for nonwovens. Rayon is often used as a substitute to cotton, as it is cheaper than cotton. It is widely used in making blends with other fibres like cotton, nylon, polyester, acrylic etc. where it contributes softness, lustre and absorbency. Following are some of the uses of viscose rayon:

Apparel Uses: Casual and party wear, sarees, undergarments, sportswear etc.

Pic No. 4.4 Apparel Uses

Household Uses: Curtains, draperies, bed sheets, tablecloth, towels, blankets, mops etc.

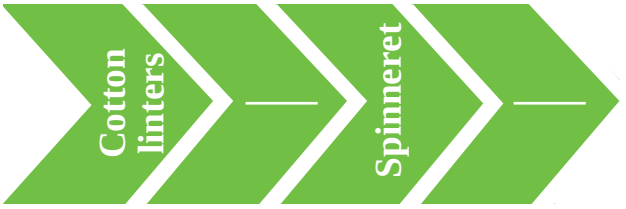
Pic No. 4.5 Household Uses

Pic No. 4.6 Miscellaneous Uses

Miscellaneous Uses: The third most important use of rayon is in non-woven fabrics, where absorbency is important. Items include industrial wipers, medical supplies including bandages, diapers and sanitary napkins. These products are biodegradable.

Use Your Brain power

1. Complete the given flow chart :



2. Who am I ?

1. I made the first Rayon fibre.
2. My name means 'reflecting sun rays'.
3. I am the main raw material for making rayon.
4. I am the orange coloured solution used for making rayon fibres.
5. I am the common delusterant used for viscose fibres.

EXERCISE

Objective Type Questions

1. Match the following :

(i)

A		B	
1.	viscose solution	a.	cotton linters
2.	making viscose fibres	b.	artificial silk
3.	other name for rayon	c.	wet spinning
4.	raw material for viscose	d.	like honey
		e.	nitrocellulose

2. Select and write the most appropriate answer from the given alternatives for each question :

1. Rayon is also called
   a. Mineral fibre
   b. Regenerated Cellulosic fibre
   c. Synthetic fibre
2. Originally Rayon has
   a. Very high lustre
   b. Very low lustre c. No lustre
3. Rayon fibres are made by this method
   a. Melt spinning b. Wet spinning
   c. Dry spinning
4. Strength of Rayon is
   a. Good b. Moderate
   c. Bad

3. Write whether the given sentences are True or False :

1. Rayon is a weak fibre.
2. Delusterant is usually used while manufacturing Rayon fibres.
3. Rayon is usually used in blended form with other fibres.
4. Rayon starts melting beyond a certain temperature.
5. Rayon has low moisture absorption.

4. Name the following :

1. Raw material for making Viscose rayon.
2. Spinning method for Viscose Rayon.
3. Device used for making Rayon fibres.

Short Answer Type Questions

1. Define following terms:

1. Spinneret
2. Regenerated Cellulosic Fibre
3. Wet spinning

2. Give Reasons :

1. Rayon fabric frails at knees and elbows.
2. Rayon is used in making sportswear.
3. Rayon is considered good summer wear.
4. Wet spinning method is used for making Viscose fibres.
5. We should be careful while washing rayon fabrics.

3. Answer in short :

1. Uses of Viscose Rayon.
2. Microscopic structure of Viscose Rayon.
3. Biological properties of Viscose Rayon.

5. NYLON AND POLYESTER

Can you tell?

What are tooth-brushes bristles made of?

What are hosieries made of?

Have you seen how fishing nets are made?

Introduction :

Man-made fibres were invented in 20th century only but in less than 100 years. They have become an integral part of our clothing and household. Today we are using various man-made fibres in many different fields. The popularity of man-made fibres is due to their easy availability, cheaper price, good look, easy care and maintenance and not being easily affected by natural elements.

In this chapter we will be learning about two fibres which are most popular amongst all the man-made fibres - Nylon and Polyester.

5.1 Nylon :

Nylon is the first man-made fiber which is made from Non-Fibrous Material. In this sense, it was the first truly 'man-made' fibre.

A peek in the History :

In 1928, the DuPont Company gave funds to a small group of scientists headed by Dr. Wallace H Carothers to do a the research. He accidently invented a long, silky filament. Finally in 1938 Nylon was manufactured and introduced in the market. The name Nylon was given to this fiber because it was marketed from two branches of DuPont Company from **N**ew **Y**ork and **Lon**don.

Nylon is mainly of two types – Nylon 6 and Nylon 66. The numbers refer to the no. of carbon atoms present in the chemicals used for making the fibre. Nylon 6 is made from **Caprolactum**. Nylon 66 is the most popular type and is made from two chemicals –

1. Hexamethylene Diamine
2. Adipic Acid

Do You Know ?

Man-made fibres are used widely in various fields of life because of their many good properties. One of the biggest drawback of these fibres is that **they are not biodegradable and hence are responsible for environmental pollution.** Because of this reason, scientists and governments are trying out ways of reducing their usage and substitute them with other natural fibres about which we learnt in standard XI.

Manufacturing Process :

Both the above mentioned chemicals are taken in required quantities and mixed in an **autoclave** which is like a giant pressure cooker. Polymerization takes place under high temperature and pressure. The melted liquid is solidified into ***Ribbons.*** These ribbons are cut into ***chips.*** The chips are melted again and Nylon 66 fibres are spun.

Properties of Nylon:

5.1.1 Microscopic Properties:

Smooth, lustrous fibre.

Even diameter.

Transparent, like glass rod.

Pigments can be seen (grainy appearance) (For diagrams see practical no. 6)

Physical Properties:

Length: the length of Nylon can be controlled as it is man-made fiber. It is manufactured as a filament fiber but can be cut to staple lengths.

Lustre: Nylon has good Luster. Luster can be controlled by the addition of delusterants like Titanium Dioxide.

Texture: Nylon is very smooth and transparent.

Strength: It is a very strong fiber. The strength does not decrease under wet condition.

Elasticity: Nylon has the best elasticity amongst all textile fibers. Because of this property Nylon is used extensively in Hosiery industry.

Resiliency: Nylon has excellent resiliency. The wrinkles or creases go away readily and ironing is not required.

Moisture Absorption:- Nylon has poor absorption power. Nylon fabric do not get wet. The water remains on the surface and runs off because of the smooth surface. It dries quickly. The one disadvantage of lack of moisture absorption is that it does not absorb perspiration and hence is not comfortable to wear in summers.

Density: the density of Nylon is very low. It is light in weight.

Biological Properties:

Effect of mildew: Nylon is resistant to effect of mildew.

Effect of moth: Nylon is resistant to effect by most insects and microorganism.

Thermal Properties:

Effect of heat: Nylon is a thermoplastic fiber. It changes shape and melts when heated. Because of this reason, it cannot be ironed with a hot iron. When burnt, it forms a black uncrushable bead and smells like that of a chemical or plastic.

Heat Conductivity: Nylon is a bad conductor of heat.

You Should Know ?

Pilling is a special property found in manmade fibers only. The long filaments present inside a yarn breaks under friction but cannot come out of the yarn and so they from a "Pill" on the surface. This does not affect the strength but spoils the appearance of the fabric.

5.1.2 Uses of Nylon:

Apparel Uses: Dress materials, shirtings, sarees, sportswear, etc. Nylon is extensively used in hosiery industry for making socks, stockings and under garments.

Pic. No. 5.1 Nylon Sarees

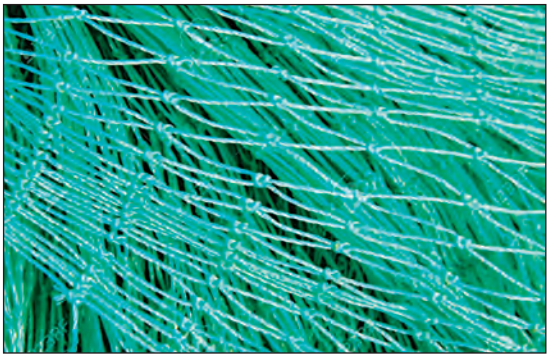
Pic. No. 5.2
Sportswear

Pic. No. 5.3
Socks

Household Uses : Curtains, Carpets, upholstery.

Pic. No. 5.4 Nylon Curtains

Miscellaneous Uses: Brushes, fishing nets, toothbrushes, ropes, umbrellas etc.



Pic. No. 5.5 Fishing Net

Pic. No. 5.6 Nylon rope

Polyester

This was the second man-made fibre invented after Nylon. Nowadays, it has become more popular than Nylon as it is more versatile, can be used in a number of ways and can make blends with all man-made as well as natural fibres.

The two chemicals used in making Polyester are :

Ethylene glycol.

Terephthallic acid.

When an Alcohol and an Acid meet, an Ester link is formed. During polymerization of this fibre, many alcohol molecules link with many acid molecules. A number of ester links are formed, So the fibre has been given the name – Polyester. The fibre has two other names; in England it is called **Terylene** and in America it is called **Dacron.**

A peek in the history :

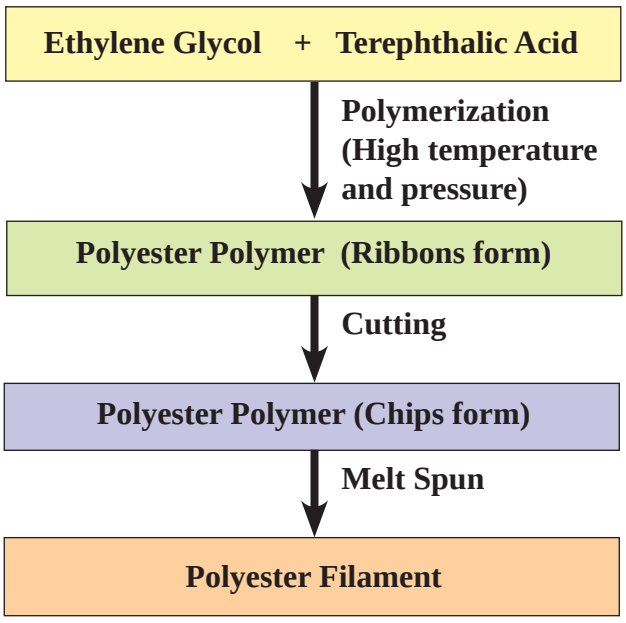
The initial work for polyester fibre was done by Dr. W. H. Carother. Later the idea was developed by the British scientists John Whinfield and James Dickson, who made **polyester** in 1941 in England. They called it **"Terylene"** based on the two chemicals used in manufacturing it –**Ter**ephthalic Acid and Eth**ylene** Glycol.

In 1945, Du Pont Co. acquired the rights of manufacturing Polyester fibre in America. They named it **"Dacron"** to rhyme with their first fibre Nylon.

Manufacturing Process

It is very similar to that of Nylon. Ethylene Glycol and Terephthalic acid is taken in required quantity and mixed in an autoclave. Polymerization takes place under high temperature and pressure. The polymer liquid is solidified into Ribbons which are cut into Chips. The chips are again melted and Polyester fibres are spun.

Chart no. 5.1 Manufacturing Process of Polyester



5.3.2 Properties of Polyester

Microscopic Properties:

1) Smooth, glass rod like fibre.
2) Even diameter.
3) When delustered Pigments can be seen (grainy appearance). (For microscopic diagram, refer practical no. 6)

Physical Properties:

1. **Length:** As it is a manmade fibre, polyester can be produced in any length. It can be manufactured as a filament fibre and can be cut to staple length.

Can you tell?

Polyester dress can be worn directly after washing. Why?

Polyester garments are not so comfortable in summers. Why?

Polyester is called an 'Easy Care' fabric. Why?

Hint : the answers lie in the properties.

2. **Lustre:** Originally fibre is lustrous. Lustre can be controlled by the addition of a delustering agent called Titanium Dioxide.
3. **Texture:** It is a smooth texture fibre.
4. **Strength:** It is the strongest fibre. In wet condition, the strength does not change. It is abrasion resistant too and so polyester fabrics are very strong and durable.
5. **Elasticity:** The elasticity of polyester fibre is very good.
6. **Resiliency:** The property of resiliency and recovery from creasing is outstanding. It does not wrinkle when wet and also when dry. It is known as **'wash-n-wear'** fabric.
7. **Moisture Absorption:** Polyester has very low moisture absorption. It is therefore well suitable for making water repellent clothes such as raincoats. Due to poor absorbency it cannot be dyed with simple techniques. It dries quickly but is not very suitable for summer wears as it does not absorb moisture from the body.
8. **Density:** The density of polyester is 1.38 gm/cc. Fabrics made from polyester are light in weight.

You Should Know ?

- *The Pilling property described earlier with the properties of Nylon is seen in Polyester also.*

New Wicking Polyester:

- *Polyester also has a unique property called* **'Wicking'**, *which means that the fibre allows moisture to pass through one end to other without actually absorbing it. This property makes Polyester a more comfortable wear in summers as compared to Nylon.*

Biological Properties:

1. **Effect of Mildew:** Polyester is not affected by Mildew in any condition.
2. **Effect of Moth:** Polyester is not affected by moth or any other insects.

Thermal Properties:

1. **Effect of Heat:** Hot water and hot iron should not be used for polyester. Polyester is a thermoplastic fibre. Like Nylon it softens and melts with heat and smells like chemical or plastic. It forms a hard residue bead like which is hard and uncrushable.
2. **Heat Conductivity:** It is not a good conductor of heat.

5.3.3 Use of Polyester

1) **Apparel Uses:** Shirts, Slacks, Trousers and Sarees.

Pic. No. 5.7 Polyester shirt

Pic. No. 5.8 Polyester Saree

2) **Household Uses:** Curtains, draperies, carpets, upholstery etc. pillows, comforters, quilts.

Pic. No. 5.9 Polyester curtains

Pic. No. 5.10 Polyester quilt

3) **Industrial Uses:** Tents, ropes, cording, fishing nets, disposable diapers, paintbrush, badminton rackets, parachutes, sails, etc.

Pic. No. 5.11 Tents

Pic. No. 5.12 Disposable diapers

Pic. No. 5.13 Parachutes

Pic. No. 5.14 Badminton racket

4) **Medical Uses:** Artificial artery, veins, and sutures.

Pic. No. 5.15 artificial veins

Pic. No. 5.16 Sutures

Internet my friends

Find out about other manmade fibers used in Textile Industry.

Table No 5.2 Similarities between Nylon & Polyester

PROPERTIES	NYLON	POLYESTER
Microscopic	Smooth, even glass rod like, grainy if delustered	Smooth, even glass rod like, grainy if delustered
Length	Filament: Can be made in staple form.	Filament: Can be made in staple form.
Lustre	Highly Lustrous but lustre can be controlled.	Highly Lustrous but lustre can be controlled.
Strength	Very Good	Very Good
Elasticity	Excellent	Very Good
Resiliency	Very Good	Excellent
Moisture Regain	Very Low	Very Low
Density	Low (light in Weight)	Low (Light in weight)
Effect of Mildew	No Harmful Effect	No Harmful Effect
Effect of Moth	No Harmful Effect	No Harmful Effect
Effect of Heat	Thermoplastic Fibre. Cannot withstand high temperature. Burning fibre smells like chemical. Melts and forms hard black bead.	Thermoplastic fibre. Cannot withstand high temperature. Burning fibre smells like chemical. Melts and forms hard black bead.
Heat Conductivity	Very Low	Very Low
Pilling	Small 'pills' of fibre are formed on the surface due to friction spoiling the appearance.	Small 'pills' of fibre are formed on the surface due to friction spoiling the appearance.
The manufacturing Process is also similar in case of both Nylon & Polyester.		

Table No 5.3 Differences between Nylon & Polyester

DIFFERENCES	NYLON	POLYESTER
Chemicals used in making them are different.	Hexamethylene Diamine + Adipic Acid	Ethylene Glycol + Terephthalic Acid
Elasticity	Excellent	Elasticity of Polyester is second to that of Nylon.
Resiliency	Nylon is second to Polyester in this property.	Polyester is best and so is called 'wash-n-wear' fabric.
Wicking	Not found in Nylon.	A speciality of Polyester.
Uses	Especially used for making socks, stockings and hosiery material.	Has a wider application. Especially used for medical purposes.
Blends	Nylon is usually used as 100% Nylon, can be blended with wool, and cotton.	Makes blends easily with all natural and man-made fibres.

Use Your Brain Power

I. Who am I?

1. I am used to make Nylon.
2. I am a property which makes polyester comfortable to wear in Summer.
3. Water does not enter me because I am made from polyester.
4. I am the property responsible for small balls being formed when nylon socks are worn continuously.
5. I am a man-made fibre known as Terylene in England and Dacron in America.

II. Put a cross or tick mark in the given table appropriately:

	Nylon	Polyester
Adipic Acid		
Autoclave		
Ethylene Glycol		
Wicking		
Hosiery		
Thermoplastic fibre		
Blends		
Bio degradable		

EXERCISE

Objective Type Question

1. Match the following :

A		B	
1	Titanium dioxide	a.	Du Pont Company
2.	W.H.Carothers	b.	Pilling
3.	caprolactum	c.	Delusterant
4.	Dacron	d.	Nylon
		e.	Polyester

2. Select and write the most appropriate answer from the given alternatives for each question :

1. Raw material used for manufacturing Nylon 6 is _____.
   a. Wax b. Caprolactum
   c. Cellulose
2. Man-made fibre is _____.
   a. Polyester b Silk c. Linen
3. Fibre produced by melt spinning method _____.
   a. Viscose Rayon b. Polyester
   c. Silk
4. The delusterants used for reducing the lustre of man-made fibre is _____.
   a. Citric Acid b. Caustic Soda
   c. Titanium dioxide.
5. _____is a thermoplastic Fibre.
   a. Rayon b. Nylon
   c. Cotton

3. State whether the following sentences are true or false: -

1. Man-made fibres are non-thermoplastic fibres.
2. Nylon and Polyester Fibers are suitable for rainy season.
3. Nylon fabric requires ironing.
4. Polyester fibres are strong and durable.
5. Man made fibres are uniform in diameter.
6. Man-made fibres are harmful for the environment.

Short Answer Type Question

4. Define the following terms: -

1. Pilling 2. Thermoplastic fibre.
3. Wicking

5. Give Reasons:

1. Nylon is used to make hosiery garments.
2. Polyester fabrics are used for rainy season.
3. Man-made fibres start melting beyond a certain temperature.
4. People are trying to find substitutes for man-made fibres.

6. Answer in short

1. Microscopic properties of Nylon Fibre.
2. Give the biological properties of Polyester Fibre.
3. Distinguish between the chemicals of Nylon and Polyester.
4. Give the use of polyester fibre.
5 Give the thermal properties of Nylon fibre.

Long Answer Type Question

1. A) Write the raw materials used to manufacture Nylon fibre?
   B) Explain the physical properties of Nylon Fibre.(any four)
2. A) State the 2 chemicals used to manufacture Polyester Fibre?
   B) Explain the thermal properties and microscopic appearance of Polyester fibres?

Project / Field Work

1. List the textile items made of man-made fibres in your home which can be substituted by eco-friendly fibres.
2. Find out the newly invented man-made textile fibres and its use in the house hold.

6. FABRIC CONSTRUCTION

Do you know

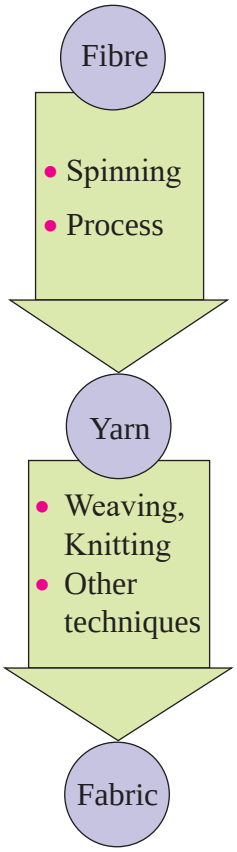
Do you know how fabrics are made from yarns?

Do you have any idea how many types of different fabrics can be made from the same yarns?

Can you tell in how many ways fabrics can be made?

Fabrics are made from yarns which are in turn made from fibres. Fabrics can be made in many different ways like Weaving, knitting, felting and braiding etc. The three fundamentals of textiles are as follows -

Chart No. 6.1 Sequence of Fabric Construction



- **Fibre:** is either spun into yarn or directly compressed into a fabric.
- **Yarn:** is woven, knitted or otherwise made into fabrics by spinning process.
- **Fabric:** is a finished consumer goods by various finishing processes.

6.1 Weaving

The most popular method of fabric construction is **Weaving.**

Weaving is interlacing of warp and weft yarns at right angles.

- **Warp yarns :** The lengthwise yarns in a woven fabric which runs parallel to the selvedge are called warp yarns. They are also known as "ENDS".
- **Weft yarns:** The widthwise yarns in a woven fabric which runs across the selvedge are called weft yarns. They are also known as "PICKS".
- **Selvedge:** The outer finished edge on both sides along the length of the fabric. There are always two selvedges in a fabric which run parallel to each other. The distance between the two selvedges is the width of the fabric. Selvedges protect the fabric and prevent it from raveling. There are different types of selvedge for different fabrics. Eg. Plain, fused, split and tape.

Weaving is done with the help of a machine called **Loom.**

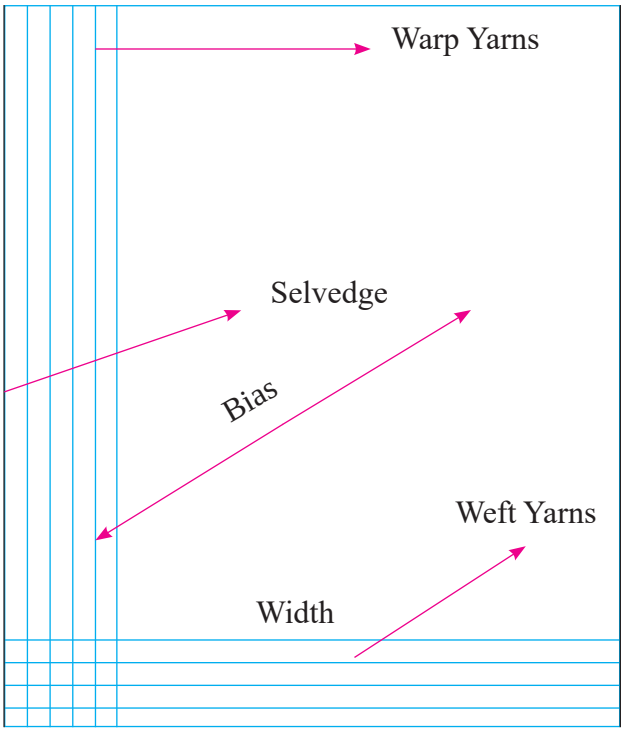
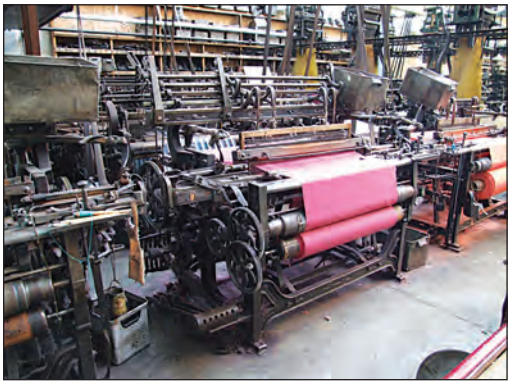


Fig No. 6 .1 Woven Fabric

Pic. No. 6.2 Hand loom



Pic. No. 6.3 Power loom

A peek in history!

The knowledge of weaving was known to man even before spinning by observing the interlacement of grasses and twigs in bird's nest.

Initially crude looms were made from tree branches. Later for a long time simple handlooms were used for making fabrics all over the world. Power loom was invented in 1784 by **Edmund Cartwright.**

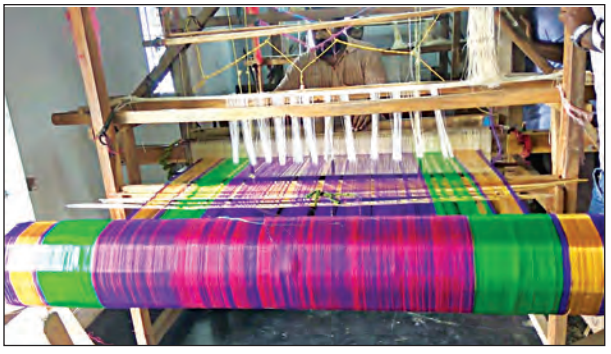
Indian traditional textiles about which you have studied last year, are still made on handlooms.

6.2 Basic structure of a Loom

Whether it is a handloom or a power loom, the basic parts and operations remain the same. Any loom will have at least the parts and operations discussed below.

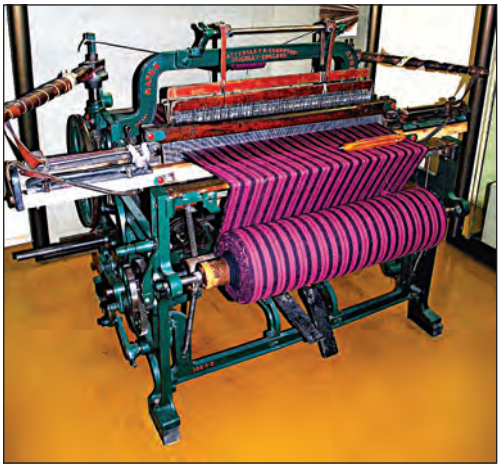
Different parts of a Loom:

- **Warp beam:** This is situated at the back of the loom and the warp yarns are wounded over it and conveyed to the cloth beam.



Pic. No. 6.4 Warp beam

- **Cloth beam:** This is situated at the front of the loom and the cloth that is woven is wound or rolled on this beam as it is constructed.



Pic. No. 6.5 Cloth Beam

- **Harness:** It is a rectangle wooden frame inside which a series of wires are attached. These wires are called **Heddles**. Each heddle has a hole inside it which is known as Eye. The warp yarns while travelling from warp beam to cloth beam, pass through the eye of a heddle.

Pic. No. 6.6 Harness

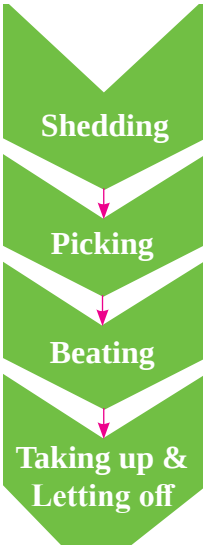
- **Reed**:- This is a wooden frame that resembles a "Comb". It has wires but there are no holes in them. The gap between the wires is called **'Dent'**. All the warp yarns passes through the dents. Function of reed is to push the newly inserted pick(weft) yarn towards the cloth constructed.

Pic. No. 6.7 Reed

- **Shuttle :** It is a small flat compass like instrument which carries the weft yarn. The weft yarn is wound on a spool and then the spool is fixed inside the shuttle. During weaving this shuttle passes from one side to the other side of the loom and inserts the weft yarn in the fabric.

Pic. No. 6.8 Shuttle

Chart No. 6.2 Four Operations (steps) of Weaving :



6.3 Operations of Weaving

- **Shedding:** Raising one or more harness to separate the warp yarns and form a gap between them through which the shuttle can pass. This gap is called **Shed.**
- **Picking:** Passing the shuttle through the shed to insert the filling (weft) yarns.
- **Beating or Battening:** Pushing the filling yarns firmly in the place in the woven cloth with the reed.
- **Taking up & Letting off:** Winding the finished fabric on the cloth beam and releasing more of the warp yarns from the warp beam.

Guess what!

When the loom is working, the first, second and third step are repeated a number of times till some length of the fabric is woven. Then the first three steps are suspended for a while and the fourth step is carried out. After that again the first three steps are done for a number of times.

Pic. No. 6.9 Weaver on the loom

Table No. 6.3 Difference between Warp and Weft Yarns

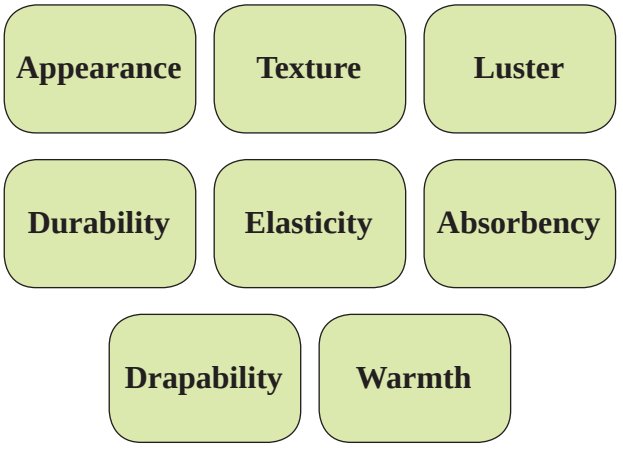
	Warp Yarns		Weft Yarns
1	They are lengthwise yarns in a woven fabric	1	They are widthwise yarns in a woven fabric.
2	They are comparatively stronger than weft yarns.	2	They are weaker than Warp yarn.
3	They are called Ends.	3	They are called Picks, Filling, short Woof.

6.4 Type of Weaves

The pattern in which the interlacement is done is called Weave. The repeat of the pattern is called a "weave repeat".

Weave pattern can determine many characteristics of a fabric like-

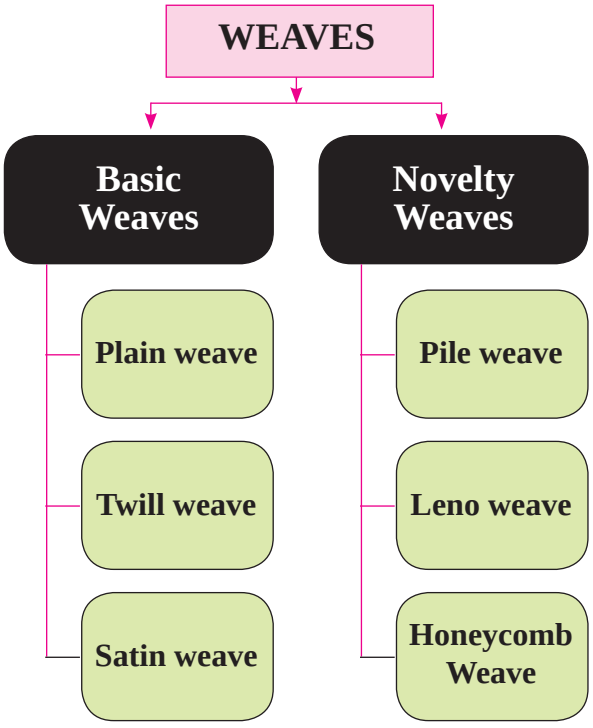
Chart No. 6.4 Characteristics of Fabric affected by Weave Pattern



Weaves can be made in many different ways. Based on the way warp and weft yarns interlacement, weaves are classified into two broad categories, A) Basic weaves and B) Novelty waves.

A) **Basic Weaves :** These are comparatively simpler weaves. They can be made on simple looms with limited number of harnesses. They are found in many of the fabrics of our daily use. The surface of the fabric is usually flat and smooth.

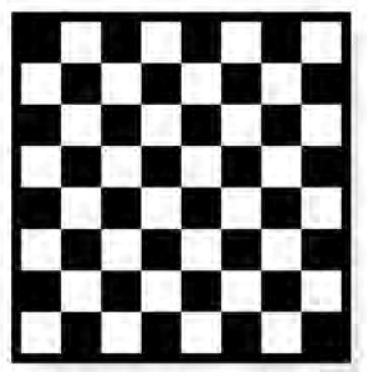
Chart No. 6.5 Types of Weaves



- **PLAIN WEAVE:** Also known as Simple weave or 1 up 1 down weave. The weft yarns and warp yarns go over and under each other alternately.

Characteristics of a plain weave:-

- Is the simplest of all weaves.
- Made on a simple loom.
- Requires only two harnesses.
- Weaving is alternately over and under one warp and weft yarns.
- Strong weave because interlacing of warp and weft is very high.
- Plain weave are reversible as they look alike from both sides.
- They are easy to clean less expensive, durable, uniform in construction.



Pic. No. 6.10 Plain Weave

Fabrics made of plain weave :

Long cloth, Gingham, Canvas, Chiffon, Georgette, Rubia,

Muslin, Cambric, Organdy, Casement, Organza, Voile

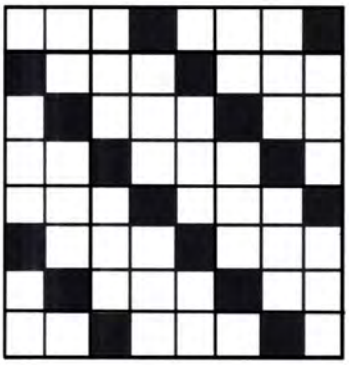
Variations of Plain Weave :

- **Rib weave:** Single warp yarn interlaces with multiple wefts or single weft yarn interlaces with multiple warp yarns. Length wise or width wise strips are seen on the surface of the fabric. Examples - Broad cloth, poplin
- **Basket weave:** Multiple warp yarns interlace with multiple weft yarns. Open block like design is seen on the surface of the fabric. Examples - Monks cloth, Shepherd Check.
- **TWILL WEAVE:** Diagonal lines are seen on the surface of the fabric.

Characteristics of a Twill weave:

- A prominent, distinct design of “diagonal lines” is formed on the surface of the fabric.
- The diagonal lines are visible on opposite sides of fabric too.
- The twill weave requires 3-8 harnesses.
- The twill weaves have good strength because the interlacing of warp and weft yarns is maximum.
- They are more complicated and expensive than plain weave fabric.

- They do not show dirt easily.
- They have good drapability, pliability and resiliency.



Pic. No. 6.11 Twill weave

Fabrics made of Twill weave :

Denim, Drill, Jeans, Gabardine, Serge, Khaki, Flannel, Corkscrew, Chino

Variations of twill weave:-

- ***Even twill weave*:-** When the filling yarns pass over and under the same number of warp yarns. It looks the same from both sides.
- ***Uneven twill weave*:-** When the filling yarns pass over either more or fewer warp yarns then go under, the weave is called uneven twill weave. It does not look same from both sides.

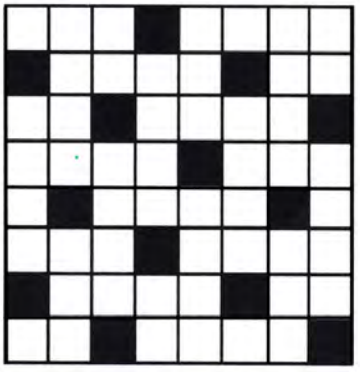
You Must Know ?

Twill weaves are also classified as right hand and left hand depending on the direction of the diagonal lines.

- **SATIN WEAVE:** The fabric is also known by the same name. The weave is made in such a way that the fabric looks extra lustrous and feels extra smooth.

Characteristics of a Satin weave:

- The extra luster and smoothness is because of the long "Floats" of warp yarns seen on the surface of the fabric.
- The weave uses basic construction of twill weave but it forms a broken diagonal lines.
- Satin weave uses 5-12 harnesses.
- Satin weave fabrics are relatively weak and less durable because the interlacing between warp and weft yarns is minimum.
- They have greater tendency to wear out by abrasion and snagging because of the longer floats.



Pic. No. 6.12 Satin weave

Fabrics made of Satin weave :

Dasmask, Slipper satin, Bridal satin, Antique satin,
Venetian, Crepback satin

Variation of Satin weave:

- ***Sateen weave*:-** In this long floats of weft yarns are seen on the surface of the fabric.

Do You Know ?

- 'Floats' are the length of the warp yarns between two wefts.
- Reflection of light on the floats gives lustre to fabric.

Can you tell why?

Satin weave fabrics are used for bridal gowns.

Internet my friends

Find out about more variations and examples of basic weaves.

B) Novelty Weaves:

Novelty weaves are formed by introducing changes in the interlacing patterns of warp and weft yarn. Novelty weaves are used to increase attractiveness, variety and to enhance beauty of the fabric. These weaves require some type of special attachments on or above the loom. The three novelty weaves discussed in this chapter are as follows -

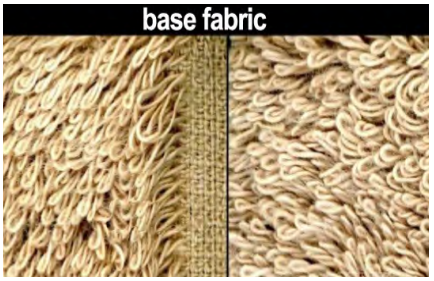
- **PILE WEAVE**: This is a 3-dimensional weave. There are loops or piles seen on the surface of the fabric.
  - The pile is produced by weaving three sets of yarns, wrap yarns, weft yarns and an additional wrap or weft yarn is the basic structure.
  - The additional yarn forms loops at regular intervals.
  - The pile weave fabrics create an effect of depth.
  - Pile weave fabrics gives softness, warmth and absorbency.

Pile weave fabrics are of two types: -

- **Cut pile weave:** When the loops formed on the surface are cut or closely sheared. These piles or loops are cut with knife edges. Examples of Cut pile weave:- Velveteen, Corduroys and Velvet.

Pic. No. 6.13 Cut pile weave

- **Uncut pile weave:** When the loops formed on the surface are not cut, it is called Uncut pile weave. Uncut pile fabrics are soft and fluffy and the pile loops make the surface more absorbent. Examples:- Terry Towels, Carpets and Upholstery.



Pic. No. 6.14 Uncut pile weave

Table No. 6.6 Difference between Cut Pile & Uncut Pile Weave

Cut pile weave		Uncut pile weave	
1	Loops formed on the surface are cut or closely sheared.	1	Loops formed on the surface are not cut.
2	Cut loops appear only on one side of the fabric.	2	Loops appear on one or both sides of the fabric.
3	Cut loops may not catch and tear.	3	Loops may catch and tear.
4	Soft and beautiful.	4	Absorbent.
5	Eg. Velveteen	5	Eg. Terry Towel.

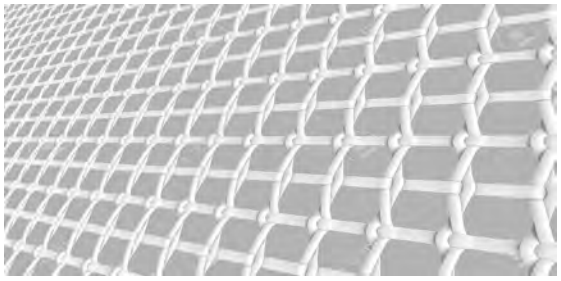
- **LENO-GUAZE WEAVE:** This is made in a totally different manner. The fabric has a lace like appearance with lots of open space.
  - Leno weave is also called guaze weave.
  - In this weave the warp yarns are in pairs, situated front and back. They keep on exchanging place as the fabric is made.

- The front one goes at the back and the back one comes to the front making a figure of 8 shape in between which a weft yarn is inserted.
- Each filling yarn is encircled by two warp yarns.
- This weave produces a decorative fabric which is durable, stable and has strength.

Do you know?

Leno weave is made with the help of a special attachment known as 'Doup'. This is a hair pin like device on the loom which moves both horizontally and vertically and controls warp yarns.

- Examples of Leno fabrics, Curtains and drapery fabrics, mosquito nets, laundry bags, food bags, shopping bags, mosquisette and grenadine.



Pic. No. 6.15 Leno weave

- **HONEYCOMB WEAVE:** This is again a special weave made with the help of a special attachment to the loom. It has an interesting surface.
  - This weave has cell like appearance.
  - This appearance is created by the floating warp and weft yarns which forms ridges and hollows.
  - The surface is not smooth but is quite absorbent and so quite often used as toweling material.

There are two types of honey comb:-

- **Ordinary honey comb:** In this weave cell-like effect is observed on both sides of the fabric.

Pic. No. 6.16 Honeycomb weave

- **Brighton honey Comb:** In this cell-like formation is only on one side of the fabric.

Examples of Honey-Comb weave: Towels, bedcovers, blankets and quilts, dress materials and coat materials.

Internet my friends

Find out about other Novelty weaves and how they are used.

Table No:6.7 Difference between Basic weaves and Novelty weaves

Basic weave		Novelty Weave	
1	Formed by simple interlacing patterns.	1	Formed by introducing changes in the interlacing patterns.
2	Does not require special attachments on the loom.	2	Require some type of special attachments on the loom
3	Create simple effect in the fabric.	3	Create decorative effect in the fabric.
4	Examples- plain, twill, satin.	4	Examples-pile, leno, honey comb.

6.5 Non-woven Fabric Construction

Though weaving is the most common way of producing woven fabric. Many fabrics are made by other techniques like Knitting, Felting, Braiding and Web Formation etc.

6.5.1 Knitting: This is the second most popular method of fabric construction. It is the creation of fabrics by forming loops of the yarn. The interlocking and continuous formation of new loops produces knit fabric.

In the construction of knit fabric, two terms ***Wales*** and ***Courses*** are used.

Wales: Refers to a column of loops that run parallel to the length of the knitted fabrics.

Courses: Refers to a series of successive loops lying crosswise in the fabric.

Pic. No. 6.17 knitted fabric

Knitting can be done by hand or by machine. There are two types of knitting machines -

- **Weft knitting machine:-** This is a circular machine in which the fabric is produced in the shape of a tube. This process is comparatively slow.
- **Warp knitting machine:-** In this machine, fabric is produced flat with straight side edges just like hand knitting. This is much faster.

Characteristics of a knitted fabrics:-

- They are stretchy, elastic, porous and resilient.
- These fabrics are soft, light in weight and require minimum or no ironing.
- They allow freedom of movement without fabric deformation.
- They allow air circulation.

Can you tell?

Why knitted materials are very popular as Sportswear?

Examples of Knitted fabrics:-

- Winter wears, inner wears, sport wears, hosiery etc. home furnishing, household textiles and industrial purpose.

6.5.2 Felting: This is a special process where fibres are directly converted into fabric without undergoing the step of yarn making. In felting process, wool or fur fibers tend to mat or interlock when they are subjected to heat, moisture and pressure. This happens because of the scales present on the surface of wool fibres. They form a sheet like construction which is known ***'Felt'*** and so the process is called ***'Felting'***.

Characteristics of felt fabric:

- Felt has no grain, does not fray or ravel. Because of this, it is possible to cut Felt fabric in any shape.
- Absorbs sound. Because of this it is used below table clothes and other places where sound needs to be curbed.
- It has no elasticity.

Examples of felt:

Hats, slippers, shoe insoles, table padding, home furnishing, industrial purpose like matting and felt boards.

Pic. No. 6.18 Items made from Felt

6.5.3 Braiding: This is a process of interlocking or plaiting three or more yarns or strips of cloth, over and under one another to form a flat or tabular fabric. Braids are stretchy and easy shaping.

Examples of Braiding:

Braided fabrics are used for articles like straw, pads, small rugs, belts, narrow ribbons, necklace, shoe laces, wicks, fish lines, parachutes and glider cords and cables.

Pic. No. 6.19 Braided fabric items

6.5.4 Web formation: Web formation is a method to make fabric by construction of fibre webs. Fiber webs are produced by bonding or interlocking fibers by chemicals, mechanicals, thermal or solvent means. This is possible only with man-made fibres. They are cheaper and excellent choice for use and throw.

Examples of web-formed fabrics :

Diapers, sanitary napkins, surgical and industrial mask, bandages etc.

Pic. No. 6.20 Fibre web Items

Internet my friends

Find out more about other non-woven fabrics.

Use Your Brain Power

I. Who am I?

1. I am a machine which makes fabrics by interlacing of warp and weft yarns.
2. I make sheet like substance directly from woollen fibres.
3. I am the gap made between warp yarns in a loom..
4. The woven fabric is wound over me.
5. Heddles are fixed in my wooden frame.

II. Solve the Cross Word :

X	1	X	2	X	X	3	X
X	4						
X		X		X	X		X
X		X		X	X		X
X	5				X		X
X	X	X	6				
X	7	X	X	8	X		X
9							X
X		X	X		X	X	X
X		X	X	10			X

Horizontal	Vertical
4. interlacing of warp & weft yarns	1. diagonal lines on the surface
5. weave that looks like net or lace	2. long floats of warp yarn
6. 1up 1 down weave	3. loops interlocking one another
9. matting of woolen fibres	7. comb like part of loom
10. hole in the middle of heddle	8. loops on the surface of fabric

EXERCISE

Objective Type Question

1. Match the following:

A		B	
1	Plain weave	A	Marquisette
2	Twill weave	B	Cell like
3	Leno weave	C	Battening
4	Reed	D	2 Harnesses
5	Pile weave	E	Denim
		F	Towels

2. Select and write the appropriate answer from the given alternative for each sub questions:-

1. The length wise yarn in a woven fabric is _____.
   a. Warp b. Weft c.Bias
2. The basic characteristics of Twill weave is _____.
   a. Diagonal lines b. Luster
   c. Loops
3. _____ is a novelty weave.
   a. Plain weave b. Honey-comb
   c. Satin
4. The _____ is produced directly from the fibers.
   a. Knit b. Lace c. Felt
5. Weaving is done on a machine called_____.
   a. Sewing machine b. Loom
   c. Cording Machine

3. State whether the following sentences are true or false:-

1. Warp yarns are stronger than weft yarns.
2. Gauze bandage is a pile weave.
3. There is only one harness in a loom.
4. Fiber webs are made directly from fibers.
5. Braiding is done on a doup loom.

4. Find the odd one out :

1. a. Felt b. Satin
   e. Braiding f. Fibre web
   g. Knitted fabric
2. a.Harness b. Reed
   e. Shuttle d. Knitting needles
   g. Warp beam
3. a.Voile b. Canvas
   e. Khaki d. Gingham
   g. Muslin
4. a.Terry cloth b. Velvet
   e. Corduroy d. Sweater
   g. Velveteen

Short Answer Type Question

5. Classify the following into given categories :

Woven construction Non-woven construction

Denim, Felt, Braiding, Satin

6. Give two examples of the following:-

1. Parts of the loom.
2. Plain weave fabrics.
3. The types of non-woven fabrics.
4. Twill weave fabrics.
5. Uses of fibre web.

7. Define the following terms:-

1. Weaving
2. Warp
3. Shedding
4. Felting
5. Knitting

7. Give Reasons:

1. Warp yarns are stronger than weft yarns.
2. Satin weave fabric are lustrous.
3. Pile weave is used for towels.
4. Twill weave is suitable for work cloths.
5. Fiber webs are cheaper than woven or knitted fabrics.

9. Answer in short :

1. What is a selvedge?
2. Write the characteristics of twill weave.
3. Write the uses of Felt.
4. Describe the pile fabrics.
5. Write the characteristics of knitted fabric.

10. Differentiate between:

1. Warp and Weft
2. Satin and Twill weave
3. Cut and uncut pile
4. Basic and novelty weave.

Long Answer Type Question

1. A) Types of weaves.
B) Describe the plain weave.

2. Explain the parts of Handloom?

3. Operations of weaving?

4. A) Describe any two Novelty weaves.
B) Give the basic characteristics of a novelty weave.

Project / Field Work

1. Visit a handloom industry and find out their difficulties and problems faced while weaving?
2. Collect the different types of fabrics and analyse their weaves.
3. Find out in how many ways we use non-woven fabrics in our life.

7. FINISHES

Do You Know ?

Can you name few finishes ?

Have you ever seen any fabric without any finish ?

Why do you feel finishes are necessary for textiles ?

Let's find out more such information in this lesson.

Newly constructed fabric as it comes from the mill is called 'greige goods or gray goods'. This does not imply that the fabric is gray in colour, it simply denotes any unfinished fabric. The goods must pass through various finishing processrs to make it suitable for its intended end use.

7.1 Introduction

A finish is defined as anything that is done to fiber, yarn or fabric either before or after weaving or knitting to change the appearance (what is seen), the hand (what is felt) or the performance (what the fabric does).

Finishes contribute so much to the final character and appearance of the fabric that it is often said, 'It's the finish that makes the fabric'.

Finishes may be done in the mill where the fabric is constructed or it may be done in a separate establishment by a highly specialized group called converters.

7.2 Basic Objectives of Finishing

The finishing operations differ according to the type of fibers in a fabric and properties to be imparted. Fabrics can be finished in many ways, soft feel of mulmul, attractive appearance of embossed or khadi printed fabric, stiffness of organdie, warmth of flannel is all because of finishing.

❖ **Following are the basic objectives of finishing**

- **To clean the fabric:** These finishes remove natural impurities and other impurities deposited on fiber, yarn or fabric during fabric formation. These finishes improve appearance of fabric and impart standard quality to the fabric. eg. General or routine finishes applied to various fabrics are scouring, bleaching, degumming etc.
- **Improve aesthetic properties:** Finishes in this category improve luster, drape, texture, hand (feel) of the fabric. Mercerization, glazing etc are included in this category.
- **Impart special quality not inherent in the fiber or fabric:** These finishes usually do not alter the appearance of fabric but they improve performance of fabric. Finishes such as fireproof finishes ,waterproof finishes are some of the examples.
- **Improve durability and other service qualities:** These finishes improve durability, resistance to biological conditions and impart easy care characteristics to fabric eg. Moth proof finishes, crease-resistance finishes etc.

7.3 Classification of finishes

I. On basis of processing: Finishing processes are categorized in several ways. Those concerned with textile processing may classify them as wet & dry finishes. They are also referred to as chemical & mechanical finishes.

a) Chemical Finishes : These finishes are obtained by deposition of chemicals such as starch, fats, rubber, latex, synthetic resins etc. These finishes can also be obtained by chemical reactions of acid, alkalies, bleaching agent etc. with fibers, yarns & fabrics eg. Mercerization, Bleaching etc.

Table no. 7.1 Classification of Finishes

On the basis of	Types			
Processing	Chemical Finishes (Wet Finishes)		Mechanical Finishes (Dry Finishes)	
Degree of Permanency	Permanent Finishes	Durable Finishes	Semi-durable Finishes	Temporary Finishes
End Product	Basic / Routine / General Finishes		Special Purpose / Functional Finishes	

b) Mechanical Finishes : They are also referred to as physical finishes. These finishing treatments include use of metal plates, brushes, calenders, rollers, roller with bristles, blades etc. eg. Calendaring, brushing.

II On basis of degree permancy: Finishes are also classified according to their degree of permanency as permanent, durable, semi durable & temporary finishes.

a) Permanent Finishes: A permanent finish generally involves a chemical process that changes the fiber structure that will not subsequently alter throughout the life or fabric.
Eg. Macerization

b) Durable Finishes: Durable press finish may last throughout the life of the fabric but its effectiveness diminishes. Eg. Water Proofing

c) Semi durable Finishes: A semi durable finish will last through several launderings or dry cleanings; some are renewable. Eg. Sizing

d) Temporary Finishes: A temporary finish will be removed or substantially reduced when the fabric is laundered or dry cleaned. Eg. ironing

III On basis of End Product: Designers, merchandisers, sales personal & other concerned with end products classify finishes as Basic finishes & Special purpose finishes.

a) Basic Finishes : Basic finishes are often referred to as 'Preparation'. They are also termed as 'Routine Finishes' or 'General Finishes'. Routine finishing includes those steps in finishing that are done to most fabric to prepare them for dyeing & for special purpose finishes. In many cases they cannot

be seen or felt. These finishes mainly improve the appearance of fabric & impart standard quality to the fabric.

Eg. Scouring, Bleaching, Sanforization

b) Special Purpose Finishes : Special purpose finishes are also known as functional finishes. Special purpose finishes are directly related to the end use requirements of a particular textile item. These finishes impart special characteristic to fabric according to the use.

Eg. Waterproof finishes, Flame proof finishes etc.

7.4 Types of finishes:

After discussing classification of finishes and basic objectives of finishing, lets learn some of the basic finishes and special purpose finishes in detail.

7.4.1 Basic of finishes:

Table no. 7.2 Basic Finishes

Fabric Finish	Function
• Brushing	Removes short loose fibres
• Singeing	Burning surface fibres and lint
• Scouring	Removes dirt, oil and sizing materials
• Bleaching	Whitens the fabrics
• Sizing	Improves body, feel and add lustre
• Mercerizing	Imparts lustre and improves dye affinity of cotton
• Sanforizing	Shrinking the fabric – corrects length and width
• Calendering	Straightens, smoothens and embosses
• Degumming	Removes natural gum from silk fibre
• Weighting	Compensate boiled out gum
• Delustering	Making fabric dull or reducing lustre

❖ Brushing

Brushing is a mechanical finish that involves the removal of short loose fibre ends from the surface of the fabric. Cylinders covered with fine bristles rotate over the fabric, pick up the loose fibre ends and pull them away either by vacuum or gravity. This operation is usually applied to fabrics of staple fibres to give them a smooth and uniform appearance.

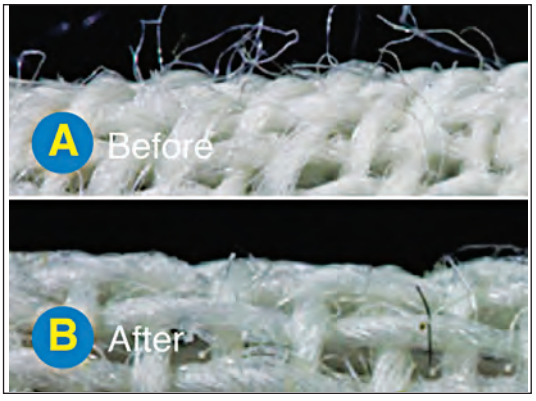
❖ Singeing

If a fabric is to have a smooth finish, singeing is one of the first essential preparatory processes.

Singeing burns off lint and threads as well as fuzz and fibre ends leaving an even surface. It is done before the fabric passes through other finishing processes or a printing operation.

Singeing is accomplished by passing the opened out fabrics directly over gas flames or hot plates at a speed sufficient to permit the protruding material to burn but not to allow the fabric itself to be scorched or burned. The fabric moves rapidly at a speed or 210-250 meters per minute and enters a water-bath as soon as it leaves the singeing area. The water-bath extinguishes any sparks or afterglow and prevents damage.

The finish is applicable only to the cotton and spun viscose rayon fabrics, but it is not suitable for wool or silk because fibres cling to each other. It is not applicable for man-made thermoplastic fibres because singe beads will be formed on the surface of the fabric and fabric will look very unattractive.



Picture No. 7.1 Effect of Singeing

❖ Scouring

Fabrics may be scoured or bleached before mercerizing, dyeing and printing. Scouring and bleaching are usually carried out together in large kettles called kiers.

Scouring is thorough cleaning of fibres to remove foreign matters such as dirt, natural waxes and grease, dry perspiration, processing oils and sizing compounds that are deposited on fibres, yarns or fabrics.

Scouring is a chemical finish and improves the moisture regain of the fibres for further finishing operations to be followed.

Scouring procedures vary depending on the fibres involved. Soap or synthetic detergents with alkaline builders and with wetting agents constitute the most common scouring agents. When the process is used for protein fibres, the chemicals selected should be neutral or slightly acidic.

❖ Bleaching

Bleaching follows the normal scouring operation. Fabrics, yarns or fibres are bleached either to make them white or to prepare them for dyeing or printing. Bleaching is a chemical operation, is relatively durable when the bleaching method is appropriate to the fibres involved.

Bleaching agents are of two kinds

Oxidising bleaches

Reducing bleaches

Oxidising Bleaches : These bleaches provide Oxygen to the fabric and make it white. They are many varieties available from the mildest to strongest. Sunlight, H_2O_2 are mild oxidizing bleaches while Sodium Hypochlorite ($NaClO_3$) or Javelle water is the strongest. The bleaches containing chlorite are strong and they are weaken fabric. That is why they can be safely used only on strong cellulosic fibres like cotton and linen.

Reducing Bleaches : These bleaches take away Oxygen from the fabric and make it white. Sodium Hypochlorite and sulphorous acid are commonly used reducing bleaches. These bleaches are milder and can be safely used on protein fibres like silk and wool.

Manmade fibers sometimes require bleaching but if they are properly processed during manufacture, many fibers are naturally white.

Picture No. 7.2 Effect of Bleaching

❖ Sizing

Sizing is the application of various materials to a fabric to produce stiffness or firmness. This is a chemical finish and is generally applied to cotton and linen to increase strength, weight, smoothness and stiffness. Cellulosic fabrics are sized with starches, resins, dextrin, clay and chalk etc.

Starch fills up the openings in constructed cloth creating an appearance of a greater compactness thus making an inferior fabric look attractive.

An important use of sizing is to prepare warp yarns for the weaving on loom. The sizing is applied to the yarn as they are wound onto the final warp beam. This is a temporary finish as the type of chemicals used are easily removed by the desizing and scouring processes that follow fabric construction.

❖ Mercerization

Mercerization is a chemical finish applied to cellulosic fibres especially cotton and cotton blends. It is also applied to linen.

The main purpose of mercerization is to alter the chemical & physical properties of the fiber. This process improves luster, strength, dye ability, absorbency, softness, elasticity of fiber.

The standard mercerization process uses caustic soda i.e. sodium hydroxide (NaOH) of 20-23% concentration. The fabric is saturated in the solution and held under tension. Fabric is then fed to timing rolls for a specific time period. Finally it is thoroughly rinsed in water & dried.

Know Your Scientist!

John Mercer was an English dye and fabric chemist. Born in Britain, he developed a process in 1844 for treating cotton with caustic soda. The process improved many physical properties of cotton. The process is named after him as 'Mercerization'.

❖ Sanforising (Shrinking)

Fibres spun into yarn are under constant tension during the weaving process. Their physical condition is changed but not permanently fixed. The fibres tend to revert to their natural state, causing shrinkage.

The fibres are made to assume a final condition by shrinking the fabric in a preparatory finishing process that minimize subsequent shrinkage, such as immersions in cold water, followed by hot water, steam or a chemical treatment.

Picture No. 7.3 Sanforizing Machine

Fabrics can be labelled as 'Preshrunk', 'Fully Shrunk', 'shrink proof' etc.

For basic finishes degumming and weighting refer to chapter Silk fiber. For delustering finish refer to chapter Viscose Rayon.

❖ Calendaring :

This is a mechanical finish.

Calendaring is the finish applied to nearly all the fabrics. Technically, the word pressing is used for wool fabrics and calendaring is used for all the other fibre fabrics.

Picture No. 7.4 Calendaring Machine

The need for calendaring arises mainly because the fabric when it is wet processed and dried is in the least lustrous state and its surface is not smooth because of the presence of highly crimped and wavy threads. To meet this need the fabric is passed between the rollers termed calender and this mechanical process is called 'calendaring'.

This finish is similar to ironing but is done with much higher pressure. Calendaring is done by feeding the fabric between large rollers. One of these roll is somewhat soft while a second roll is firm and heated. The action is similar to the use of heated iron placed on a padded ironing board.

7.4.2 Special Purpose Finishes

Following are some of the commonly used special purpose or functional finishes

Table 7.3

Special Purpose or Functional Finishes

Fabric finish	Example
• Finishes that add to durability	• Abrasion resistant finish • Antislip finish
• Finishes that provide added comfort	• Absorbent finish • Water-proof finish
• Finishes that provide safety	• Flame retardant finish
• Finishes that make care easier	• Crease-resistant finish • Durable press/ wash and wear finish • Stain and spot resistant finish
• Finishes that provide environmental resistance	• Fume fade resistant finish
• Finishes that provide biological resistance	• Moth-resistant finish • Mildew-resistant finish • Perspiration resistant finish

After getting information regarding Special Purpose Finishes, lets learn some of the finishes in detail.

❖ Waterproof finish

For a fabric to be truly waterproof, it must be completely sealed with a substance that is insoluble in water. The familiar rubber coated garb of police officer and fire fighters is a good example.

Modern water proofing materials include **vinyl resins**, which do not oxidize and crack as readily as rubber. Synthetic rubbers are also more durable to outside influences than natural rubber. Today's waterproof fabrics are mostly used to protect merchandise in transit. However these materials close the pore of the fabric and do not permit it to breathe and therefore are incompatible to wear. This finish is chemical in nature.

Picture No. 7.5 Fabrics with waterproof finish

❖ **Microporous waterproof Finish :** This is the latest invention in water-proofing

A microporous film is applied to the back of fabric. Although the film appears to be solid, it has millions of tiny cells called **'Micropores'**. These cells are too small to permit rain to penetrate, but they do allow passage of air. This finish is used for rainwear and outerwear fabrics.

❖ Flame-retardant finish

The term Fire-proof or Flame-proof can only be applied to glass or asbestos fibres because only a material which undergoes no change when exposed to fire can be termed Fire-proof. But in practice, a fire-proof material means one which does not propogate flame beyond the charged area. There is as yet no known finish which can make textile materials as fireproof in the real sense of term. What is aimed at in Fire-proofing is to make the material **"fire-resistant"** or **"flame-retardant"**. This finish is chemical in nature.

Certain textiles are required to be fire-proof where the risk of fire is involved or when statutory obligations demand them to be so. It is often used for uniforms of fire fighters, for workers in ammunition factories, coal mines. This finish has large application in defence organization.

Internet my friends

Find out detailed information about textile items which needs fireproof finish in defence organization.

Picture No. 7.6 Fire-proof Fabrics

Some interesting facts !

Evidence of asphalt being used as a plastic material and as a waterproofing agent was found as early as 6500 BC.

❖ Moth proof finish

Fibers containing protein such as wool and silk are especially susceptible to the damage caused by moth and carpet beetles. The protein keratin which is found in wool and other hair-fibres is believed to be what the moth prefers, than silk fibres that contain fibroin protein. Carpet beetles however are likely to eat all protein substances including keratin and fibroin. Protein fibres treated with this finish become so unpalatable as to cause the larva to starve and die. This finish is available in both temporary and permanent type & is chemical in nat**ure.**

Picture No. 7.7 – Textiles with Moth-proof finish

Picture No. 7.8 - Attack on Cloth by Moth

Let's Find Out

Find out information regarding moth-proof bags and moth repellents available in market.

❖ Mildew-proof finish

This finish is applied to cotton, rayon and linen and protects the fabric from damage caused by mildew and fungi. Starched cotton fabrics and damp fabrics are more susceptible to the mildew damage.

Picture No. 7.9 Fabrics with Mildew proof finish

TABLE No. 7.4

Difference between Basic finishes and Functional finishes

	Basic Finishes		Special Purpose Finishes
1.	The Finishes from this category are applied first on to the fabric eg. Singeing, Scouring etc.	1.	Finishes from this category are applied after basic finishing process. eg. Waterproofing, mothproofing.
2.	They impart standard quality to the textiles.	2.	They impart special character to the fabric according to the end use of textiles.

Use Your brain Power!

A) In the table given below finishes & their functions are given. Some places have been left blank. Can you fill them up?

	Finish	Function
1.	Calendaring	
2.		Removes dirt
3.	Bleaching	
4.	Degumming	
5.		Compensate boiled out gum

B) Can you complete the bracket by using similar word.

1. Wet finish – [ ] finish
2. Mechanical finish – [ ] finish
3. [ ] finish – General finish
4. Special purpose finish – [ ] finish

C) Can you reshuffle the letters to name the finish.

1. G L H E I B C N A - _____
2. E M U N D G I M G - _____
3. R E I E C R M I Z G N - _____
4. Z N I S G I - _____

EXERCISE

Objective Type Question

I A - Match the pairs.

	A		B
1	Mildew proof finish	a.	Makes fabric stiff
2	Bleaching	b.	Cellulosic fabrics
3	Singeing	c.	Remove dirt
4	Scouring	d.	Burns surface fibres
		e.	Whitens the fabric

B - Match the pairs.

	A		B
1.	Moth proof finish	a.	Thermoplastic fibre
2.	Sanforizing	b.	Stiffness
3.	Sizing	c.	Provides biological resistance
4.	Calendaring	d.	Length contraction
		e.	Similar to ironing

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

1. Singeing is making shrink proof fabric.
2. Brushing removes short loose fibres.
3. Weighting is compensating boiled out gum of silk.
4. Mildew proof finish is applied for protein fibres.
5. Degumming is removal of silk gum.

III. Multiple choice questions.

Select and write the most appropriate answer from the given alternatives for each sub-questions.

1. Special purpose finishes imparts special
   a. Texture b. Drape
   c. Characteristics
2. Finishes which use acids, alkalies, bleaches are called
   a. Physical finish b. Chemical finish
   c. Mechanical finish
3. Finish that improves care characteristic is
   a. Starching b. Crease resistant
   c. Scouring
4. Newly constructed fabric without any finish is called
   a. Gray good b. White good
   c. Raw good
5. Basic finishes removes
   a. Impurities b. Hardness
   c. Lustre
6. Waterproof finish is applies to
   a. Carpets b. Raincoat
   c. Blanket
7. Fireproof finish is applied to
   a. Labcoats b. Umbrella
   c. Curtains
8. Fiber which is more susceptible to moth
   a. cotton b. silk
   c. polyester
9. Process which burns out loose fibers from surface
   a. Sanforizing b. Singeing
   c. Scouring
10. Finish which makes the fabric stiff
    a. Sizing b. Bleaching
    c. Brushing

Short Answer Type Question

- **List the following**

1. List two special purposes finishes.
2. List two properties improved after mercerization.
3. List one example each of reducing and oxidizing bleaches.
4. List two basic finishes.
5. List two examples where the fireproof finish is essential.
6. List two examples where waterproof finish is required.

- **Give reasons.**

1. Chlorine bleaches are not used for protein fibre.
2. Uniform in ammunition factories requires fireproof finish.
3. Woollen fabrics are given moth-proof finish.
4. Degumming is essential for silk.
5. Singeing is not used for fabrics made up of thermoplastic fibres.
6. Cellulosic fabrics are given mildew proof finish.
7. Calendaring finish is essential for most fabrics.

- **Differentiate between**

Basic finishes and special purpose finishes.

A) Classify the following finishes into Basic finishes & Functional finishes

a) Water proof finish b) Scouring
c) Mildew proof finish d) Sizing

B) Classify following into chemical finishes & mechanical finish

a) Brushing b) Bleaching
c) Mercerization d) Calendaring

- **Answer in short.**

1. Calendaring
2. Mercerization
3. Basic finishes
4. Singeing
5. Sanforizing
6. Scouring
7. Bleaching
8. Special purpose finishes
9. Fire proof finish
10. Water proof finish
11. Moth proof finish

Long Answer Type Question

1. Explain basic objectives of finishing.
2. Explain the term basic finishes & explain mercerization
3. Explain the term special purpose finishes and explain mothproof finish

Self Study Project

1. Study labels on the fabric and find out various routine finishes applied to fabrics.
2. Educate your family & friends regarding care of woollens from moth

8. LAUNDRY REAGENTS AND DRY-CLEANING

Do You Know ?

Why do we need to wash our clothes regularly?

What is fixed dirt?

What is dry cleaning?

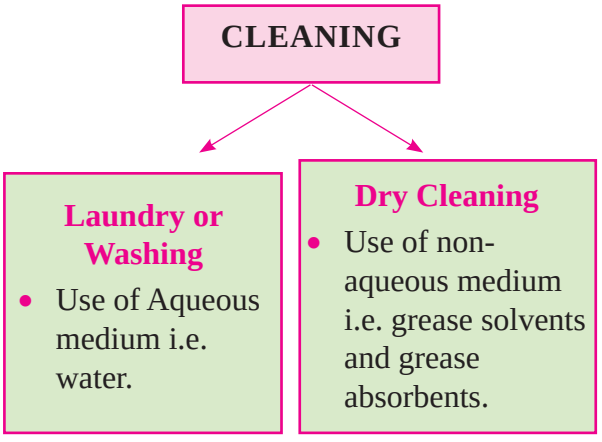
Why do we give our expensive clothes to commercial laundry outlets for dry cleaning?

What is the difference between laundry & dry cleaning?

Clothes require cleaning after they are used so that they can be worn again. The dirt, perspiration and stains (if any) need to be removed, otherwise they will damage the fabric. The outcome of successful cleaning are clean, fresh, hygienic and spotless clothes. The dirt present in the clothes are of two types – **Loose dirt** and **Fixed dirt.** The loose dirt can be brushed off from the clothes easily. The fixed dirt can not be easily removed as it is greasy and so sticks on the clothes. To remove this dirt, cleaning is required.

Cleaning of cloths is done by two different types of processes: -

Chart 8.1 Method of cleaning clothes



Do you recall what we learnt in XIth standard?

Objectives of Laundry :

1. To improve serviceability.
2. To retain attractiveness.
3. To study various reagents used in laundry.
4. To develop skills regarding the use of various laundry equipment.

8.1 Laundry Reagents

In this chapter we will learn about the laundry agents, water, soap and synthetic detergents.

The different laundry reagents can be classified in the following manner –

Chart No. 8.2 Different Laundry Reagents

Cleaning Agents	Stiffening Agents	Whitening Agents
• Water • Soap & Detergent	• Starches • Gums	• Blues • Optical Brighteners

You Should Know ?

Stiffening Agents are now available in the form of commercial ready to use starch .

Optical Brightness are now component of detergents.

Internet my friends

Find out about some more commercially available laundry reagents and their specific functions.

Water

Water is the prime laundering agent. All over the world water has been used for laundry purpose since the civilizations developed and mankind started to use clothes. The popularity of water as a prime laundry reagent is due to the certain outstanding qualities -

Functions of water in laundering:

1) As a **wetting** agents: Water penetrate into the fabric and causes wetting.

2) As a **solvent**: Water is a good solvent and is able to dissolve most of the dirt. Cold water is the best solvent for protein matter and hot water helps to remove greasy matter.

3) It is neutral. Does not chemically react with other laundry reagents.

For laundry purpose, water is classified into two types – Soft water & Hard water.

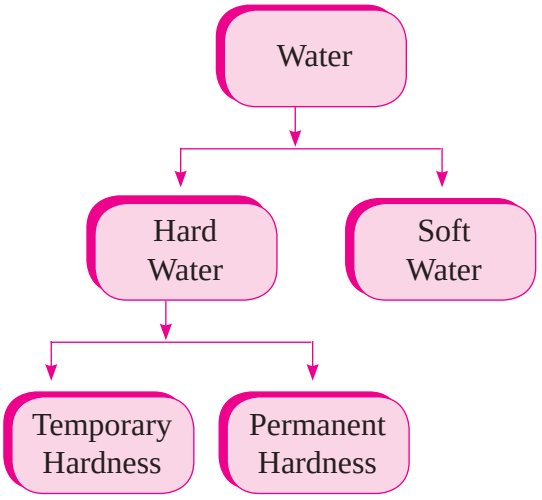
You must know

Pedesis is the movement of water particles. They move in and out of the fabric and with every movement they remove some amount of dirt, thus cleaning the fabric..

Can you tell?

What are the sources of water?

Chart No. 8.3 Types of Water



Soft water is considered suitable for laundry. It contains **Sodium salts** which do not interfere with the action of soap. It gives lather freely when soap is added and clothes get clean satisfactorily. Hard water is not suitable for washing because it contains **Magnesium(Mg) or Calcium (Ca)salts** which interfere with the action of soap. It does not give lather easily when soap is added and clothes do not get cleaned satisfactorily. The amount of these salts present in the water decide how hard the water is. All these salts are perfectly soluble in water and so it is not possible to filter them out.

Some interesting facts !

Hardness of water is measured in degrees from 1-10 and is expressed as Part Per Million or PPM.

Water having up to 3^0 hardness is considered soft water.

Water having more than 3^0 of hardness is considered hard water.

You Should Know ?

If water contains Bicarbonates of Ca or Mg, it is considered **Temporary hardness.**

If water contains Sulphates, Nitrates or Chlorides of Ca or Mg, it is considered **Permanent hardness.**

Disadvantages of Hard water in Laundry:

- Hard water does not form lather with soap.
- When soap is added in hard water the Magnesium and Calcium salts react with the soap and use it up so soap is not able to clean the fabric.
- As a result of the reaction of these salts with soap, **scum** is formed which is deposited on the fabric and spoils the appearance.
- Soap is wasted.
- Clothes do not get clean.

Scum is a sticky, curd like precipitate which has no cleaning power and gets deposited on the fabric making it even more dirty.

Due to these disadvantages, it is not advisable to wash clothes with hard water but unfortunately, soft water is not easily available everywhere and so the hard water has to be made soft for making it suitable for laundry. There are many ways of doing it –

Methods of softening hard water:

a) **Boiling Method:** Temporary hardness can be removed by boiling water. Due to the heat, the soluble Ca or Mg bicarbonates break into insoluble carbonates which gets precipitated at the bottom and can be filtered out making the water soft.

b) **Chemical Method:** Permanent hard water does not become soft by boiling and so chemicals have to be added in it to make it soft. Water is treated by any of the following chemicals -

- **Ammonia** – Used at commercial level. Not safe to be used at household level.
- **Caustic soda** – Used at commercial level. Not safe to be used at household level.
- **Base Exchange method (Zeolite Softeners)** – used in big cities.
- **Washing soda** – Most commonly used at household level.

In all the above methods the temperature of the water and amount of chemical should be properly controlled. Too little will not have the desired effect and too much will make the water alkaline and spoil the clothes.

Table No. 8.4 Difference between Soft Water and Hard Water.

	Soft Water		Hard Water
1)	Does not have any Ca or Mg Salts	1)	Ca and Mg salts are present in the form of bicarbonates, sulphates, nitrates and chlorides.
2)	When soap is added it forms lather.	2)	When soap is added it forms scum.
3)	Makes the fabric whiter and brighter.	3)	Makes the fabric hard and destroys the appearance.
4)	Fabrics last longer.	4)	Fabric does not last longer.
5)	Suitable for laundering.	5)	Not suitable for laundering.

Soaps

Along with water, soap is a common cleaning agent used at household and commercial level. The cleaning power of soap is known as detergency. The type of soap should be chosen according to the type of fabric and the amount of dirt present in it. Soap is available in powder, bar or liquid form. There are many kinds of soaps available in the market. You can make soap at home too.

Soap is a compound formed from a Fatty Acid and an Alkali.

Sodium, potassium or ammonium salts of fatty acids that are soluble in water and have good cleaning power and used for laundry work are known as soaps.

The process of mixing fatty acid and alkali to make soap, is known as Saponification.

Manufacturing :

Oil and caustic soda are mixed in a fixed quantity and heated for some hours. Saponification takes place and the soap mixture is ready.

To separate the soap from this mixture, common salt is added. This results in separation of four layers –

- Upper first layer of foam which is removed.
- Second layer of soap liquid which is taken out.
- Third layer of unused alkali called 'spent lye'.
- Fourth layer of impurities.

The soap liquid is boiled to reduce water content. Colour, perfume and other additives are added and it is poured into moulds. By the next day, it solidifies. It is then stamped, wrapped, packed and sold.

A peek in history.

The word **sapo** is a Latin word. It has come from mountain called **Mount Sapo** within the Roman World .

According to one Roman legend , Roman housewives noticed that a strange yellow substance in the water of River Tiber flowing near Mt. Sapo made their cloths cleaner and brighter than ordinary water.

Mt. Sapo was an ancient location for animal sacrifice. Animal fat mixed with wood ashes and rain water created an excellent Soap mixture having great cleaning power. This mixture was named **'Soap'**, as it was found near Mt. Sapo.

You Should Know ?

The history of soap manufacturing in India by the organized sector can be traced to as far back as 1879, to the North West soap company at Kanpur by the British and Kerseve soap company at Meerut in 1897. By 1918 there were as many as eleven large soap manufacturing units in India which started the production of modern type of soaps.

Raw material required for soap manufacture are as follows :

Table No. 8.5 Raw Materials for Soap Making

	Components	Examples
1)	Alkali	Caustic Soda, Caustic potash.
2)	Fats and oils for fatty acids.	Animal Fat: Tallow, Lard. Vegetable fat and oil: Palm oil, castor oil, cotton seed oil, etc.
3)	Builders	Sodium silicate, borax.
4)	Fillers	Starch, clays and chalks.
5)	Anti-oxidant	Sodium hydrosulphite.
6)	Perfumes	Natural, semi-synthetic or synthetic perfumes.

Function of Soap in laundry:

- Soap acts as wetting agent: by making the penetration of water into fabric easier.
- Soap increase Pedesis thus helping to remove non-greasy dirt by the action of water molecules.
- Soap helps in emulsification of greasy dirt and breaks the bond between the greasy dirt and fabric thus removing it from the fabric.

- Soap makes a film around each dirt particle and does not allow them to deposit on the fabric again. That is why usually after washing clothes we see that the soap water has become dark and dirty as the dirt from the clothes is now in the soap solution.

Types of Soaps :

- **Neutral Soaps:** These are natural detergents. They are dried fruits and berries of certain plants and have been in use as cleaning agents since very ancient time. They have very good detergency.

Pic. No. 8.1 Ritanut

They do not contain free alkali. They are used for washing Silk and wool. Eg. Ritanut. They are also used in place of shampoo to wash hair.

Something Interesting!

Rita is one fruit which lathers even in hard water. It is a fruit like berry which contains saponin a substance which produces lather, when soaked in water.

There is one more neutral soap occurring in nature. Find out about it.

- **Built Soaps:** Has a mixture of added alkalinity and soap. Can be used for cotton and linen only as other fibres are not able to tolerate such high amount of alkali. Certain alkalis known as builders are added in the soap mixture. Some common builders are washing soda, borax etc. They have better detergency than normal soap.
- **Hard Soaps:** These have firm physical form. Less soluble in water. Do not give lather easily. Require more labour and time. Eg. Sodium Soaps.
- **Soft Soaps:** These are soft in touch. More soluble in water. Give free lather. Soap gets used up quickly. Eg. Potassium and Ammonium Soap.
- **Mild Soaps:** These soap has correct balance of fat and alkali. Suitable for delicate fabrics like silk, wool. Eg. Soap Flakes and Bath Soap.

Think & tell

1. Why Hard soap requires more labour and time for laundry work.
2. Why soft soap turns out to be more expensive in laundry.

Table No. 8.6 Difference between Neutral Soap and Built Soap.

Neutral Soap	Built Soap
• Neutral soap does not contain free alkali. • Suitable for washing silk and woolen fibers.	• Built soap has added alkalinity to increase detergency. • Suitable for washing cotton and linen fibers.

Table No. 8.7 Difference between Hard Soap and Soft Soap.

Hard Soap	Soft Soap
• Less soluble in water. • Less wastage in laundry work. • Does not give free lather. • Eg. Sodium Soaps	• More soluble in water. • More wastage while washing fabrics. • Gives free lather. • Eg. Ammonium Soaps and Potassium Soaps

Synthetic Detergents

Manufacturing of soaps require fatty acids obtained from fats and oils which were needed as food too. Therefore scientists were trying to find out a substitute for fatty acids. They discovered that a chemical called LAS obtained from petrochemicals has a chemical structure similar to fatty acids and so can replace fatty acids in the making of soap. They called this material **Surfactant.** As this new substance was made from synthesized raw materials, it was named as **Synthetic Detergent.** It proved to be far superior to soaps and hence replaced soap in many households as the favourite cleaning agent. It can be available in powder, bar or liquid form.

A peek in history.

During World War I, there was acute shortage of fats and oil. The surfactant was discovered at that time and synthetic detergent was first made in Germany. It came into markets after world war II.

In India, the production of detergent started in 1958.

Table No 8.8 Components of Synthetic Detergents

Components		Functions	
1)	Surfactant	1)	Basic Cleaning ingredient.
2)	Builder	2)	Softens water. Adds detergency.
3)	Foam Boosters	3)	To stabilize foam.
4)	Optical brightening agent	4)	To give an optical illusion and make the fabric look brighter.
5)	Perfumes and colors	5)	To mask the bad odour and white color of the surfactant.

Advantages of synthetic detergents in laundry:

1) Equally effective in hard water as well as in soft water.
2) Has more detergency than soaps.
3) Stable to acidic and alkaline conditions.
4) Equally effective in cold and hot water.
5) Prevents redeposition of dirt on fabric.
6) Makes the fabrics look brighter.

Table No. 8.9 Difference between Soap and Detergent.

Soap	Detergent
• Alkaline.	• Neither Alkaline nor Acidic.
• Detergency of soap is low.	• Detergency is superior.
• Not effective in hard water.	• Effective in hard as well as soft water.
• Effective in alkaline medium.	• Effective in acidic as well as alkaline medium.
• Superior washing in hot water.	• Equally effective in hot as well as cold water.
• Can not make fabrics look brighter.	• Can make fabrics look brighter.

Internet my friends

Find out about the different detergents available in the market and their components.

Find out which two men discovered the chemical process of making Soap.

Do you wash your expensive clothes at home?

Can fabrics with pleats or embossed design be washed with ordinary laundering?

Dry Cleaning

Dry-cleaning is also known as **"Chemical Cleaning"** or **"French Cleaning"**. Dry cleaning is based on the fact or principle that most of the dirt to fabric is because of grease. When this grease is removed or dissolved by suitable reagent, the fabric is free from dirt. Hence the greasy dirt is removed in Dry-cleaning.

The term **'Dry Cleaning'** is somewhat misleading. The fabrics are not cleaned by dry reagents but they are cleaned with substances other than water. As water is not used, it is called Dry cleaning.

A peek in history.

The modern history of dry cleaning began with a funny accident in the 1840s. French textile maker Jean-Baptiste Jolly's maid accidentally knocked over a kerosene lamp onto a linen tablecloth. Jolly was surprised to find that the linen in that spot became much cleaner. Jolly quickly turned this revelation into an extension of his business, and the firm of **Jolly-Belin** in Paris is historically credited as the first dry cleaning business, using kerosene as its primary cleaning material.

As it was discovered by a French person, the process was known as 'French Cleaning'.

- **Dry Cleaning Substances:**

Dry-cleaning is done by following substances -

a) **Grease absorbents –** These are dry powder like substances which are used to clean grease spots from light coloured fabrics. Eg. Fur, Lace, Shawls, Hats.

b) **Grease Solvents –** These are liquids which are used to clean either stains or entire garments. These can be inflammable or non-flammable.

Chart No. 8.10

Dry Cleaning by Grease Absorbents	Dry Cleaning by Grease Solvents
Brush the garment well to remove the loose dirt	Brush the garment well to remove the loose dirt
⬇	⬇
Place Blotting paper on both sides of soiled fabric	Pour sufficient solvent in Dry-cleaning pump
⬇	⬇
Spread a thick layer of absorbent powder.	Soak the garment in the solvent
⬇	⬇
Rub in circular motion	The pump is used up and down for 15-20 minutes.
⬇	⬇
Leave for ½ Hr.	The garment is removed and the solvent is drained
⬇	⬇
Shake off powder and brush the garment.	The garment is dried in shade for 2-3 days
⬇	⬇
What are French chalks, Talcum powder, bread crumbs, starch, fuller's earth. These are **grease absorbents.**	**Flammable solvents** - petrol, kerosene, benzene, methylated spirit. **Non-flammable solvents** - Carbon tetrachloride, tri-chloro ethylene, tetrachloroethane etc.

- **Dry-cleaning pump:**

The dry cleaning pump is a round tin with a lid made of a rust free metal. A tap at the lower side and fitted in suction washer, with a handle. The lid has 3 screws, which make it air-tight. The tin is filled with the solvent.

The clothes to be cleaned are put in the solvent, the screws are tightened to make the lid air tight. The clothes are moved in the solvent with the help of the handle for 10-15 mins.

At the end of the process the tap is opened and the solvent is filled in a bottle to be reused again. The clothes are taken out and the solvent drained out. The clothes are dried in shade for 2-3 days or till the smell of the solvent is gone.

Pic. No. 8.2 Dry cleaning Pump

The dry cleaned clothes are never dried in direct sunlight as the solvent present in them may catch fire due to the heat of sun.

Dry cleaning is best suited for the following types of clothes –

Silk & wool, Zari fabrics, Fur, Clothes in which colour may bleed, Lace fabrics, Permanent pleated dresses, Embossed or embroidered fabrics.

Advantages of Dry cleaning :

1. Can be used for cleaning garments like fur, felt, crepe, silk, woolens, velvets and corduroy.
2. Colours of fabric does not bleed.
3. Pile of fabrics does not flatten.
4. Does not affect the colour, texture, and luster of the fabrics.

Disadvantages of Dry cleaning :

1. It is costly.
2. The smell of solvents remains in the fabric for longer time.
3. Can clean only greasy dirt.
4. Use of flammable solvents is dangerous and requires caution.

Internet my friends

Find out about latest trends in dry cleaning, dry cleaning soap and spirit soap.

Table No. 8.11 Difference between Grease Absorbent and Grease Solvents

Grease Absorbents	Grease Solvents
1. Dry powder like substances.	1. Liquids.
2. Used for removing greasy spots.	2. Used for cleaning entire garment.
3. Non-flammable.	3. Some of them are highly inflammable.
4. No smell.	4. Strong smell.
5. No equipment required.	5. Dry cleaning pump required.
6. Can be done at home.	6. Should not be done at home.

Table No. 8.12 Difference between Washing and Dry Cleaning

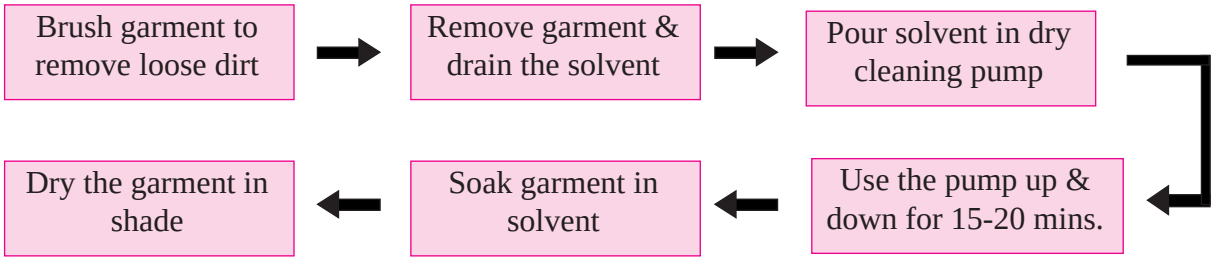
Laundry or Washing	Dry Cleaning
1. Water and soap are used.	1. Grease absorbents and grease solvents are used.
2. Done for all kinds of regular clothes.	2. Done for special kinds of clothes.
3. Safe for regular use.	3. Can be dangerous for regular use.
4. Tub, scrubbing brush etc. are used.	4. Dry cleaning pump is used.
5. Cheaper	5. Costly

Use Your Brain Power !

I. Find out 5 types of soaps in the grid given below :

B	U	I	L	T	S	M	N	P
A	R	Y	T	M	O	I	D	S
N	E	U	T	R	A	L	F	O
L	W	Q	I	T	E	D	P	F
H	A	R	D	M	X	U	E	T

II. Arrange the given dry cleaning process in proper sequence :



EXERCISE

Objective Type Question

1. Match the following.

	A		B
1)	Soap	a)	Use of non-aqueous medium.
2)	Soft water	b)	Movement of water particles.
3)	Dry cleaning	c)	Petrochemicals.
4)	Detergents	d)	Salts of fatty acids.
5)	Pedesis	e)	Suitable for laundry.
		f)	Starching.

2. Select and write the appropriate answer from the given alternative for each sub questions:-

1. Hardness of water is measured in
   a. Centimeter b. Degree
   c. Kilogram
2. The process of manufacturing Soap is called as
   a. Saponification b. Distillation
   c. Boiling.
3. Synthetic detergents are synthesized from
   a. Vegetable oils b. Petrochemicals
   c. Animal Fat
4. Dry-cleaning solvent is
   a. Water b. Petrol c. Oil
5. Dry-cleaning absorbent is
   a. Starch b. Salt c. Mud

3. Write whether given statements are true or false.

1. Temporary hardness can be removed by boiling.
2. When soap is added in soft water scum is formed.

3. Hard water is suitable for laundering.
4. Dry-cleaning can be done for silk & wool.
5. Water is used as a dry-cleaning solvent.

4. Name the following:

1. Neutral soap found in nature.
2. Substances which increase the alkalinity and cleaning power of soap.
3. Cleaning method which does not use water.
4. Movement of water particles.
5. Most commonly used water softener at household level.

Short Answer Type Question

1. Define the following terms:

1. Pedesis
2. Dry-cleaning
3. Saponification
4. Mild soap
5. Neutral soap

2. Give Reasons:

1. Hard water is not suitable for laundering.
2. Soda should be used in proper quantity while softening the water.
3. Neutral soaps are suitable for laundering silk and wool garments.
4. Detergents are better than soap.
5. Dry-cleaning is more suitable for fabrics like fur.
6. Dry cleaned clothes are always dried in shade.

3. Give two examples of each :

1. Salts present in permanent Hard water.
2. Grease absorbents.
3. Types of soaps.
4. Components of synthetic detergents.
5. Chemicals used for softening water.

4. Answer in short:-

1. Functions of water in laundering.
2. Advantages of detergent in laundering.
3. Differentiate between Grease Absorbents & Grease solvents.
4. Functions of soap in laundering.
5. Dry-cleaning pump.
6. Disadvantages of hard water.
7. Differentiate between Washing & Dry cleaning.

Long Answer Type Question

1. A. Explain the types of water.
   B. Explain the methods used for softening water.
2. Explain the types of soap used in laundering.
3. A. Explain what is dry-cleaning.
   B. Explain the methods of dry cleaning.

Project / Field Visit

1. Collect the information about various types of laundry soaps.
2. Collect information about the various forms of detergent available in the market.
3. Collect information about the dry-cleaning commercial products available in the market.
4. Collect information about stain removal liquids and solutions found in the market.

9. DYEING & PRINTING

Do You Know ?

What is the first thing that attracts your attention when you go shopping for clothes?

Do you know how so many beautiful shades of colour and patterns are created on the clothes we buy and use?

Colours play an important part in our life. Apart from adding beauty and vibrancy, colours also have specific psychological effect on us. We also use colours for cultural and social reasons. As civilizations all over the world developed, mankind was not content with using textiles in their original natural colour. Ancient people found out ways of colouring their textiles to make them more attractive and beautiful and that was the origin of the art and science of textile dyeing & printing.

9.1 Origin

A dye is a natural or synthetic substance used to impart colour to textiles, paper, leather and other materials in such a way that the colouring is not easily affected by heat, light, washing or any other factors.

Ancient people had used various natural substances to dye their textiles. They used to develop various colours from different kinds of plants, minerals and insects. Table 9.1 will give you an idea about various coloured dyes obtained from various natural resources. All these dyes are collectively known as **Natural Dyes.** For a long period of time, these were the only dyes known to mankind.

Pic. No. 9.1 Dyeing in ancient times

Pic. No. 9.2 Natural Dyes

A peek in history.

The use of dyes to colour textile materials began 3000-2000 years BC. Archaeologists have found evidence of dyed textiles in ancient civilizations all over the world. Fabrics dyed with natural dyes have been found in Egyptian pyramids, excavations of Mohen-jo-daro, China, Europe and various cave paintings found in pre historic caves dating back to Neolithic period.

Table No. 9.1 Natural Dyes

Colours	Obtained from
Reds & Pinks	Madder plant, Henna, Avacado pits, Asafoetida.
Yellows	Saffron, Pomegranate rind, Turmeric, Onion skin, bark of Oak tree.
Greens	Wood , combining Indigo with yellow dyes.
Blues	Indigo in India, Woad in European countries.
Purple	Sea snails.
Black	Logwood (blue colour) + mordant (a special chemical)

Do You Know ?

In ancient times India was world famous for its **Indigo** dye. It was the primary supplier for this dye and textiles dyed with this dye. The Britishers put an end to Indigo production in India.

The purple dye obtained from sea snails was the costliest dye as one snail could provide only one drop of the dye. Hence only royalty used to wear clothes dyed with this dye and so it came to be known as ***Royal Purple.***

Internet my friends

Find out about other natural dyes, the colours they produced and their origins.

But Natural dyes had certain limitations –

- Their availability was limited and seasonal.
- Their manufacturing and subsequent application on textiles was at times quite tedious.
- The colour range they provided was limited.
- They were not compatible with the new fibres discovered.

The limitations of Natural dyes led scientists all over the world to discover new types of dyes which are called **Synthetic Dyes.** These dyes are made from chemicals or petroleum products. They are –

- Cheaper than natural dyes,
- Easier to manufacture and apply on textiles,
- Provide a wide range of colours and
- Can be applied to all kinds of textiles.

You Should Know ?

Synthetic dyes were discovered in the mid 19th century. The first synthetic dye called ***mauveine*** was discovered by William Perkin in 1856, derived from coal tar. ***Alizarin,*** the red dye present in madder, was the first natural dye to be duplicated synthetically in 1869. By 1870, the business of commercial dyeing with natural dyes started collapsing.

Whether Natural or Synthetic, a good dye should have the following qualities :

Qualities of a good dye :

- It should not be very costly.
- It should be non-toxic.
- It should be compatible with other dyes and chemicals used on the fabric.
- It should have high colour strength.
- It should get fixed on the fabric easily.
- It should have good fastness – to sun light, washing or dry cleaning.

9.2 Types of Dyes

Some major types of dyes available now in market and widely used are as follows –

- **Direct Dyes :** These are very cheap and easy to apply. They were used extensively for dyeing cotton and so are also known

as ***Direct Cotton Dyes.*** They are readily soluble in water and so very easy to apply. Their fastness is poor and so to make them fast they are treated with salt or some other chemicals. Because of this reason, these dyes are also called ***Salt Dyes***.

- **Acid Dyes** : These are soluble in water containing H_2SO_4. They are also cheap. **They are used for protein fibres and also for nylon and acrylic**. Fast to sunlight, Not so fast for washing.
- **Vat Dyes** : *Vat dyes* are insoluble in water but become soluble after treating them with certain chemicals. The process of darker converting insoluble *vat dyes* into soluble form is known as ***vatting.*** **These are fastest dyes for cellulosic fibres , protein fibres and man-made fibres.** These dyes require hot water. They are expensive.

Do you know what is Mordant?

Most of the dyes require a fixative to set the dye on the fabric. Such reagents are called **Mordants.** Alkali mordant like soda ash is used for cotton while acid mordant vinegar is used for wool.

- **Azo Dyes :** They are also known as ***Aniline Dyes***. They are applied in two stages – first the fabric is treated with naphthol and then it is treated with Azo dyes. Colour develops afterwards. Used mostly for cotton but can be used for many other fibres too. They are considered easy to use, relatively cheap and provide clear, strong colours. They are very fast and being cold water dyes are especially suitable for techniques like ***batik*** and ***tie-n-dye.***

  Some of the Azo dyes can be harmful to skin and so are banned.

- **Basic Dyes** : Basic dyes are powerful colouring agents. **They are applied to wool, silk, cotton and modified acrylic fibres. They are special dyes for acrylic fibre.** Usually acetic acid is added to the dyebath to help the take up of the dye onto the fibre. They have good fastness and provide bright shades.
- **Reactive Dyes** : Reactive dyes are comparatively newly discovered. **They have good fastness properties because the dye chemically reacts with the fibre and gets attached to it.** Reactive dyes are most commonly used in dyeing of cellulose like cotton or flax, but also for wool and nylon.
- **Sulphur Dyes :** *Sulphur dyes* are the most commonly used dyes manufactured for applying dark shades or black colour to cotton and other cellulosic fibres including Rayon. They are inexpensive, generally have good wash-fastness, and are easy to apply. They are water insoluble. The basic method of application is same as Vat dyes. **Sulphur dyes are usually black, brown, and dark blue in colour.**
- **Disperse Dyes** : Disperse dyes are the only water -insoluble dyes which can be applied on cellulose acetate and polyester. Both these fibres have very poor moisture absorption and so it was not possible to dye them with the regular dyes available at that time. Scientists invented disperse dyes specially for these fibres. These dyes are applied at high temperature. **The thermoplastic fibres start softening at high temperature and these dyes are dispersed inside the fibres.** Because of this method of application, these dyes have excellent fastness.

The different types of dyes and their special properties are given in table no. 9.2 –

Table No. 9.2 Types of Dyes

S. No.	Type of Dye	Applied on	Special Properties
1.	Direct Dyes	Cotton & other cellulosic fibres.	Cheap and easy to apply. Readily soluble in water. Poor fastness. Treatment required.
2.	Acid Dyes	Wool, Silk, Nylon, Acrylic etc.	Soluble in acidic medium. Cheap Fast to sunlight. Not so fast for washing.
3.	Vat Dyes	Cotton, Linen, Rayon and other cellulosic fibres. Wool, Nylon, Polyester too.	Fastest dyes for cellulosic fibres. Hot water dyes. Insoluble in water. Certain chemicals are needed to make them soluble.
4.	Azo Dyes	Mostly to Cotton. Also for Nylon.	Fast to washing and sunlight. High intensity colours. Cold water dyes suitable for Batik, tie-n-dye.
5.	Basic Dyes	Acrylic, Wool, Silk, Cotton.	Special dyes for acrylic fibres. Good fastness. Bright colours.
6.	Reactive Dyes	Natural and Man-made fibres.	Excellent fastness. High temperature needed.
7.	Sulphur Dyes	Natural and man-made cellulosic fibres.	Cheap. Easy to apply. Dark colours.
8.	Disperse Dyes	Cellulose Acetate, Polyester.	Insoluble in water. Different method of application. Good fastness.

9.3 Types of Dyeing

The textile material to be dyed is first prepared for dyeing by washing, bleaching and drying it. **The method of dyeing differs according to the type of dye and the fibre to be dyed.** The basic two methods of dyeing are –

A. Hand Dyeing : Hand dyeing is the oldest and simplest method of dyeing textiles. The dyeing takes place in a wash tub. Dye bath is prepared by mixing the required amount of dye in a small amount of water and then adding the dye solution to the wash tub having clean water of desired quantity. The amount of water depends upon the size of the textile material to be dyed and also the intensity of colour desired. The material to be dyed is put in the dye bath and rotated with a wooden ladle. The material is lifted out at intervals to check the level of dyeing.

B. Machine Dyeing : This is a faster and easier way of dyeing textiles which requires less time and skill. During industrial revolution, a number of dyeing machines were invented and new versions are still coming out. Machine dyeing basically follows

the principle of Hand dyeing only but the amount of textile material to be dyed is large in a lesser time. These machines can be divided into three major types:

Pic. No. 9.3 Hand Dyeing

Pic. No. 9.4 Machine Dyeing

- Machines that move the material through the dye solution. Rotating Arm machines, Dye Box and Ferris-wheel machines are examples of this type.
- Machines that move the dye solution through the textile material.
- Machines that do both procedures simultaneously.

9.4 Methods of Dyeing

Dyeing can be done at different stages of textile manufacturing process. Textiles can be dyed as fibre, as yarn, as fabric or as garment. Some of the popular methods of dyeing are as follows –

- **Direct Dyeing :** When a dye is applied directly to the fabric without the aid of a mordant, it is called **direct dyeing.** The direct dyes, which are largely used for dyeing cotton, are water soluble and can be applied directly to the fiber from an aqueous solution. Most other classes of synthetic dye, other than vat and sulphur dyes, are also applied in this way.
- **Stock Dyeing :** Stock dyeing refers to the dyeing of the fibers, or stock, before it is spun in to yarn. It is done by putting loose, unspun fibres in to large vats containing the dye bath, which is then heated to the appropriate temperature required for the dye application and dyeing process. This method is used mainly for woollen fibres.
- **Top Dyeing :** Top dyeing is also the dyeing of the fibre before it is spun in to yarn – much like Stock dyeing. The term ***top*** refers to the longer fibres of wool which are used to spin worsted yarn. Slivers of these fibres are dyed in this method.
- **Yarn Dyeing :** This is dyeing of the yarns before they have been woven or knitted into fabrics. Yarn dyeing is used to create interesting checks, stripes and plaids with different-coloured yarns in the weaving process. This is also known as ***Hank dyeing.***

Pic. No. 9. 5 Hank Dyeing

- **Piece Dyeing :** The dyeing of cloth after it is being woven or knitted is known as piece dyeing. It is the most common method of dyeing used. The various methods used for this type of dyeing include jet dyeing. Jig dyeing, pad dyeing and beam dyeing.
- **Garment Dyeing :** Garment dyeing is the dyeing of the completed garments. The types of apparel that can be dyed are mostly

non-tailored and simpler forms, such as sweaters, sweatshirts, T-shirts, hosiery, and pantyhose. This is done by placing garments (usually about 24 sweaters) into large nylon net bag. The garments are loosely packed. From 10 to 50 of the bags are placed in large tubs containing the dye bath and kept agitated by a motor – driven paddle in the dye tub. The machine is appropriately called a **Paddle dyer.**

Pic. No. 9.6 Garment Dyeing

- **Ombre Fabric Dyeing :** This means to dye a fabric from light to dark or from one colour to another colour. The word Ombre means gradual transition from one colour to another. So if there is light blue colour on one end of the fabric, it will go on intensifying and will become dark blue on the other end of the fabric.

Pic. No. 9.7 Ombre Dyeing

9.5 Some Popular Traditional Resist Dyeing Techniques

- **Bandhani :** This is a traditional textiles of the state of Gujarat. It is made by using tie-n-dye technique and dates back to the Indus Valley Civilization in 4000 BC. It is also known as ***Bandhej.*** The word ***bandhani*** comes from the Sanskrit word ***Bandh*** which means ***to tie.*** This is basically a resist dyeing technique in which some portion of the fabric is not allowed to be dyed , resulting in beautiful patterns.

- **Object Tieing and dyeing :** Tyeing object into the fabric before dyeing can create a variefy of patterns.

Material used – Cotton and Silk were traditionally used for making bandhani. Nowadays the technique is used with man-made fibres also.

Technique - The art of bandhani is a highly skilled process. In this, the fabric is plucked by finger nails, tied into tiny knots which create a design and then dyed. Alternately, pulses, beads or tiny pebbles are put in the fabric and the area around is tied tightly by a thread. Then the fabric is dyed in bright colours like red, green, pink, yellow etc. In olden times, natural dyes were used for dyeing but nowadays mostly synthetic dyes are used.

Pic. No. 9.8 Dyeing cloth for Bandhani

Pic. No. 9.9 Bandhani

Some interesting facts !

In ***bandhani,*** different colours have different meanings. For eg. Red colour represents a bride while yellow colour represents a new mother.

Sarees, scarves, dupattas, kurtis, turbans, hand bags etc. made by this technique has been in use since centuries and are still popular. Today bandhani technique is also being used in a modern context in fashion designing industry. It is one of the most popular Indian textiles in foreign markets.

Nowadays bandhani is made in Gujarat, Rajasthan, Sindh, Punjab and Tamil Nadu. In Tamil Nadu, it is known as ***Chungidi.***

- **Leheria -** This is a simple dyeing technique popular in Rajasthan. It results in striped textiles in many bright colours. The word ***Leher*** means waves, and the pattern made on the fabric resembles that. This is also a resist dyeing technique.

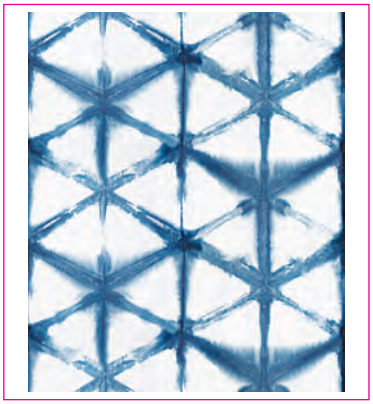
Material used – Traditionally cotton and silk. Nowadays all kinds of fibres are used.

Pic. No. 9.10 Leheria

Technique – The cloth is folded and then tied diagonally in such a manner that diagonal stripes or ***lehers*** are created all over the fabric.

- **Shibori -** This is a traditional resist dyeing technique of Japan. In Japan the earliest known example of fabrics dyed by Shibori technique dates back to 8th century.

Material used – Traditionally natural fibres.



Pic. No. 9.11 Shibori Fabric

Some interesting facts !

During the 8th Century, the technique of Shibori first came into Japan from China. The word Shibori comes from 'Shibori,' a term that means, 'to wring, squeeze, and press.'

Technique - The fabric is folded, twisted, stitched and clamped in different manners to create different unique patterns. The fabric is then dyed and the clamps or stitches are removed after drying. The areas of fabric with clamp or stitches remain undyed. The exact technique is chosen according to the type of textile to be dyed.

In many books, the Shibori technique is mentioned as Shibori Print because of the beautiful patterns created on the surface of the fabric but technically it is a type of resist dyeing.

- **Batik :** This is a very interesting technique for resist dyeing. This first originated in Egypt in 4th century BC and since then has been practiced in many countries. It was popular in China, India and Japan too.

Material used – Cotton and silk. Synthetics are not used.

Technique – The creation of Batik is a laborious three-stage process of waxing, dyeing and dewaxing (removal of wax). A pattern is made on the fabric and on certain portions of the pattern, liquid wax is applied and allowed to cool. Then the fabric is dyed. The wax acts as a resistant and does not allow the dye to colour the specific areas of fabric. After dyeing, the wax is removed by treating the fabric with hot water.

The characteristic effect of batik are the cracks formed in wax coating which allow the dye to colour the cracked parts. The final effect is very beautiful and not possible with any type of printing. Like Shibori, Batik is also termed as Batik Print in many books.

Pic. No. 9.12 Batik fabric

Internet my friends

Find out about more traditional dyeing techniques prevalent in different regions of India.

Do You Know ?

Batik is an Indonesian word.

The art of batik was revived in 20th century when it was included as a subject in the famous university of Shanti Niketan in Kolkata.

Batik produced in Chennai is known for its original and vibrant designs.

Indonesia is considered the cradle of batik with its many designs. Their designs have significant mythological meanings.

Sri Lanka also produces batik with simpler designs more suitable for modern clothing.

9.6 Textile Printing

Printing like dyeing, is a process for applying colour to a surface. However, instead of colouring the whole surface - as in dyeing, print colour is applied only to defined areas to obtain the desired pattern. This involves different techniques and different machinery with respect to dyeing, but the physical and chemical processes that take place between the dye and the fibre are similar to dyeing.

Textile Printing is a technique by which beautiful patterns and motifs can be created on the surface of the fabric by applying dyes to only selected areas of the fabric.

A peek in history.

The Asian continent has the oldest history of decorating fabrics using textile printing methods. For instance, in 327 B.C. when Alexander the Great invaded India, colourful, printed textiles were found.

China also had expertise of different ways of printing textiles.

This process of decorating textiles has been around for centuries. Of course the techniques have changed a lot over the years, but textile printing is an ancient art that can be seen in fabrics dating as far back as the 4th and 5th Centuries B.C.

Pic. No. 9.13 Textile Printing

You Should Know ?

A dye paste is prepared for Printing. It contains the dye, a solvent, a mordant and a thickener to avoid bleeding of colours. Traditionally oil-water emulsions were used thickeners. Nowadays starch, flour, gum arabic, guar gum, tamarind, alginate, dextrin, albumen, or polyacrylate are used.

9.7 Types of Printing

Printing, unlike dyeing, can use many colours to add a pattern on to a fabric. The patterns can be floral, geometric or stylised. Following are a few popular methods of printing textiles –

- **Block Printing :** The earliest type of printing on fabric is Block Printing, also sometimes referred to as ***Relief printing.*** This is the process of dye being pressed onto a fabric from a carved material; historically wood, copper but also rubber and now many other materials. For a very long period, this was the main method for printing textiles.

Pic. No. 9.14 Printing Blocks

The fabric to be printed is washed, dried and ironed. A dye paste is made using a suitable dye along with starch**,** A curved wood block is carved in such a way that the pattern looks embossed on it. The dye paste is applied on the block and then it is pressed against the fabric so that the design gets transferred to the fabric. The fabric is then boiled and washed to fix the dye on the fabric and remove the paste material from the fabric.

Beautiful patterns can be created in a simple manner by this method and so this ancient form of printing has still not lost its charm despite the advent of other modern, faster and more convenient methods of printing. Many handloom products like sarees, dress materials, dupattas, bed sheets etc. are made by block printing technique.

Pic. No. 9.15 Block Printing

- **Stencil Printing :** By the 2nd Century A.D., Chinese textile printers introduced stencil techniques for fabric adornment to Japan where the process was further developed. A stencil is made with the design or pattern cut out on a sheet of card paper or thin metal or plastic sheet. This stencil is placed and fixed on a fully spread out fabric and dye paste is applied on it. Only the cut out parts of the stencil will allow the dye to reach up to the fabric. The fabric is boiled later to fix the dye.

Pic. No. 9.16 Stencil Printing

This technique is still popular for making small samples or for the beginners who take up textile printing as a hobby. Ready made plastic stencils are available in the market. You can

make your own pattern also by drawing it on a plastic sheet and then cutting on the lines with a sharp cutter.

- **Roller Printing :** In the 18th century, the technique of roller or cylinder printing came about thanks to industrial revolution in Europe. It was pioneered by Thomas Bell. This was similar to block printing, but with engraved rollers. It is similar to newspaper printing, where the design is 'stamped' onto the fabric via engraved rollers. In this process, the fabric is carried along a rotating central cylinder and pressed by a series of rollers, each of which is engraved with the design. Each roller is fed a different colour through feed rollers, and some roller printing machines were even able to print 6 colours at once, making them much faster than the block printing process. Because of the higher speed of production, this method is very economical also for printing large amounts of fabric.

Pic. No. 9.17 Roller Printing

- **Screen Printing :** In the early 20th Century the modern process of screen printing arrived, although it is thought that screen printing dates back much further than this. This process is similar to that of Stencil Printing but the scale is much larger. It involves making a pattern on a screen of porous mesh-which was traditionally made of silk. It can be of two types :
  - **Rotary Screen Printing:** Where a roller is used to pull ink over the stencil which is in turn forced through the mesh and onto the fabric.
  - **Flat(bed) Screen Printing:** Where the screen is fixed in a frame. For each separate colour a different screen is used of the two types, the Rotary screen printing allowed for large-scale screen prints at a faster rate, making it more economical.

Pic. No. 9.18 Screen Printing

- **Transfer Printing :** Transfer printing is the term used to describe a textile printing process in which the design is first printed on to a flexible nontextile material like paper and later transferred by a separate process to a textile. This is a new method discovered in 8th century and became popular in 19th century.

It is also known as ***Heat Transfer*** because temperature and pressure is used to transfer the dye onto the fabric. It is most suitable for thermoplastic fibres. The dye gets diffused inside the fabric and no after treatment is required. It is used when a very complicated pattern or an image is to be transferred to the fabric. It is more suitable for garment printing and you can print T shirts, cushions and such things with it. It is also a quick process.

Pic. No. 9.19 Transfer Printing

- **Digital Printing :** This is a latest technique uses computer controlled lasers and high-pressurised jets to inject ink directly into the fabric. This allows for very detailed printing at a fast pace. However it is an expensive process. It is also known as ***direct garment printing.***

Digital printing is highly suitable for printing intricate patterns and fine detail as the ink is thinner. Each garment is printed individually, and form a computerized image, which means it is highly customized. This is fast becoming a very important and popular method of printing.

Sarees, dupattas and dress materials printed with photographs or sceneries are the latest trend in fashion. You can find the photo studios using this technology to print T-shirts, cushions etc.

Pic. No. 9.20 Digital Printing

9.8 Traditional Textile Printing in India

With a printing tradition dating back to ages, India is a hub for wide variety of textile arts. The traditional textile prints of India are not only popular within the country but are admired all over the world. This traditional textile printing comes under the umbrella of handicraft sector as the artisans still use old methods like block printing. Different regions in India have a distinct style and technique resulting in unique prints which are easily recognisable when worn. Initially, the tools of block printing were crude and undeveloped, but there has been significant progress in the area. The entire concept of printing has undergone a complete revolution, and currently, the industry is blooming. Following are a few examples of Indian traditional textile prints which deserve to be preserved, promoted and appreciated.

- **Bagh :** An indigenous printing technique from the state of Madhya Pradesh, the name originates from the Bagh district, where it is most practised. It essentially refers to a technique of block printing by hand where the colours used are absolutely natural.

Motifs used – Geometric designs and bright colours are used. The designs have been inspired by paintings of the Taj Mahal, flowers, mushrooms and others.

Material used - From cotton, silk, chiffon to bamboo chicks, this process can be carried out on a variety of fabrics.

Pic. No. 9.21 Bagh Print

Technique - The fabric is made to undergo what is known as the "bhatti process" which includes boiling, drying and subsequently printing with blocks.

- **Kalamkari :** Kalamkari is a highly popular form of hand-painted or block-printed cotton textile and paintings. The name originates from Persian words ***Kalam*** (pen) and ***Kari***(craftsmanship). Andhra Pradesh is famous all over for this form of art. There are two major forms – Shrikalahasthi from Chittoor district, and Machilipatanam Kalamkari from Krishna district.

Kalamkari is a form of painting cotton fabrics with a kalam i.e. pen made of bamboo or tamarind stick. The Machilipatanam Kalamkari also uses block printing along with painting.

Pic. No. 9.22 Kalamkari

In earlier days, singers, poets and scholars used to paint accounts of stories from Hindu mythology which ultimately led to the generation of kalamkari prints. It has been practised by families and generations over the ages.

Motifs used – Scenes from Ramayana, Mahabharata are used as primary themes, and this art form depicts India in all its past glory.

Material used – Cotton fabric.

Technique - After stiffening and drying the cloth, it is printed in different phases according to the colour scheme. Wax is used while dyeing the areas blue and the remaining areas are hand painted. A bamboo stick with a bundle of fine hair is used as a brush while painting. Mostly natural dyes are used. There are different textile products produced from this style like bedsheets, wall hangings and clothing, curtains, saris etc.

- **Sanganeri :** This is a kind of block printing that originated in Rajasthan. This handicraft developed over the years and is still popular in home decor materials as well as apparel.

Motifs used – Beautiful floral designs with buds, flowers, leaves, mangoes and even jhumkas sometimes are part of the detailed designs on the blocks.

Material used – Cotton fabric.

Pic. No. 9.23 Sanganeri Print

Technique - A hand printing technique which involves laying out of the material on tables and then printing using blocks with intricate designs. The fabric is marked before, so that symmetry of design is maintained.

- **Ajrak :** Found mostly on shawls and carpets, Ajrak is a unique form of block print that is popular in Sindh, Pakistan; Kutch, Gujarat; and Barmer, Rajasthan in India. These prints include designs and patterns made using block printing by stamps. They originated in the ancient civilization of Mohen-jo-daro and the legacy still continues.

Motifs used – Various geometric shapes and patterns.

Material used – Mostly cotton and wool.

Technique – Block printing by stamps. Common colours used while making these patterns include blue, red, black, yellow and green. Ajrakh printing uses natural dyes that include both vegetable dyes and mineral dyes, with Indigo being the key dye.

Pic. No. 9.24 Ajrak Prints

- **Daboo :**

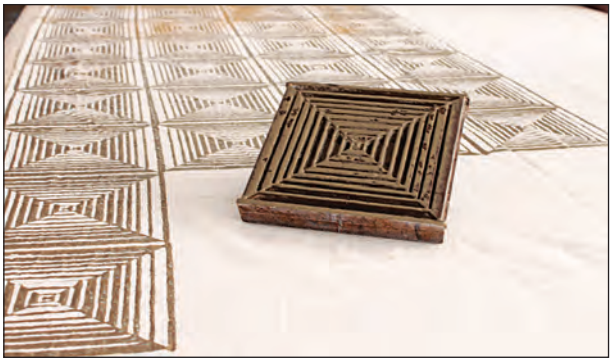
This is a famous **Mud Resist Printing** pursued in North Gujarat and Rajasthan. The print got its name from the Hindi word ***Dabana*** which means ***to press.***

Motifs used – mostly geometrical and floral patterns.

Material used – mostly cotton. Mostly natural dyes are used.

Technique – Mud, *chuna* , wheat chaff and gum are the main ingredients that go into making the mud resist. This resist is applied onto the blocks and transferred onto a flat fabric. Once the resist dries up, the fabric is put in a dye bath. Later the fabric is thoroughly washed to remove all the mud. **Due to cracks in dried mud, this print resembles Batik material.** The whole fabric will be of a darker shade while the block printed parts will be white or lighter in shade.

The fabrics thus produced have a beauty of their own.



Pic. No. 9.25 Daboo Prints

Table No. 9.3 Difference between Dyeing and Printing

Dyeing	Printing
• A dye solution is made.	• A dye paste is made.
• The whole fabric is immersed in the dye solution.	• The dye paste is applied to only selected portions of the fabric.
• At a time only one colour is used.	• Many colours can be used at a time.
• A dye colours both sides of the fabric equally.	• Printing is usually seen on only the right side of the fabric.
• Patterns if formed are blurred and limited.	• Even intricate patterns can be formed easily.
• Does not require any other instrument to apply dye on the fabric.	• Blocks, rollers, screens, stencils etc. are needed to apply dye on the fabric.

Use Your Brain Power !

I. Crossword :

1				2				
		3						
4								
5						6		
				7				

Across : **Down :**

Across		Down	
1.	Dye used for batik & bandhani.	1.	Dye used directly on cotton.
3.	Japanese technique of tie-n-dye.	6.	Hot water dye.
4.	Special dye for polyester.		
5.	Dye that chemically react with the fabric.		
7.	A special resist dyeing technique in which wax is used.		

II. Looking at the given correlation, find out other correlations :

Daboo - Gujarat, Rajasthan

Ajrak	
Bagh	
Bandhani	
	Japan
Sanganeri	
	Shanti Niketan
Kalamkari	
Leheriya	

EXERCISE

Objective Type Question

1. Match the following :

A			B
1.	Daboo	a.	wax resist dyeing
2.	Batik	b.	computerized printing
3.	Kalamkari	c.	light to dark colour
4.	Digital Printing	d.	vat dyeing
5.	Ombre Dyeing	e.	use of bamboo pens
		f.	mud resist printing

2. Select and write the most appropriate answer from the given alternatives for each question :

1. The dyes most commonly used for cotton fibres
   a. Reactive b. Direct c. Disperse
2. The earliest type of printing method
   a. Screen printing
   b. Block printing
   c. Roller printing
3. The dyes most commonly used for polyester fibres
   a. Reactive b. Direct
   c. Disperse
4. Top Dyeing is a term used for dyeing
   a. Fibres b. Yarns c. Fabric
5. Special dyes for acrylic fibres
   a. Acid dyes b. Basic dyes
   c. Reactive dyes
6. The dyes suitable for Batik work
   a. Azo dyes b. Basic dyes
   c. Direct dyes
7. The natural dye for which India was famous world wide
   a. Sulphur dyes
   b. Madder
   c. Indigo
8. The natural dye famous as Royal Purple was obtained from
   a. Sea snails b. Sea shells
   c. Wood

3. Write whether the given sentences are True or False :

1. Most dyes require a fixative reagent to get fixed on the fabric.
2. Batik dyeing originated in Europe.
3. Using Vat dyes is a two step process.
4. A dye colours both sides of the fabric equally.
5. Reactive dyes chemically react with the fibre.
6. Screen printing is the fastest type of printing.
7. In Leheriya, diagonal line effect is created by tie -n-dye.

4. Complete the sentences :

1. In ancient times, India was famous for a natural dye called _____.
2. Batik is a dyeing technique known as _____.
3. Sanganeri print is a type of _____.
4. Special dyes for acrylic fibre are _____.

Short Answer Type Question

5. Give Reason:

1. Mordants are used while dyeing.
2. The purple dye obtained from sea snails was known as Royal Purple.
3. Azo dyes are considered suitable for Batik work.
4. Polyester is dyed with disperse dyes.
5. Shibori and Batik are also called prints.
6. Daboo prints resemble Batik.

6. Give two examples of each of the following :

1. Block Printing
2. Resist Dyeing
3. Dyeing of fibres
4. Screen Printing
5. Dyes most suitable for cotton.
6. Natural dyes

7. Do as directed :

1. Differentiate between Dyeing & Printing.
2. Make a list of the qualities of a good dye.
3. What is stencil printing? Explain.
4. Write short notes on digital printing.
5. Write in short about Kalamkari.

Long Answer Type Question

8. Explain in detail :

1. Any two types of traditional Indian prints.
2. What is Transfer Printing, Block Printing and Screen Printing.
3. Any two traditional resist dyeing techniques.
4. Explain about Direct dyeing, Stock dyeing and Ombre dyeing.

Self Study Project

1. Do a market survey on different kinds of digitally printed materials.
2. Collect photographs of traditional textile printing popular in India.
3. Study the latest trends in dyeing and printing prevailing in world today.

10. FASHION DESIGNING

Do You Know

Have you ever wondered how the clothes displayed in show rooms or on Fashion Shows are made?

Who is responsible for providing so much variety in readymade garments?

Do you feel you have the creativity needed for designing clothes?

Would you like to know more about fashion designing?

The present chapter aims to give you a glimpse into the vast world of Fashion Designing. It is not possible to do full justice to such a vast field in few pages. This chapter will only be able to provide you a rough outline of all that goes into making and designing fashion.

10.1 Introduction

Oxford English Dictionary (2009) defines Fashion as -

Fashion is popular styles of clothes etc. at a particular time and place started by a few and followed by many.

Fashion design is the art of applying design, aesthetics and natural beauty to clothing and its accessories. It is influenced by cultural and social factors, and keeps on varying over time and place. It has a great effect on human psyche.

Fashion designers try to design clothes which are functional as well as good looking. They consider who is likely to wear the garment and in which situation it will be worn.

Types of Fashion : The garments produced by fashion designers fall into main three categories :

a. Haute couture (Pronounciation - हॉट कॉचर): This is a French word used for describing expensive, fashionable clothes produced by leading fashion houses. This clothing is created for a specific client. The look and fit of the garment is given utmost importance and extreme attention is given to details and finishing.

A peek in history!

Fashion design is considered to have started in the 19th century. Charles Frederick Worth was the first designer to have his label sewn into the garments he created. He set up the first ***maison couture*** (fashion house) in Paris. He was so successful that he used to dictate to his customers what they should wear.

You should know!

Fashion today is a global industry. Seven countries have international reputation in fashion – France, Italy, U.K., U.S.A., Japan, Germany and Belgium. The biggest manufacturers of clothing are China, Bangladesh and India.

b. Ready-to-wear (Pret-a-porter): (Pronounciation - पैता पोहते) These clothes are in between haute couture and mass market. They are not made for individual customers, but great care is taken in the choice and cut of the fabric. Clothes are made in small quantities so that they are exclusive and so rather costly.

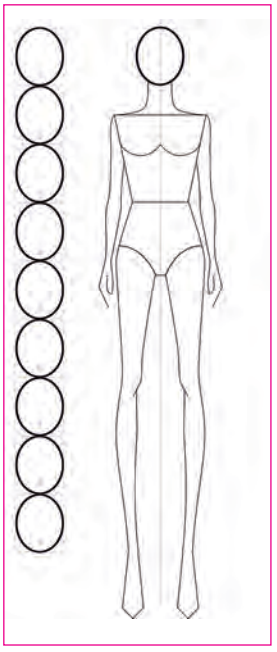
c. **Mass Market :** The mass market produces ready -to-wear garments for the general population. Cheaper fabrics and simpler techniques are used to cut down the cost. This is produced in bulk and made available in open market. These garments are available in standard sizes with multiple copies of the same design. Currently the fashion industry relies more on mass market sales.

10.2 Important terms in Fashion Designing:

- **Fashion Designer** – He/she imagines the garment and transfer their ideas in a visual form known as sketches of the design.
- **Pattern Maker** – Also known as Pattern Master. He/she drafts the shapes and sizes of a garment's pieces. This may be done manually with paper, measuring tape, scissors etc. or by using computers. At times, the fabric is directly draped onto a mannequin.
- **Tailor –** Makes custom designed garments made to client's measure.
- **Stylist** – He/she coordinates the clothes, jewellery and other accessories in fashion show or photo shoots. A stylist may work with an individual client to design a wardrobe for the client.
- **Illustrator** – Draws and paints clothing designs for commercial use.
- **Croquis-** (Pronounciation - क्रोकी) The word *croquis* comes from French and means simply "sketch". In fashion, the term refers to a quick sketch of a figure (typically nine heads tall as this is the accepted proportions for fashion illustration) with a loose drawing of the clothes that are being designed. Often a large number of croquis drawings will be created for one finished look.

Something Interesting !

The croquis is not made exactly according to human figure but a rather stylized version of human figure with 1:9 proportion.



Pic. No. 10.1 Croquis

- **Look book -** A collection of images that showcases a designer's forthcoming collection.
- **Style-** A particular design, shape, or type of apparel item defined by distinct features. For eg. A-line skirts, Bermuda shorts, or Western shirts.
- **Fad-** Temporary, passing fashion. Around only for a short period of time.
- **Classic-** Item of clothing that continues to be popular even though fashions change. For eg. the little black dress, sarees.
- **Garment**:-A particular article of apparel. For eg. a dress, suit, coat, or sweater.
- **Silhouette-** (Pronounciation - सिलुवाट) The shape of a clothing style. Formed by the width and length of the neckline, sleeves, ,waistline and pants or skirt .

- **Fit-** Refers to how tight or loose a garment is on the person wearing it .
- **CAD**: Computer Aided Design.
- **Boutique -** A boutique called ***Butik*** in French (meaning- shop)is a small store that sells stylish clothing, jewellery or other luxury goods.
- **Accessories -** A fashion accessory is an item used to contribute to the wearer's outfit, often used to complete an outfit and chosen to specifically complement the wearer's look. The term Accessories first came into use in the 20th century. It has the capacity to further express an individuals identity and personality.
- **Mannequin -** (Pronounciation - मॅनेक्वीन) It is a dummy figure used by tailors, dress designers etc. to display or fit clothing.

Fashion accessories can be loosely categorized into two general areas: those that are carried and those that are worn. The following table gives a list of both types of accessories –

Table No. 10.1 Fashion Accessories

Accessories that are carried	Accessories that are worn
Purses, handbags, glasses, hand fans, umbrellas, wallets, canes and ceremonial swords.	Jackets, boots, shoes, ties, hats, belts, gloves, mufflers, necklaces, bracelets, watches, sashes, shawls, scarves, socks, pins, rings, stockings, earrings etc.

10.3 Illustration

Fashion illustration is the art of conveying fashion ideas in a visual form.

It includes drawing, painting and sketching. It is mainly used by fashion designers to put their ideas on paper or computer. It is very important because the detailing of the design can be done without actually sewing the cloth. Illustrations can be made in a number of ways as shown in the box on the side.

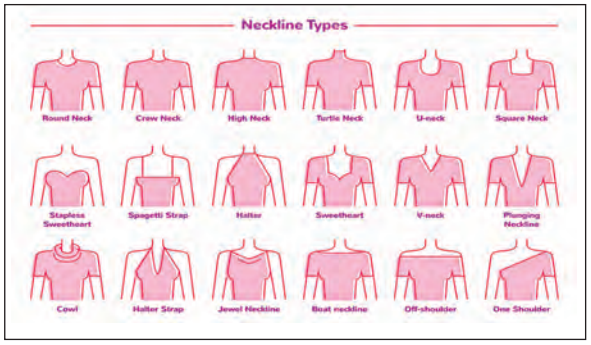
Types of Illustrations –

- *Pencil illustration*
- *Charcoal illustration*
- *Water colour illustration*
- *Collage illustration*
- *Pen & Ink illustration*
- *Acrylic illustration*

Variations in Illustration : There can be numerous variations in the illustration. Different designers use their imagination to create something new and unique. However, there are certain standard types of garments or parts of garments which have been popular over the years. Some of the variations are as follows –

A. Variations in Necklines : Some of the more popular necklines are –

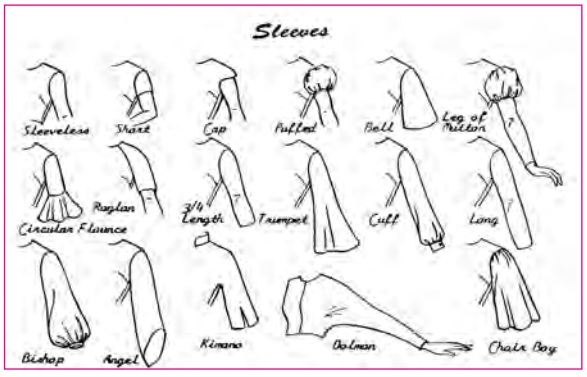
- ***Round Neck*** – This is the classic simple round neck found in T shirts, and most of the tops. The depth of neckline can change.
- ***Square Neck*** – This is square in shape from front and looks good in frocks, girls' tops, kurtis etc.
- ***V neck*** – As the name suggests, this neckline is in V shape. The depth can vary. Found in T-shirts, tops, kurtis etc.
- ***Boat neck*** – Its shape is like a boat hull and so it is named this way. Looks good in children's and ladies' garments.
- ***Jewel neckline*** – This is a closed neckline which encircles the neck.



Pic. No. 10.2 Variations in Necklines

B. Variations in Sleeves : The different kinds of sleeves are –

- ***Normal sleeves*** – This is the regular sleeve found in most of the dresses, saree blouses, T shirts etc. It can be tight fitting or slightly loose. The length can vary so we have short sleeves, 3/4th sleeves or full sleeves.
- ***Puff sleeves*** – There is a puff at the top and cuff at the hem.
- ***Raglan sleeves*** – These are joined to the bodice with a diagonal seam. Mostly found in sweaters.
- ***Cap sleeves*** – It just covers the top of the arm.
- ***Bell sleeves*** – There is a full flare at the hem.



Pic. No. 10.3 Variations in Sleeves

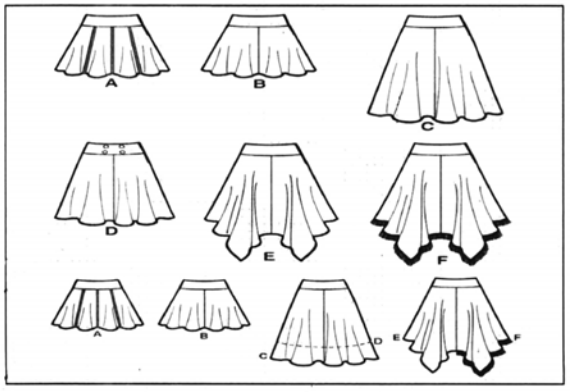
C. Variation in Bodice : The different types of bodices are as follows –

- ***Asymmetrical Top*** – The hemline is asymmetrical.
- ***Poncho*** – This is a cloak-like top. There is only one slit at the top to insert the head. There is no sleeve or defined bodice.
- ***Princess line bodice*** – This is a fitted top made from three vertical panels.
- ***Shirt*** – This is the regular kind of shirt with collar and full sleeves.
- ***T-shirt*** – Mostly made from knitted material. Length, Sleeves and necklines can vary.

Pic. No. 10.4 Variations in Bodice

D. Variations in Skirts : Skirts can be made in many different ways –

- ***A-line skirt*** – This is fitted at the waist and gets wider near the hem.
- ***Broomstick skirt*** – Long skirts or maxi skirts.
- ***Layered skirt*** – It has three or more layers and can be half, 3/4th or full length.
- ***Pencil skirt*** – This is a straight skirt that fits tight. Best suited for formal wear.
- ***Pleated skirt*** – This skirt has regular side pleats or box pleats. Found mostly in school uniforms.



Pic. No. 10.5 Variations in Skirts

A good design is not just a happy coincidence or the product of some extra ordinary creative artist. A good design can be achieved if we follow certain fundamental factors. These can be classified into two broad divisions –

Elements of Art & Principles of design

10.4 Elements of Art

These are the basic elements required to create any art or any design. They are used extensively in fine arts, interior designing and also in fashion designing. They are Line, Shape, Texture, Pattern and Colour :

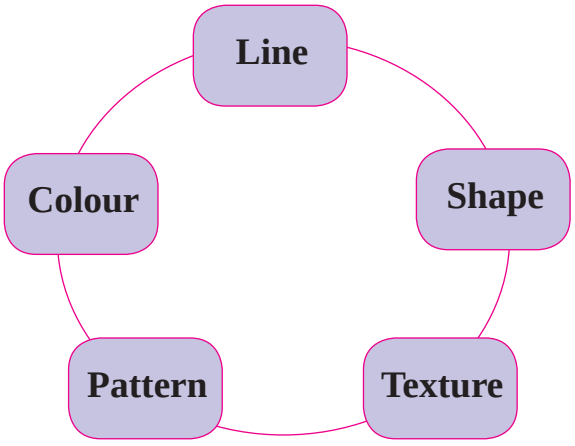


Chart No. 10.2 Elements of Art

- **Line :** A series of dots joined together is called a-line. They are very important in making a design. There are basically four types –

a) **Vertical Lines (standing lines) :** They create a sense of length and elegance as they make our eyes move in up-and-down motion. They create an illusion of taller and slimmer body. They also give a feeling of strength, dignity, alertness and they look formal.

Pic. No. 10.6 Vertical line effect

b) **Horizontal Lines (Sleeping lines) :** Horizontal lines go across on a garment. They lead our eyes to view the width of the body. The wearer looks shorter and fatter. They give a feeling of stability and restfulness.

Pic. No. 10.7 Horizontal line effect

c) **Diagonal Lines (Slanting lines) :** They are in between vertical lines and horizontal lines, and so give a feeling of restlessness and instability. They also give a feeling of movement or activeness. They are dramatic and more fashionable in nature. They are usually seen in high-fashion clothes.

Pic. No. 10.8 Diagonal line effect

d) **Curved Lines (Rounded lines) :** They give an effect of softness, femininity and roundedness to the garment. Usually used for making clothes for women but can be creatively used for men also to give a casual look rather than a formal look.

Pic.No. 10.9 Curve effect

B. **Shape :** One major function of lines is to create shapes. In fashion industry, the term ***'Silhouette'*** is normally used to describe the shape of a garment. It is a the French word which means ***general outline or shape of a costume.***

Pic. No. 10.10 Silhouette

C. **Texture :** Texture is the surface quality of an object. In fashion design, texture of fabric is created by the weave and the light reflected from the fabric. Textures can be ***Visual*** – we see that a particular fabric is dull or shiny ; or ***Tactile*** – we touch and realise that a particular fabric is smooth or rough. Texture affects the drape of a garment. Chiffon flows making it a good choice for feminine clothes while denim is firm and thick and so suitable.

Pic. No. 10.11 Texture for casual garments.

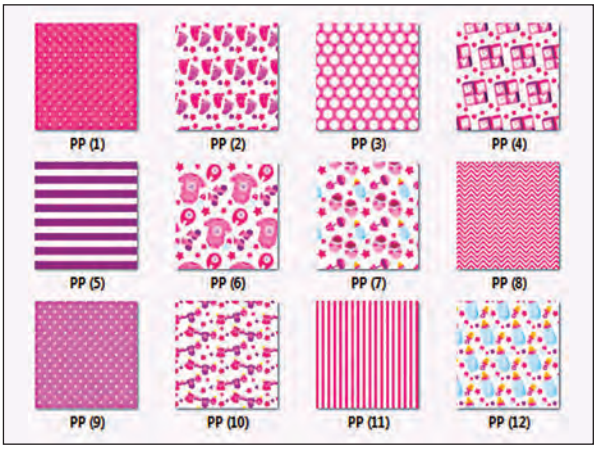
D. **Pattern :** Pattern is surface enrichment. It creates interest and liveliness. This is created through motifs. Motifs can be

a. *Natural Motifs* – flowers, foliage, animals, birds etc.

b. *Stylized Motifs* – these are based on natural forms but imagination is added.

c. *Geometric Motifs* – circles, dots, triangles, checks, stripes etc.

d. *Abstract Motifs* – Do not represent any known form and are hard to understand.



Pic. No. 10.12 Patterns

E. **Colour :** Colour is the first element to catch anyone's eyes and is a key element in fashion designing. It is often the first element to be noticed in a design and it influences whether the garment will be liked or not.

There are certain terms associated with colour which we must know –

- ***Hue*** – It is the name of the colour like Red, Blue, Green etc.
- ***Value*** – It is the lightness or darkness of a colour. Light colours have high value while dark colours are supposed to have low value.
- ***Intensity*** – It is the brightness or dullness of a colour.
- ***Primary Colours*** – There are three primary colours – Red, Blue and yellow.
- ***Secondary Colours*** - The Secondary colours are made by mixing any two primary colours together. There are three secondary colours – Green, Orange and Purple.
- ***Intermediate Colours*** – These are colours in between a Primary colour and its next Secondary colour. For eg. Blue-green, red-orange etc.
- ***Colour wheel*** – This is a wheel showing all Primary, Secondary and Intermediate colours. It serves as a guide line while selecting a colour scheme.

Pic. No. 10.13 Colour Wheel

Something Interesting!

Colours have often been used to denote rank and profession. Golden yellow and Purple were always considered to be the colours of royalty. Doctors have white lab coat while advocates have black coat.

Colour has religious and cultural importance too. For eg. Brides will wear Red in our culture and white in western culture..

Colour Schemes : These are different combinations of colours used to create a design. There are many colour schemes to choose from. Some of the major ones are listed below –

A. Monochromatic Colour Scheme – Only one colour is used. Different values of the same colours are used to create a beautiful effect.

B. Analogous Colour Scheme – This scheme uses colours which are next to each other in the colour wheel. For eg. Blue & Blue-green, Yellow & yellow-orange etc.

C. Complementary Colour Scheme – This scheme uses colours opposite to each other in the colour wheel. For eg. Blue & Orange, Yellow & Purple etc.

D. Triad Colour Scheme – This scheme uses three colours which are at equal distance with each other on the colour wheel. For eg. Yellow, Red & Blue.

E. Neutral Colour Scheme – This scheme uses Grey or Brown as the main colour.

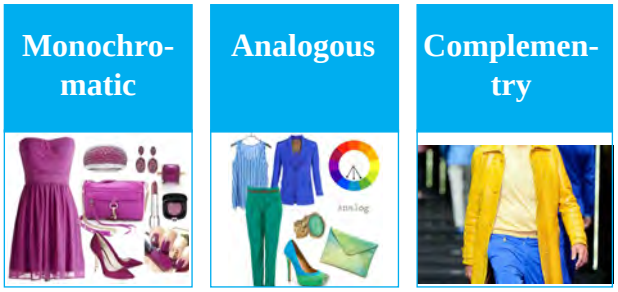
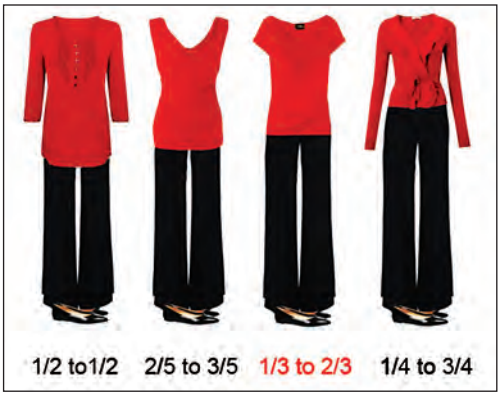


Chart No. 10. 3 Colour Schemes

10. 5 Principles of Design

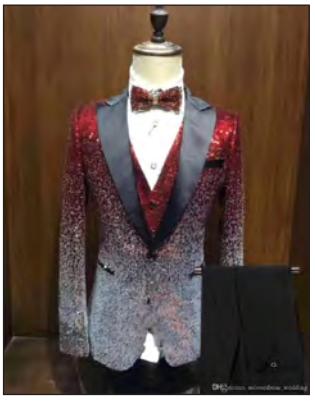
Besides the Elements of Art which are helpful in creating a design, there are certain principles which if followed, will make the design very beautiful and appealing. These principles are Proporation. Balance, Rhythm, emphasis, Contrast.

A) Proportion : In fashion designing, proportion is the size relationship of different parts of a garment to each other and to the whole design. Proportion is very important to the eyes. If the design's proportion is proper, the design's effect will be pleasing to eyes. For eg. The proportion of upper body and lower body in a garment. The golden rule for proportion is 5:8 and 8:13.



Pic. No. 10.14 Proportion

B) Balance : Balance is how the internal parts of a shape work together. Balance also refers to 'visual weight' in design. A garment must have equal 'weightage' on both sides of its centre, to look good. Balance can be symmetrical or asymmetrical. Symmetrical balance is also known as ***Formal Balance.*** In this type of balance, both left and right sides of the garment look same. A formal balance will have exactly the same details at the same place on both sides of the garment. For eg. Two pockets on two sides. It is the easiest to make and gives stability to garment. Therefore it is the most commonly used in fashion designing.



Pic. No. 10.15 Formal Balance

Asymmetrical balance is known as ***Informal Balance***. The details of the design on both sides of the centre are unequal. An eye-catching detail on one side can be balanced by a larger but less dramatic detail on the other side. This is difficult to achieve and requires lots of creativity. If done properly, the design still appears balanced, even though its two sides are different. A well done Informal balance looks very beautiful and special.

Pic. No. 10.16 Informal Balance

B) Rhythm : In fashion designing, rhythm is achieved by repetition of lines, shapes, textures and colours of garment. The flow should gently carry the eyes from one area of the garment to another. For eg. Pleats of a skirt or multi layered skirt. Rhythm can also be achieved by progression of size.

Pic. No. 10.17 Rhythm

D) Emphasis : Emphasis is a centre of interest that draws attention to the focal point of a garment. This centre of interest must be more attractive than the rest of the garment but at the same time, it should relate to the overall design of the garment. A well made Emphasis will draw our eyes quickly to the centre of interest in a design. For eg. a big bow on a plain dress.

Pic. No. 10.18 Emphasis

E) Contrast : It is the use of different colours, textures and shapes. It is one of the most powerful design principles. The use of Contrast removes the dull effect of sameness in a garment. This can be achieved by using a different colour or texture or pattern.

Pic. No. 10.19 Contrast

F) Harmony : When elements of Art are used along with Principles of Design, Harmony is created. It is the pleasing arrangement of all parts of a garment. It is not the exact opposite of Contrast, but it does mean having similarities in the use of colour, texture or patterns. It gives a very pleasing effect to the eyes.

Pic. No. 10.20 Harmony

10.6 Scope of Fashion Designing in India

Due to technological progress in recent years, the world has become smaller. News or information from any corner of the world can reach us with a click. Due to internet we are able to know the fashion trends in the rest of the world. This has made all of us, especially the youngsters, very fashion conscious. We all are spending far more money or time on clothing and accessories than our elders did. With a huge population ready to explore new trends

in fashion, India is the new market for various international, national and local brands. The scope of fashion designing is huge and is only going to get better due to globalization.

Fashion designing is an accepted career choice today for boys and girls alike. There are various government, semi-government and private diplomas and degree courses all over the country where any aspiring student can get trained. The job opportunities are plenty too. A trained person can join some fashion house or readymade garment outfit or boutique or start his/her own boutique or do freelancing. It is an excellent choice of career for women who are not able to go out of home and work somewhere for fixed number of hours. Fashion designing provides them the luxury of working from home.

Qualities required for a good Fashion Designer :

1. You need to have a creative and artistic mind.
2. You should also have good drawing skills though today computers are a big help.
3. You should be able to understand colours and their effects.
4. You should have a working knowledge of clothes and their types.
5. You should be able to express your ideas in a visual form like drawing / sketching.
6. You should have a knowledge of the fashion industry and its latest trends.
7. You should be able to guess the requirements of the fashion market.
8. A working knowledge of tailoring is always useful.

Use Your Brain Power

I. Complete the paragraph below with the words given :

(Symmetrical, visual weightage, beautiful & appealing, Golden rule, size relationship)

There are certain principles which when followed, make a design _____ _____. Proportion is the _____ _____ of different parts of a garment. __ _____ for proportion of upper and lower body is 5:8. Balance refers to _____ in design. _____ balance is called Formal balance.

EXERCISE

Objective Type Question

1. Match the columns :

	A		B
1.	Croquis	a.	Fad
2.	Boutique	b.	name of the colour
3.	Silhouette	c.	sketch of human figure
4.	Rhythm	d.	a fashion shop
5.	Hue	e.	repetition of lines
		f.	outline of a dress

2. Select and write the most appropriate answer from the given alternatives for each question :

1. Equal weightage on both sides of the centre.
   a. Formal balance
   b. Informal balance
   c. Emphasis
2. Colour scheme using a single colour.
   a. Analogous
   b. Monochromatic c. Neutral

3. Lines which give an effect of height.
   a. Vertical b. Horizontal
   c. Diagonal

4. Things worn or carried along with the garment.
   a. Croquis b. Accessories
   c. Make up

5. Garments produced for the general population.
   a. Haute couture b. Ready to wear
   c. Mass market

3. State the correlation between the pairs given below :

(example - boat neck : neckline)

1. Raglan : _____
2. Poncho : _____
3. A-line : _____
4. Layered : _____
5. Princess line : _____

4. Find the odd one out :

1. a. Red b. Blue
   c. Orange d. Yellow
2. a. Triad b. Harmony
   c. Neutral d. Analogous
3. a. Line b. Balance
   c. Shape d. Texture
4. a. Proportion b. Emphasis
   c. Colour d. Rhythm
5. a. Hats b. Belt
   c. Handbag d. Skirt

Short Answer Type Question

1. State whether true or false and give reason for your answer :

1. Haute couture is quite expensive.
2. Illustration means the outline of a garment.
3. Formal balance is easy to achieve.
4. Complementary colour scheme uses one colour only.
5. Intermediate colours are colours next to each other in a colour wheel.

2. Give two examples of the following :

1. Variation in neckline.
2. Principles of design
3. Variations in skirt.
4. Lines
5. Secondary colours

3. Define :

1. Fashion
2. Harmony
3. Illustration
4. Boutique
5. Texture

4. Write in short about the following:

1. Rhythm
2. Proportion
3. Fashion accessories
4. Contrast
5. Element of Art – Line

Long Answer Type Question

1. Describe any three colour schemes.
2. Write about any three Principles of design.
3. Write about qualities needed in a good fashion designer.
4. Write about any three Elements of Art.

Project Work / Field Visit

1. Pay a visit to a fashion house and note the kind of activities carried out there.
2. Make a portfolio about variations in parts of garments / colour schemes.
3. Find out the latest trends popular in the fashion market.

Practical No. 1.
Body Measurements & Basic terms used in Stitching.

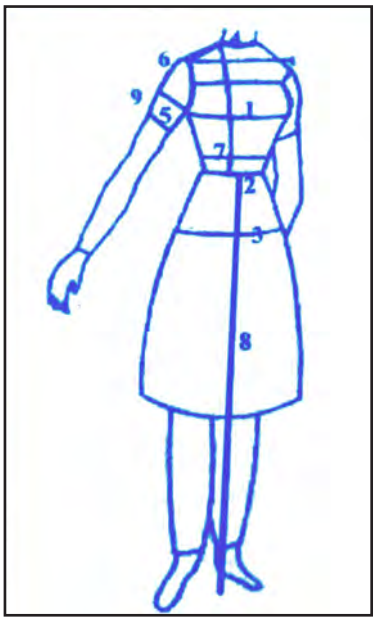
Body Measurements : When you intend to stitch any garment for some particular person, you need to take his / her body measurements so that the garment is a perfect fit. Taking accurate measurements is a necessary skill that you must practice and acquire.

Materials Required : Measuring tape, a pen and paper. If you are taking your own measurements, standing in front of a full length mirror will help.

The basic measurements required for stitching any garment can be divided into two broad categories – Horizontal Measurements and Vertical Measurements.

Horizontal Measurements :

- **Neck** – Measure all the way around the neck above the collar bone.
- **Shoulder** – Measure from one shoulder bone to the other.
- **Bust** – This is the measurement around the body across the fullest part of the bust. Make sure you keep the measuring tape straight as you record the number so that it doesn't dip at the back.
- **Waist** – This is the measurement around the body at the narrowest part of the torso.
- **Hip** – The hip measurement is taken around the body at the fullest point of the hips/bottom.
- **Arm** Girth – This is the measurement around your arm above the elbow. Depending upon the type of garment you are stitching and the person's comfort level, you can keep the measurement exact or keep it loose.



Pic. No. 1.1 Body Measurements

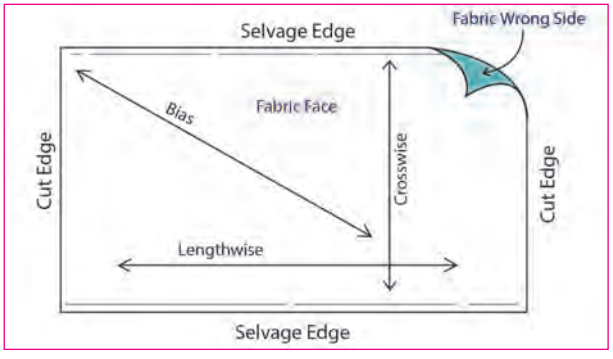
- **Wrist** – Measure around the wrist just above your hand. It is useful to know this measurement when you are stitching a full sleeved garment.
- **Thigh – This is the measurement around the thigh – midway between waist and knee.**
- **Knee – This is the measurement around the knee.**
- **Ankle – This is the measurement around the ankle.**
- **Vertical Measurements :**
- **Upper body –** Start from the point your shoulder meets your neck and go down depending upon the type of garment you are stitching. For tops and blouses - you measure up to waist, for shirts – measure up to the hips and for kameez – measure up to knee.

- **Waist to knee** – Measure from the waist up to the knee. Helpful for making skirts, frocks, uniforms etc.
- **Waist to ankle –** Measure from the waist up to the ankle. Useful for making pants, salwar, churidar, jeans, gowns, long skirts etc.
- **Inside leg –** Measure from the crotch to the ankle. Useful for sewing pants.
- **Arm Length –** Measure from the shoulder bone up to the length desired for the sleeves.

Practical Work : Students should make pairs and take each other's measurements and note it down in their journal.

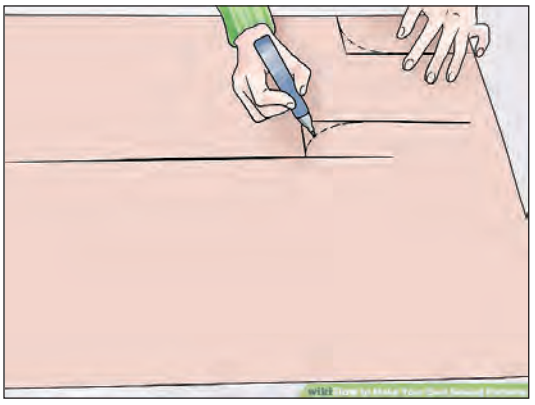
Basic Terms used in Stitching :

- **Warp** – The lengthwise yarns inside a fabric are known as Warp yarns. You can find the warp yarns in a fabric by looking at the selvedge. The warp yarns will be in the direction of selvedge.
- **Weft** – The yarns at right (90^0) angle with warp yarns are known as Weft yarns. They are in the direction of width.
- **Bias** – When a fabric is folded or cut at 45^0angle, it is called Bias. For making a bias match the selvedge to the width wise edge of the fabric.



Pic. No. 1.2 Bias

- **Selvedge** – The machine made edges on both the length wise ends of a fabric are known as selvedge. Threads do not come out from these edges. There are two selvedge in a fabric parallel to each other. For stitching purpose, the selvedge help us to determine the length of the fabrics.
- **Drafting** – Drafting is the process of creating paper patterns from which garment pieces are cut before stitching together to make garments.



Pic. No. 1.3 Drafting

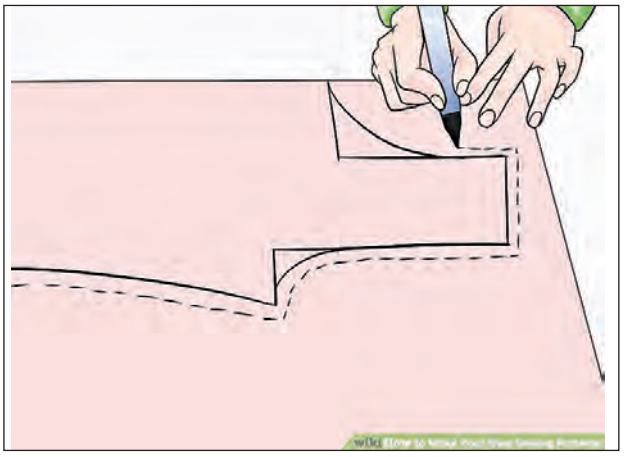
- **Layout** – Layout means putting all the pieces of drafting on the fabric in order to cut the fabric in the desired shapes.

Pic. No. 1.4 Layout

Layout should always be done keeping in mind the grain or length of fabric. The fabric can be folded length wise or can be spread open.

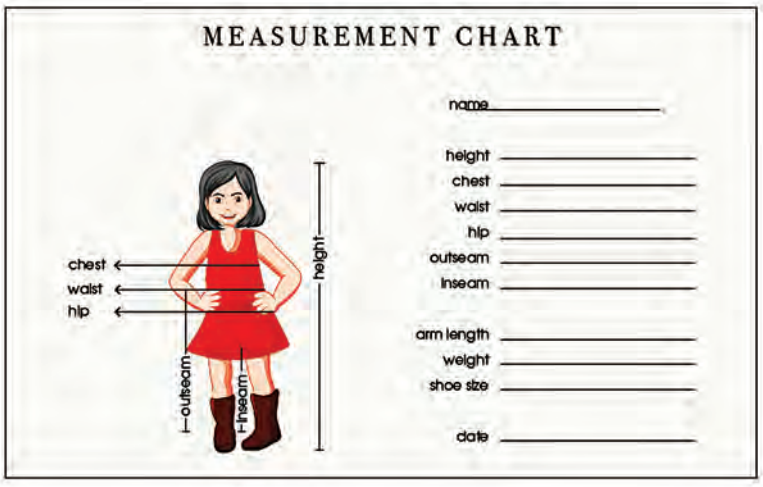
- **Cutting** – The fabric is marked with a tailoring chalk or pencil as per the drafting pattern. Seam allowance is also marked and then the fabric is cut on the seam allowance lines.

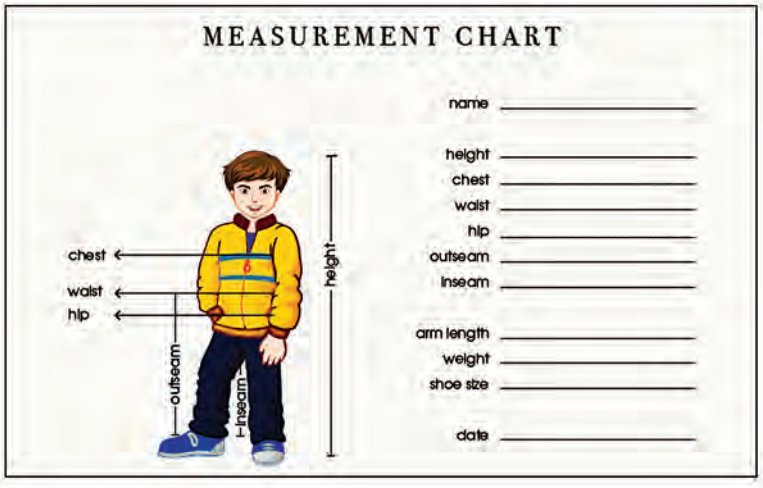
- **Seam Allowance** – It is the margin or extra fabric kept beyond the boundaries of drafting patterns on the fabric. This extra margin is used up in stitching. If this allowance is not kept in mind, the garment will turn out to be smaller than the measurements.
- **Ease Allowance** – Even the most fitting garments can not be stitched exactly as per body measurements. In order to make a garment which is easy to put on and take off, some extra margin is always kept while making drafting pattern.



Pic. No. 1.5 Seam Allowance

Body Measurement Chart For Children





Practical No. 2
Placket and Fasteners

A placket is an opening in a garment which makes putting on and taking off the garment easier.

PLAIN PLACKET:

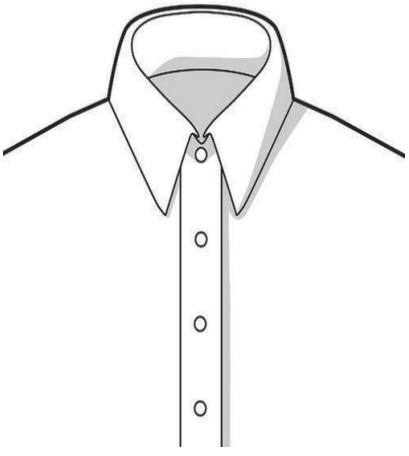
This placket is used for the garments which are full open like shirts, saree blouses, etc. two separate strips are cut to finish this type of opening. One side, usually the right side is folded halfway, extending beyond the garment. The left side is fully folded and overlaps the extended side which is the under lap.

Material Required : Plain poplin material of light colour, matching thread, measuring tape, scissors, tailor's chalk etc.

Method : The material is spread out on a table and two pieces are marked and cut in the direction of length. The size of both the pieces

Length - 15 cm

Width - 8 cm



Pic. No. 2.1 Plain Placket

These pieces are marked as Right and Left as if they are sides of a shirt.

Two strips are also marked and cut in the direction of length. The Right strip to be attached to the Right piece was cut 15 cm long and 5 cm wide. The Left strip was cut 15 cm long and 3 cm wide.

The right strip was attached to the Right piece with their right sides facing each other. The strip was then folded halfway so that it remains extended and finished.

The left strip was attached to the Left piece with their right sides facing each other. The strip was then completly folded on the wrong side like a facing and finished.

FASTNERS: Fasteners are important because the opening made by the placket has to be closed once the garment is put on and opened when it is to be put on or taken off.

Fasteners are of different types.

- **Buttons:-** These are most commonly used. They are of two or four holes. They should be positioned in such a way that top edge and lower edge of the garment are evenly aligned. when doing by hand, the needle should pass through the four holes of the button in such a way that a + sign is formed. The two hole button usually are stitched with a = sign.

  Button holes can be made by hand or by machine. Its size should be correct for the button.

Pic. No. 2.2 Buttons

- **Hook and eye:** This is a metal fastener, used as an invisible closing at the point of strain on the Garment. E.g. ends of neck, waist band, waist lines etc.

  The hook is attached to the wrong side of the overlap by hand using simple whip stitches. The two rounds of the hook is secured with stitches and then 2 – 3 stitches are taken to secure the longer hook part.

  The eye can be round or bar shaped. It can be metal bar or a thread eye can be made. Several straight stiches are taken to make a thread eye. Then it is finished with blanket stitches.

Pic. No. 2.3 Hook & Eye

Some Other Fasteners

Practical No. 3
Apron

Material required : Brown paper, Measuring tape, ruler, pencil, scissors etc.

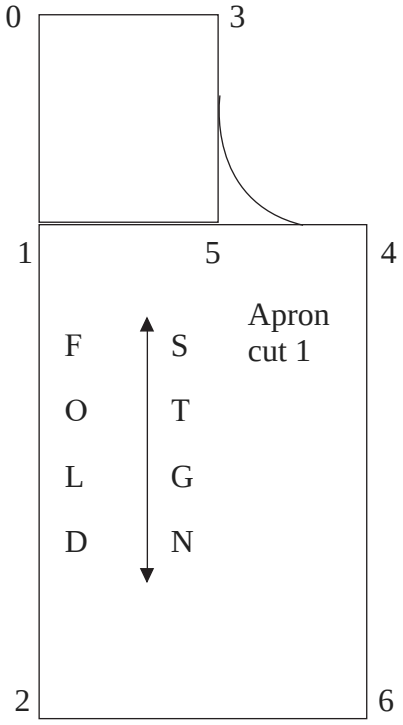
Measurements :

Round chest – 88 cms.

Round waist – 72 cms.

Length of bib – 25 cms.

Length of skirt – 60 cms.



Drafting Instructions :

Fold the brown paper length wise. Mark the drafting points on the brown paper in the following manner –

0-1 = length of bib
= 25 cms.

0-2 = length of bib + length of skirt
= 25 cms. + 60 cms. = 85 cms.

0-3 = 1/8 of chest
= 11 cms.

1-4 = 1/4 waist + 4 cms.
= 18 cms. + 4 cms. = 22 cms.

1-5 = 0-3
= 11 cms.

Join 3-5 with a straight line.

2-6 = 1-4
= 22 cms.

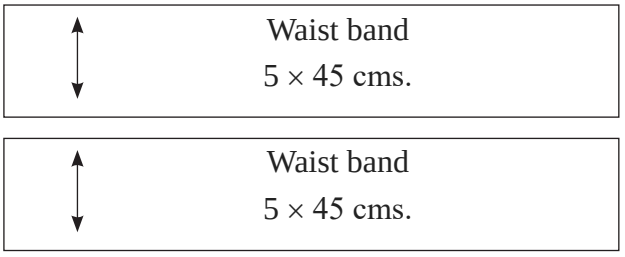
Join 4-6 with a straight line.

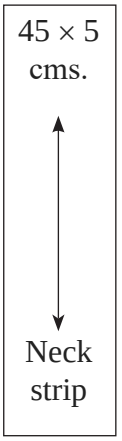
Give curve shape for a bib as shown in figure.

Cutting line : 0, 3, 4, 6, 2.

Cut two horizontal strips to be attached at waist – 5cms. × 45 cms.

Cut one vertical strip to be attached for neck – 40 cms. × 5 cms.





Practical No. 4
Romper

Material required : Brown paper, measuring tape, ruler, pencil, scissors etc.

Measurements : Full length - 50 cm.
Round chest - 60 cm.
Round neck - 30 cm.
Shoulders – 25 cm.

Method : Fold the brown paper with two folds, making four layers of the paper.

Draft in the length wise direction as given below:

0-1 : Full length (on the length wise fold) = 50 cm.

0-2 : 1/4th of chest + 5 cm.

= 20 cm.

1-3 : same as 0-2 = 20 cm.

Join 0-2, 2-3 and 1-3 with straight lines to make a rectangle.

0-4 : 1/4th of chest + 2cm.

= 17 cm.

0-5 : 1/2 of shoulder + 1 cm.

= 13 cm.

4-6 : same as 0-5 = 13 cm.

Join 5-6 with a straight line.

6-7 : 4 cm.

0-8 : 1/6th of neck + 1 cm.

= 6 cm.

5-9 : 2 cm.

Join 8-9 with a straight line for shoulder.

10 is mid-point of 9-6. Join 10-7 with a curve for armhole.

0-11 : 3 cm.

0-12 : 6 cm.

Join 8-11 with a curve for back neck.

Join 8-12 with a curve for front neck.

1-13 : 6 cm.

1-14 : 4 cm.

1-15 : 2 cm.

Join 14-13 with a curve for front crotch.

Join 15-13 with a curve for back crotch.

3-16 : 8 cm.

Join 7-16 with a straight line.

Join 13-16 with a straight line.

17 is mid-point of 13-16.

17-17A : 1.5 cm.

17-17B : 2.5 cm.

Join 13-17A-16 with a curve for front leg opening.

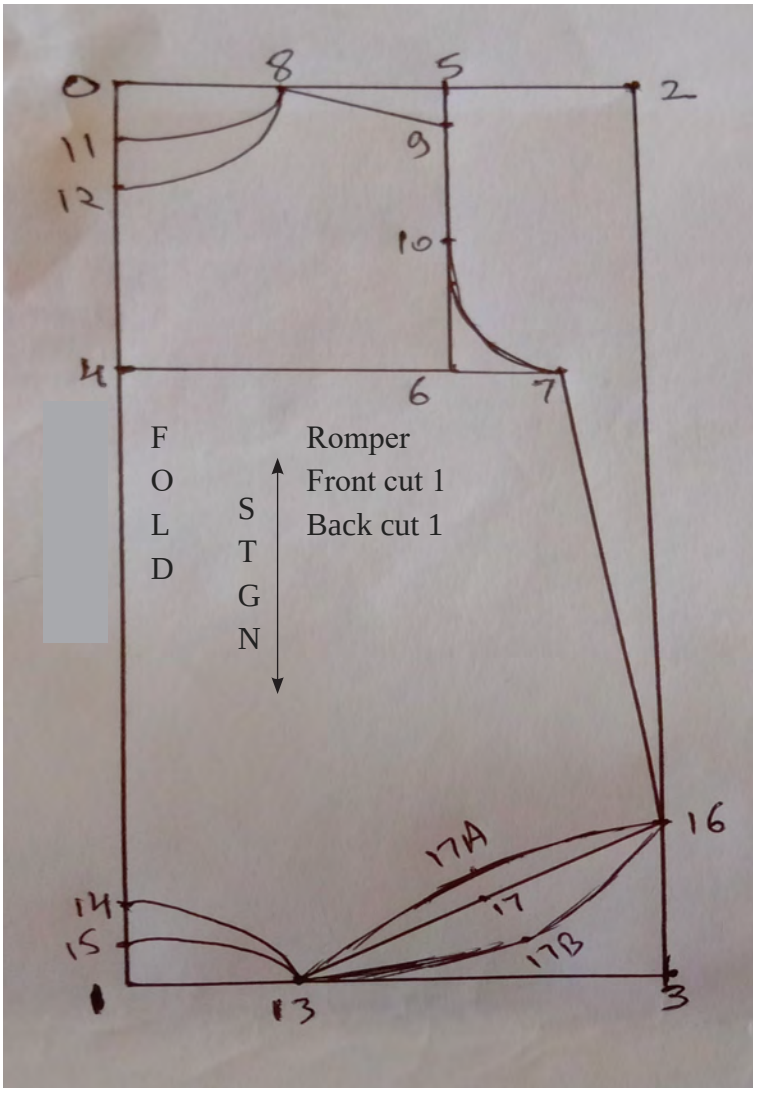
Join 13-17B-16 with a curve for back leg opening.

Cutting line for back : 11- 8- 9- 10- 7- 16 – 17B- 13 – 15. (all four layers)

Remove the back part of the romper and then cut the front.

Cutting line for front : 12 – 8. 14 – 13. 13 – 17A –16.

12 – 8 – 9 – 10 – 7 – 16 – 17A – 13 – 14.


0
8
5
2
11
9
12
10
4
6
7
FOLD
STGN
Romper
Front cut 1
Back cut 1
16
17A
17
17B
14
15
1
13
3

Practical No. 5
Weave identification and making paper weave samples

Weaves are the patterns formed on the surface of fabric due to interlacing of warp and weft yarns.

There are three basic weaves :

1. **Simple or Plain weave –** also known as 1 up and 1down weave. No design is formed on the surface of fabric.
2. **Twill weave –** Diagonal lines are formed on the surface of fabric.
3. **Satin weave –** Long floats of warp yarns are seen on the surface of the fabric.

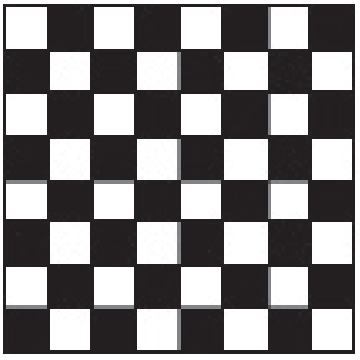


Diagram No. 5.1 Plain weave

Paper Weave making :

Material Required : Marble papers of two contrast colours, ruler, pencil, scissors.

Method : One of the marble paper is used for making the weave frame of 10 cm x 10 cm. A boundary of 1 cm is left on all four sides and warp frame is made by marking and cutting 1 cm wide warp yarns keeping the ends intact.

Weft strips are cut from the other marble paper of 10 cm x 1 cm size.

Three such frames have to be prepared for making samples of the three basic weaves.

For each frame, 7-8 weft strips are cut.

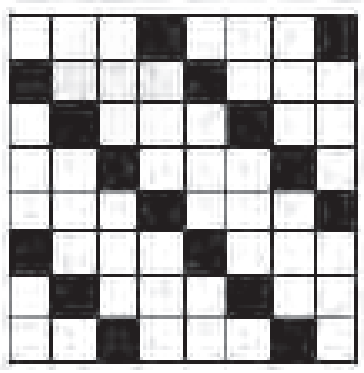


Diagram No. 5.2 Twill weave

The Simple weave sample: is made by interlacing the weft strips in the frame in 1 up 1 down manner.

The Twill weave sample: is made by interlacing the weft strips in the frame in such a manner that diagonal lines are seen on the surface. The weave can be even or uneven.

The Satin weave sample: is made by interlacing the weft strips in the frame in such a manner that long floats of warp are seen on the surface.

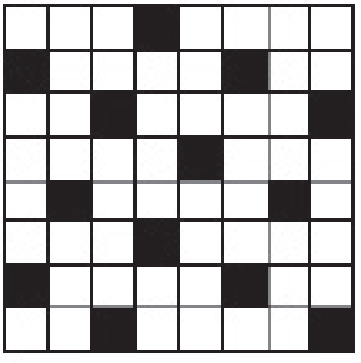


Diagram No. 5.3 Satin weave

WEAVE INDENTIFICATION:

1) Students should collect and stick fabric samples made of different weaves and observe the characteristics carefully.

2) Students should use pick-glass to observe each sample.

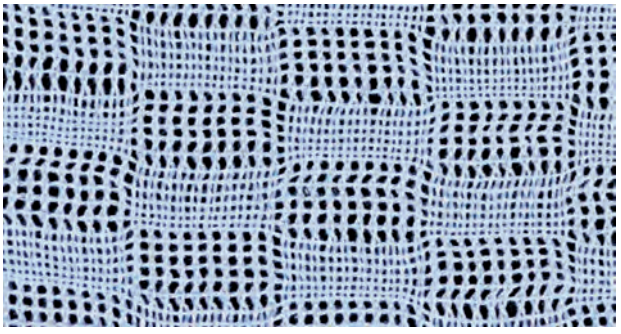
Characteristics of Novelty weaves

Uncut Pile Weave

- 3-dimensional effect
- Loops are seen on the surface

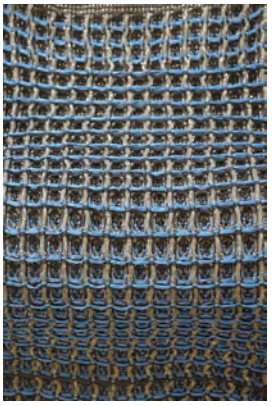
Cut Pile Weave

- 3-dimensional effect
- Yarns project out on the surface



Leno Weave

- Open mesh effect
- Net like fabric



Honeycomb Weave

- Hollows and ridges.
- cell like, honey comb appearance

Practical No. 6
Identification of fibres by Microscopic Test

The microscopic test is a technical test that involves identifying the fibres with the help of a microscope. With microscopic evaluation of fibres, it is possible to be quite specific in identification of some fibres. The test reveals the inner structures of fibres which are remarkably different from each other.

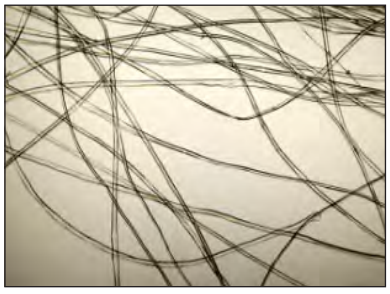
Note :- This test is carried out by teacher on demonstration basis only.

A) Microscopic Test of Wool fiber :

Picture No. 6.1 Wool fiber

1. Uneven in diameter
2. Scales are seen

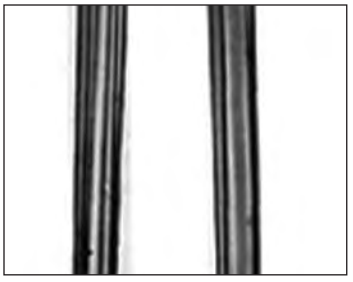
B) Microscopic test of silk fiber :



Picture No. 6.2 Silk fiber

1. Smooth in appearance
2. Transparent
3. Gummy spot are seen.
4. Very fine fibers.

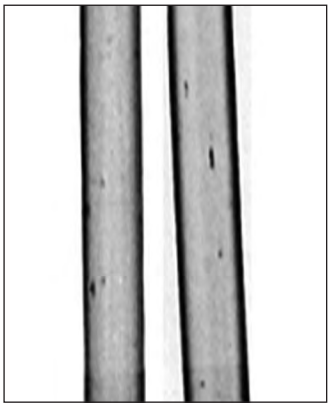
C) Microscopic test of Viscose Rayon fiber



Picture No. 6.3 Viscose Rayon

1. Even in diameter
2. Vertical lines or striations are seen

D) Microscopic test of Polyester fiber



Picture No. 6.4 Polyester fiber

1. Even in diameter
2. Transparent glass rod like
3. Grainy, pitted appearance can be seen if fibres are delustered.

Practical No. 7
Identification of fibers by Burning Test

Qualitative identification of fibers is difficult and may require several tests. The burning test can be used to identify the general chemical composition of fiber such as cellulose, protein, mineral or man made fiber.

❖ Test Procedure :

Step : 1. Unravel a yarn from the fabric sample.

Step : 2. Untwist yarns so the fibers are in loose mass.

Step : 3. Hold the loosened fibers in forceps or tweezers, and move them towards the flame from the side.

Step : 4. Notice the odour given by the fiber during burning.

Step : 5. Observe the ash or residue formed.

Table 7.1

Burning Characteristics of fibers

Fiber	Approaching the flame	In the flame	Removed from the flame	Odour	Residue
Wool and silk	curls away from the flame	Burns slowly	self-extinguishing	Similar to burning hair	Crushable bead
Viscose Rayon	Does not shrink away, Ignites on contact	Burns quickly	continues burning, After glow	similar to burning paper	light fluffy residue
Polyester	Fuses, melts & shrink away from flame	Burns slowly and continues to melt	Self extinguishing	Chemical odour	Uncrushable bead

Practical No. 8
Tie-and-Dye

Tie-and-Dye is a type of resist dyeing technique used since ancient times. It is still popular in the modern context. In India ***Bandhani, Leheriya, Bandhej, Chungidi*** are examples of traditional tie-n-dye technique.

Material Required : white cotton dupatta, commercial dye powder, tub, water, wooden ladle, threads to tie, small bowl, spoon, salt.

Method : The dupatta is washed thoroughly, dried and ironed. It is then folded according to pre determined pattern and tiny portions of all layers of the material are picked by finger nails and tied with threads or rubber bands. Once the desired no. of threads are tied, the dye bath is prepared by taking half a tub of plain, clean water.

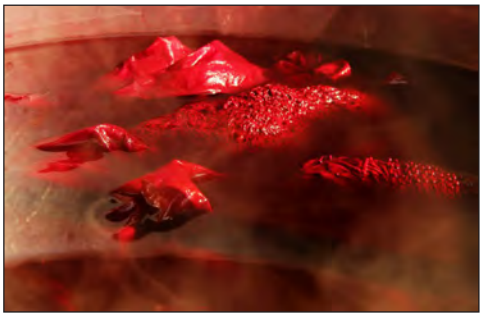
The dye powder is mixed in a little amount of water in the small bowl and then the solution is added to the tub containing water. The tied dupatta is put in the dye bath and allowed to take up colour for 30 -40 mins. It is stirred occasionally with the wooden ladle.

Once the fabric has taken up the desired intensity of colour, the dupatta is taken out from the dye bath and rinsed thoroughly. Salt is added in the rinse for better fixation of the dye. The dupatta is squeezed lightly and allowed to dry in the tied state.

Once the dupatta is dried, all the knots are opened and the dupatta is ironed.

Pic. No. 8.1 Preparation of material

Pic. No. 8.2 Tied material



Pic. No. 8.3 Material being dyed

Pic. No. 8.4 Final Product

Practical No. 9
Block Printing / Stencil Printing

Printing of textiles to decorate them is a very ancient art. There are many methods of printing. Block Printing and Stencil Printing are two of the oldest methods used for printing which are still popular today.

Block Printing : It is the oldest method of textile printing. Wooden blocks on which the desired pattern have been engraved, are used. Dye paste is applied on them and the patterns are transferred to the fabric simply by pressing the block on the fabric. For every repeat pattern, the same procedure has to be repeated. It is a time taking, laborious process but the results are beautiful.

Material Required : Textile product to be printed – any one of the following –

T-shirt	cushion cover
kurti	pillow cover
dupatta	table cloth
Shirt	hand bag

Engraved wooden blocks, fabric colours, paint brush, rough cloth, old newspaper.

Method : The garment or household article to be printed is washed, dried and ironed. It is spread over the rough cloth which serves as back support. Alternately, old news papers can be spread out and the article to be printed is spread over it single layered i.e. if it's a T-shirt or kurti, the back support of rough cloth or news papers should be in between the front and back of the garment.

Fabric colour is applied on the engraved part of the wooden block with the help of paint brush and then it is pressed on the desired part of the article so that the colour and the pattern gets transferred on the fabric. The process is repeated as desired. Colours or wooden blocks can be changed. The colour on the fabric is allowed to dry and the article becomes ready for use.

Pic. No. 9.1 engraved wooden block

Pic. No. 9.2 Block printing

Stencil Printing : It is also one of the oldest methods of textile printing. Here a stencil is prepared by cutting a pattern on a card paper or thin metal sheet. The stencil is fixed on the surface to be printed. Dye is applied on the stencil which allows the colour to reach the fabric only on parts which have been cut. The stencil is removed carefully and put on another part of the fabric as desired.

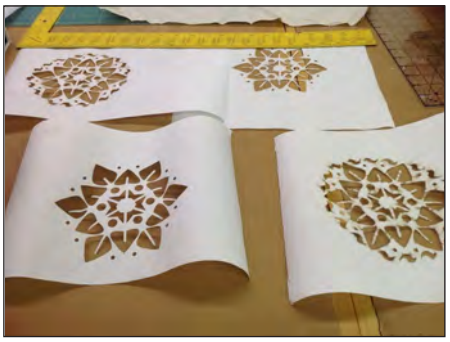
Material Required : Textile product to be printed – any one of the following –

T-shirt	cushion cover
kurti	pillow cover
dupatta	table cloth
Shirt	hand bag

Acrylic sheets, sharp knife or paper cutter / ready made stencils, fabric colours, paint brush or sponge, rough cloth, old news paper, U pins ,weights.

Method : The garment or household article to be printed is washed, dried and ironed. It is spread over the rough cloth which serves as back support. Alternately, old news papers can be spread out and the article to be printed is spread over it single layered i.e. if it's a T-shirt or kurti, the back support of rough cloth or news papers should be in between the front and back of the garment.

The stencil can be made by cutting a pattern on the acrylic sheet with a cutter or a ready made stencil can be used. The stencil is placed carefully on the surface of fabric and secured with U pins or some kind of weight is put on the corners so that the stencil stays in place. The colour is applied on the cut parts of stencil with the help of paint brush or sponge. The stencil is then carefully removed, wiped clean and can be used again. The colour is allowed to dye and the article is ready to use.



Pic. No. 9.3 Stencil

Pic. No. 9.4 Stencil Printing

Practical No. 10
Basic Body Block variations & use of Colour Schemes

Fashion illustration is the art of conveying fashion ideas in a visual form.

Materials required : paper, croquis stencil, pencils, eraser, crayons or coloured pencils.

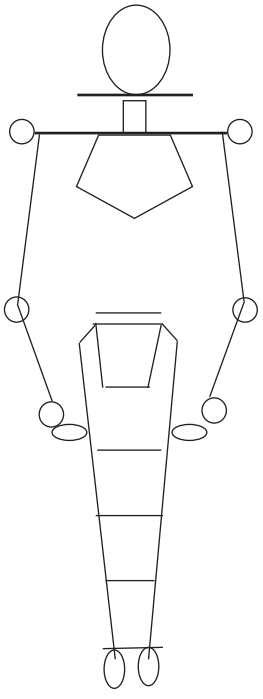
Method :

For Variations in Necklines, Sleeves and skirts –

Make an outline of the basic croquis with the help of croquis stencil on four papers.

On the first paper make a basic bodice (top) and skirt .

On the other three papers make variations in necklines, sleeves and skirts as per your imagination.

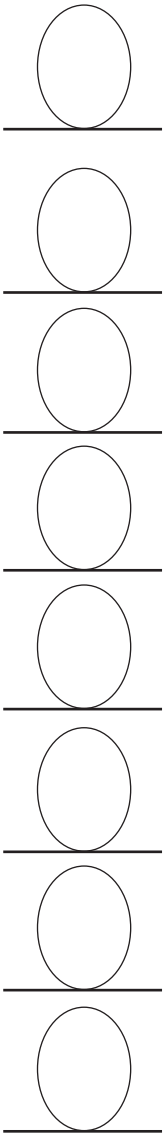


For Colour Schemes :

Make an outline of the basic croquis of any garment with the help of croquis stencil on three papers.

Choose three different colour schemes and fill colours accordingly to the garment drawn on the paper.

Basic Croquis drawing



1. Top of head to chin
2. Chin to mid-chest
3. Mid-chest to natural waist
4. Natural waist to bottom of pelvis
5. Bottom of pelvis to mid-thigh
6. Mid- thigh to knees
7. Knees to mid- calf
8. Mid- calf to feet

Practical No. 11
Maintenance of journal

❖ Students should maintain journal and write all the practicals serially as per the syllabus.

Practical No. 12
Project Work

The students are supposed to do one project work during the academic year. This project should be based on the syllabus. The suggested topics are listed after every chapter. The student can choose any one of them or can find out a new topic for project subject to teacher's approval. The format of the project i.e. how it is to be presented is given below.

Format of the Project

Title page - Title of the project, Name of the student, Class, Division. Roll No./Seat No. Name of the College.

Acknowledgement

Index /Table of Contents

Introduction

Main body of the Project with suitable photographs, illustration, tables, graphs, diagrams etc.

Conclusion

Bibliography

Annexure

Websites

ANNEXURE

Textile Times

(Historical Progress of Textiles)

B.C. 10, 000	Evidence of animal skins and furs used as body covering - vegetables clothing some leaves also used as body covering. Old sanskrit scripts are full of such descriptions.
7000	Evidence show that flax was in use in the same swiss lake dwellings.
6500	Evidence shows that weaving was in use.
6000	Evidence that flax was in regular use in Egypt.
5800	Spinning wheel and distaff in regural use. The early poetic works are full of spinning.
5600	'Athena', the greek goddess, is considered the Goddess of Distaff. Ample evidence of spinning wheel and distaff in early folklore.
4000	There are indications showing that cotton was regarded as a fiber.
3500	Cotton cloth was used. Ample evidence of this is found in the old Sanskrit script.
3000	Cotton fabrics of quality in regular use. Evidence of this found at Mohenjo-Daro (Sindh Pakistan) Shows cotton manufacturing as established industry. About this time there is evidence in old sanskrit writing showing that the method of preparing 'Indigo' a vegetable dye-was already known in India. Evidence shows that cotton was also in use in Mexico, Peru and North America.
2800	Vedic hymns give ample indications that cotton cloth of good quality was being used regularly in India.
2700	Ancient Chinese writing indicates that by this time Hemp was used as a fiber in China. Evidence shows that the properties of the rich fiber 'wool' were recognised by this time.
2640	Chinese Empress 'Si Ling - Chi' wife of Emperor 'Huage - ti' began experimenting with silk worms and sericulture. The invention of reeling of silk is attributed to her.
2600	Silk become an established industry in China, the art was however kept a closely guarded secret.
2100	Probably now began the art of dyeing and printing. Evidence of dyeing and printing of fabrics - pictured on the walls of a tomb in Egypt are shown people with decorated fabrics Also found there were illustrations of upright loom.
2000	Cotton Fabrics - Supremancy in India.
1466	Natural Dyestuff began to be used. Linen decorated with conventional design found in the tomb of Thothmus IV.
1200	A sample of Batik printing found in a temple of Java.

1050	Early Sanskrit Literature suggests the existance of silk industry, in India at about this time.
540	Evidence of ornamental linen tapestry.
500	Resist printing first practicised in China. Probably now began the art of fast colour dyeing with mineral colours.
445	Cotton clothes export from India to Europe was carried on fairly regularly by Arabs.
425	Evidence found that Babilonian and Egyption dress consisted of linen shirt reaching to the feet over which was worn a woollen tunic.
350	Secrets of silk manufacture were smuggled out of China. Japan tried to establish its silk industry - four chinese girls helped to establish the Japanese silk industry.
327	'Alexander the Great' in his invasion of India - took the Greece some quantity of printed cotton goods.
300	'Magasthenes' A Greek traveller writes in his narrations that in Indian people wore flowered garments made of finest muslins. This is probably the first indication of the famous Dacca - mulls. 'Megasthenes' - Greek ambasador to the court of 'Chandra Gupta Maurya' mentions decorated cotton fabrics with gold and silver threads and precious stones.
100	Records show evidence of domesticated breed of Angora goat in Turkey.
63	Old Roman records mention used of cotton awnings.
43	Evidence of woollen manufacturing process in writings.
01	Inventions of draw loom in Egypt was an important step in weaving.
00	"True lace fabrics" appear in the form of Egyption painting.

GLOSSARY

Term : Definition / Meaning

- **Abrasion resistant :** The ability of a fibre withstand rubbing in use and care.
- **Absorbent finish :** A finish that applied to a fabric improves its moisure absorption quality.
- **Antislip Finish :** A finish that applied to keep the yarn in place so that they will not slip over one another.
- **Basic finishes :** Finishes that are done to the most fabrics to prepare them for dyeing and special purpose finishes.
- **Basket weave :** The variation of plain weave produced when two or more filling yarns with little or no twist are interlaced with a corresponding number of lap yarns.
- **Bias :** Any direction in the fabric which does not follow exactly warp yarns or weft yarns.
- **Bleaching :** A Chemical process that makes fabrics, yarns or fibers white or prepares them for dyeing or printing.
- **Braiding :** A simple form of narrow fabric construction with interlocking or plaiting yarns of strips of cloth.
- **Brushing :** A machanical finish that removes short, loose fibres from the surface of the fabrics.
- **Carding :** An initial process in yarn making of removing impurities and arranging the fibers into parallel fashion and convert them into card sliver.
- **Cellulosic fibres :** Fibres having cellulose as their basic component. All natural vegetable fibres are cellulosic fibers. Rayon is a regenerated cellulosic fibre.
- **Cohesiveness :** The ability of fibres to stay together and adhere to each other.
- **Combing :** A process involved while manufacturing high quality yarns, which separates long desirable fibres of same length from short, undesirable fibres and arranges them in parallel order in the form of sliver.
- **Crease resistant finish :** A finish that makes fabric more resistant to wrinkling.
- **Cultivated silk :** Silk obtained after sericulture. It is produced by a species called Bombyx Mori.
- **Cut pile weave :** A type of pile weave in which loops formed on the surface of the fabric are cut or closely sheared.
- **Degumming :** Removel of the gum **Sericin** from silk filaments.
- **Delusterning :** The process of dulling the luster of man made fibre with chemicals usually titanium dioxide.
- **Density :** Mass / unit volume. It is expressed as gm/cc. The closeness with which the molecules of a substance are packed within it. Fabrics made with high density fibres are heavier than fabrics made with low density fibres.
- **Detergent :** A substance having cleaning ability.

- **Detergency :** The ability of a substance to clean.
- **Drawing :** A process in yarn manufacture in which the sliver is elongated by passing through a series of pairs of rollers.
- **Dry cleaning :** A method of laundry which uses special volatile solvents instead of water and soap to clean the clothes. It remove all greasy dirt easily.
- **Durable press finish :** A finish that imparts properties which resist wrinkling through many wearing and washing treatments.
- **Durability :** The quality of a substance which makes it long lasting.
- **Elasticity :** The ability of a substance to change dimensions when force is applied and to come back to original position once the force is removed. Clothes made from fibers having good elasticity are easy to put on or take off.
- **Felt :** Woollen fibres get interlocked with each other under special circumstances to form a non-woven fabric called Felt.
- **Felting :** A non-woven process of producing fabric directly from the fibres, usually wool or fur.
- **Fibroin :** The type of protein present in silk fibres.
- **Filament fibres :** Long, continuous, fibres whose length can be measured in meters or yards. All man-made fibres and silk are filament fibres.
- **Filature :** The processes done after Sericulture to produce silk yarn and fabric.
- **Finishing :** Any process that is applied either before or after weaving or kniting to fibre, yarn or fabric to change its appearance, hand or performance.
- **Flame retardant finish :** A finish that makes the fabric fire resistant.
- **Flammability :** The manner in which a fibre reacts to fire.
- **Fleece :** Wool obtained from live sheep.
- **Flexibility :** The ability to bend without breaking.
- **Fume fade finish :** A finish that prevents fading of dyes on textiles by environmental factors.
- **Hard water :** Water that contains calcium and magnesium salts in the form of bicarbonates, sulphates, nitrates and chlorides.
- **Heat conductivity :** The ability of substance heat to allow the heart to pass through it. Fibres with good heat conductivity are more comfortable in summer and fibres with bad heat conductivity are more suitable for winter.
- **Honeycomb weave :** A novelty weave having cell like appearance produced by floating yarns which form ridges.
- **Household Textiles :** Fabrics which we use for various activities in our homes.
- **Hydrophobic :** Substance which gets repelled by water (water hating).
- **Keratin :** The type of protein in wool fibres.
- **Knitting :** A method of constructing fabric by interlocking series of loops of one or more yarns.

- **Lace :** A method of construction of open-work fabrics usually with some figures, produced when yarns are knotted, interlooped interlaced or twisted.
- **Leno and Gauze weave :** Novelty weave with open mesh effect which has increased durabililty, stability and strength.
- **Lustre :** The amount of light reflected back and reaching our eyes from the surface of a substance.
- **Man – made fibres :** Fibres which do not occur in fibrous form in nature and have to be made into fibers.
- **Mercerization :** A chemical finish applied to cellulosic fibres especially cotton to impart luster or improve dye affinity.
- **Mildew-proof finish :** A finish applied to cotton, rayon and linen fabrics to protect them from the damage caused by mildew and fungi.
- **Monomer :** A single unit or molecule form which polymers are formed.
- **Moth-proof finish :** A finish applied to wool and silk fabrics to protect them from the damage caused by moth and carpet beetles.
- **Natural Fibres :** A fibre which is available in nature in fibrous form.
- **Non – thermoplastic fibres :** Fibres which do not change shape or melt due to heat. Such fibres burn and turn to ash on contacting fire.
- **Perspiration resistant Finish :** A finish applied to fabrics to inhibit bacterial growth and formation of perspiration odour.
- **Permanent hardness :** Hardness of water caused by the presence of calcium or magnesium sulphates, nitrates and chlorides.
- **Pile weave :** A novelty weave that produces decorative third dimension creating an effect of depth.
- **Piles :** The loops formed on the surface of a fabric with the help of extra warp or weft yarn.
- **Plain weave :** The simplest of the three basic weaves made on the simple loom by yarns at right angles passing alternately over and under each other.
- **Ply yarn :** A yarn made by twisting two or more single yarns together.
- **Polymer :** A large molecule formed by linking together many monomers.
- **Polymerisation :** The linking of many monomers to form a polymer.
- **Pulled wool :** Wool obtained from dead sheep.
- **Reeling :** The process of unwinding the cocoon and winding the silk filament on large bamboo wheels.
- **Regenerated fibres :** Fibres for which the raw material is taken from nature and then a new fibre is made by various chemical treatments. Rayon is a prime example.
- **Resiliency :** The ability of the fibre to recover after wrinkling or to save itself from wrinkling.
- **Rib weave :** Modification of plain weave producing rib or carded effect in the warp or filling direction.

- **Sanforishing :** A preparatory finishing process that minimises shrinkage and stabilizes the length and width of the fabric.
- **Saponification :** The process of mixing alkali, and fatty acid to produce soap.
- **Satin weave :** One of the basic weaves, characterized by luster because of the long floats that cover the surface of the fabric.
- **Scouring :** Finishing process that removes dirt, oil and sizing material deposited on fibres, yarns or fabrics.
- **Simple yarn :** Yarn that is even in size, has equal twist throughout length and is smooth and uniform.
- **Sericin :** The gummy substance which is produced along with silk fibre.
- **Sericulture :** The raising of silk worms for the production of silk.
- **Singeing :** A finishing process that burns off surface fibres and lint leaving an even surface before the fabric passes through any other finishing process.
- **Sizing :** The application of various materials to a fabric to produce stiffness or firmness.
- **Sliver :** Round, continuous untwisted rope like strand of fibres.
- **Soft water :** Water that contains minimum or no traces of salts.
- **Speciality fibres :** Body hair of animals other than sheep which are found only in limited areas in the world.
- **Special or functional Finishes :** Finishes which enable the fabric to perform certain function more effectively by adding to the aesthetics, comfort, ease of care or the economic attributes of textiles.
- **Spinneret :** A device consisting a series of tiny holes, essential for the manufacture of man-made fibres.
- **Spinning :** A final process of yarn manufacturing where twist is imparted to the yarn to give strength and other desirable characteristics.
- **Spun silk :** Silk yarns and fabrics produced from short fibres of a broken or damaged cocoon.
- **Stain and spot resistant finish :** A finish that protects the fabrics against permanent staining and soil retention.
- **Staple fibres :** Short fibres whose length can be measured in cm or inches. All natural fibres except silk are staple fibres.
- **Stoving :** Stifling the chrysalis with hot water or steam so that we can get unbroken cocoons.
- **Suction Washing :** A method of laundry which uses a special instrument called suction washer. This method is used mainly for heavy and large clothes.
- **Synthetic fibres :** Fibres made from chemicals that were never in fibrous form.
- **Temporary hardness :** Hardness caused due to the presence of calcium or magnesium bicarbonates.
- **Tenacity :** The tensile strength of a fibre expressed in gm / denier.
- **Terry weave :** A weave in which loops or piles are seen on both sides of the fabric. Makes a heavy, absorbent fabric.
- **Textile fibre :** A thin, long, thread – like structure which is enough flexible and strong to be made into yarns fabrics.

- **Texture :** The touch or feel of a surface.
- **Thermoplastic fibres :** Fibres which start changing their shape or start melting beyond a certain temperature.
- **Throwing :** The process of imparting slight twist to the silk yarn. Such silk is also called Thrown silk.
- **Twill weave :** A basic weave characterized by a diagonal line on the surface of the fabric.
- **Twist :** The spiral arrangement of the fibres around the axis of the yarn.
- **Uncut pile weave :** A type of pile weave in which loops formed on the surface of the fabric are cut or closely sheared.
- **Warp :** The lengthwise yarn in a woven fabric which in parallel to the selvedge.
- **Water proof finish :** A finish that makes fabric unable to be penetrated by water.
- **Weave :** The pattern of interlacement of warp and weft to attain the specific appearance of the fabric.
- **Weft :** The crosswise yarn in a woven fabric which is perpendicular to the selvedge.
- **Weighting :** Due to degumming, 25% of weight of silk is lost. To compensate this weight loss, weighting is done.
- **Wild silk :** Silk produced by moths of species other than Bombyx Mori without sericulture.
- **Worsted yarns :** Yarns made from longer wool fibres having better quality which look like any other normal yarn.
- **Yarn :** A continuous strand of textile fibers, filaments or material in a form suitable for knitting, weaving or otherwise intertwining to form a textile fibre.

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