Basic Footwear Production Operations

LEVEL I

Based on Nov, 2019 V5 OS and Feb, 2020 V1 Curriculum

Module Title: - Identifying Foot wear Product and Materials

LG Code: BFP1 M05 LO(1-9) LG (14_22)

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November, 2020

Table of Contents
page

LG#14	**LO #1-** Describe Foot anatomy and foot abnormality

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Explaining the structure and main function of the foot
- Explaining foot abnormality
- Explaining various types of the abnormality
- Explaining the basic feature for the footwear abnormality

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Explain the structure and main function of the foot
- Explain foot abnormality
- Explain various types of the abnormality
- Explain the basic feature for the footwear abnormality

Learning Instructions:

Read the specific objectives of this Learning Guide.

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Information Sheet 1	Explaining the structure and main function of the foot

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1.1 Function of the foot

The foot has the following two vital functions:

Balance and Standing

The foot is used to support the weight of the body in standing or walking and keeping it properly balanced in an erect position. For these function the foot need stability.

Walking and Running

The foot is acted as a lever to raise the body, propel it into motion (it can be walking or running) and helps it to absorb socks. For these function the foot needs flexibility.

1.2. Structure of the foot (foot anatomy)

The human foot is a combined structure of base and lever, supporting and balancing the body’s weight while standing, as well as raising and moving the body forward when in motion. Our feet works for us the whole day, whether we stand, play, run, or walk and in the process they become the most affected part of our anatomy.

Foot Anatomy is the science, which studies the structure of the feet and the interrelations of its parts. The important structures of the foot can be divided into several categories. These include:

- Bones and joints
- Ligaments and tendons
- Muscles

- Nerves
- Blood vessels

All of these components work together in union to provide the body with support, balance and mobility. A structural flaw and malfunction in any one part can result in the development of problems elsewhere in the body. Conversely, abnormalities in other parts of the ultimately can lead to problems in the feet.

1.Bones and parts of the foot

The foot is made up of 26 skeletal bones held together by muscles, ligaments and tendons.

These 26 bones are divided into three groups (Fig. 1): These are:

- **Tarsus:** The tarsus is the group at the back of the foot and has seven irregularly shaped short bones.
- **Metatarsus:** The Metatarsus group consists of five metatarsals (long bones). It is slender bones located in the front of the instep.
- **Phalanges:** The phalanges are consisting of the fourteen long bones forming the toes

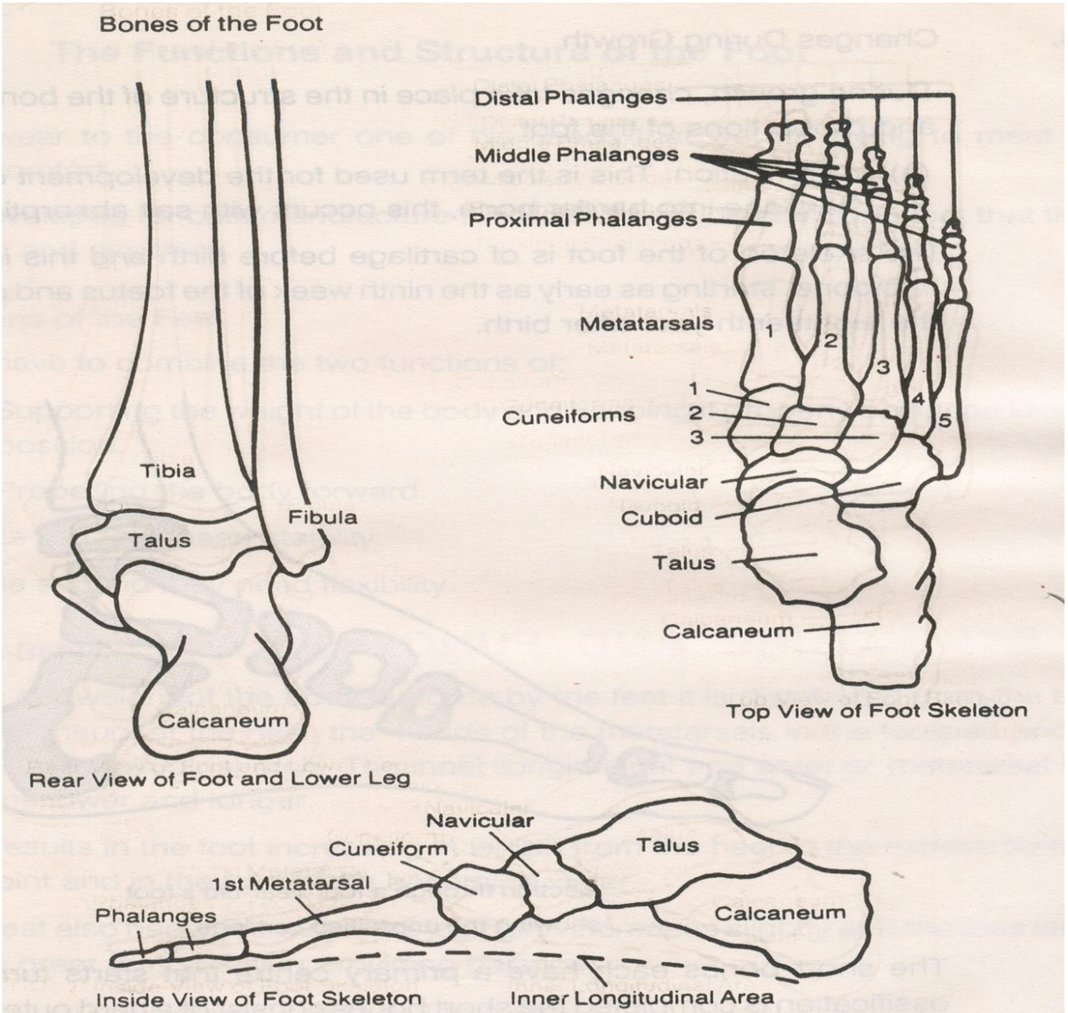

Fig 1: Different views of the foot bones

Structurally, the foot has three main parts; the **forefoot,** the **mid foot**, and the **hind foot**.

- **The forefoot:** - is composed of the five toes, collectively called Phalanges, and their connecting long bones, the metatarsals.
- **The mid foot**: - featuring five irregularly shaped tarsal bones (the navicular, cuboids, and three cuneiform). It forms the foot's characteristic arch and serves as a shock absorber.

- **The hind foot**: - The talus and the calcaneus make up the hind foot. The calcaneus is the largest tarsal bone, and forms the heel. The talus rests on top of it, and forms the pivot of the ankle.

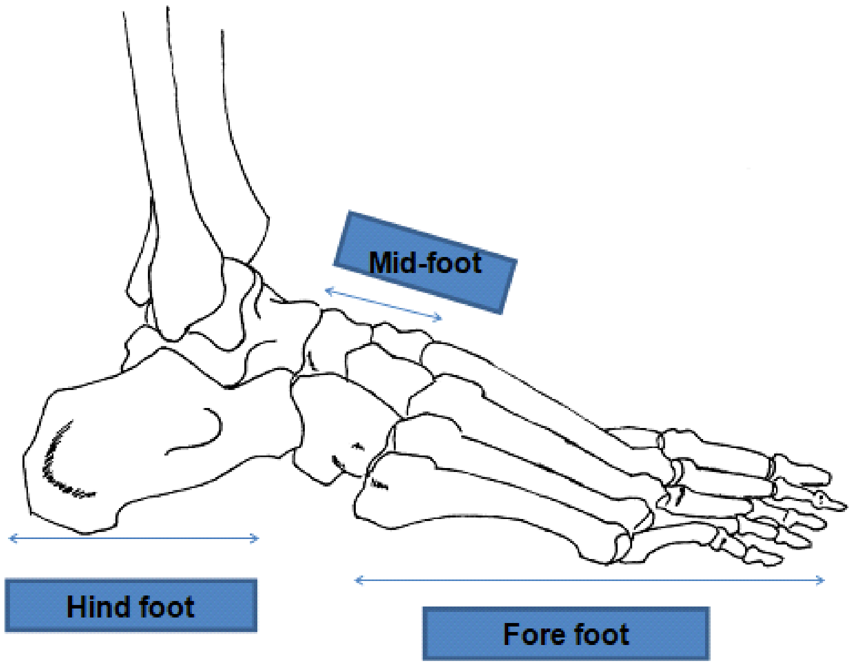

Fig 2: Parts of the foot

Fig 2 : Parts of the foot

2. Muscles and tendons

Muscles of the foot and leg balance the body and control the levers. The muscles in the leg provide power for the foot and those in the foot itself are used mainly for balance and direction.

There are some 20 muscles in the foot. They give the foot its shape by holding the bones in position, and expand and control to impart movement to the bones and joints. One of the muscles is connected to a bone but at the other end the sheath is extended and becomes a tough non-elastic cord called a tendon. This tendon then transfers the power of the muscle to the joint on another bone where it is to be applied. Tendons are strong inelastic “ropes” which attach the muscles to the bones. They keep the dynamic balance and shape of the foot. Tendons are very similar to ligaments; the difference is that tendons attach muscles to bones, whereas ligaments attach bones to bones. Like ligaments tendons are also made up of small fibers of a material called Collagen.

There are four groups of muscles in the leg that act on the foot.

1. **The front group:** Four muscles in front of and between the tibia and fibula whose tendons pass in front of the ankle joint. They raise the foot, turn the sole in and out and extend the toes up.

2. **The outside group:** Two muscles, which join the fibula. The tendons pass behind the ankle joint so they bend the foot down and turn the foot out.

3. **The surface back group (the calf):** One muscle joined to the thigh bone (femur) and the other to the tibia and fibula. They pass, via the Achilles tendon, over the back of the ankle and bend the foot down.

4. **The deep back group:** Four muscles under the calf whose tendons pass behind the ankle to flex the toe down and turn the foot.

3. Ligaments

Ligaments are the soft fibrous tissues that attach bones. They stabilize the joints. The longest of these, plantar fascia, forms the arch on the sole of the foot from the heel to the toes. By stretching and contracting, it allows the arch to curve or flatten, providing balance and giving the foot strength to push off and initiate the act of walking. Medial ligaments on the inside and lateral ligaments on outside of the foot provide stability and enable the foot to move up and down.

The foot has 109 ligaments that serve as hinges to keep the bones and joints together. They are bands of “ropes”. They are fibrous and strong but less elastic than muscles.

Ligaments hold the bones together, particularly those of the arch by keeping it in a firm, unyielding curve when weight is placed upon it. They maintain the static form of the foot.

Joints

The main joints of the foot are:

1. **Ankle Joint-Hinge:** The bases of the two bones together from a socket into which the talus fits-thus forming the ankle joint.
2. **Sub Tales Joint-Gliding:** Talus glides on the calcaneum.
3. **Mid Tarsal Joint-Gliding and ball and socket:** Cuboid glides against the calcaneum.

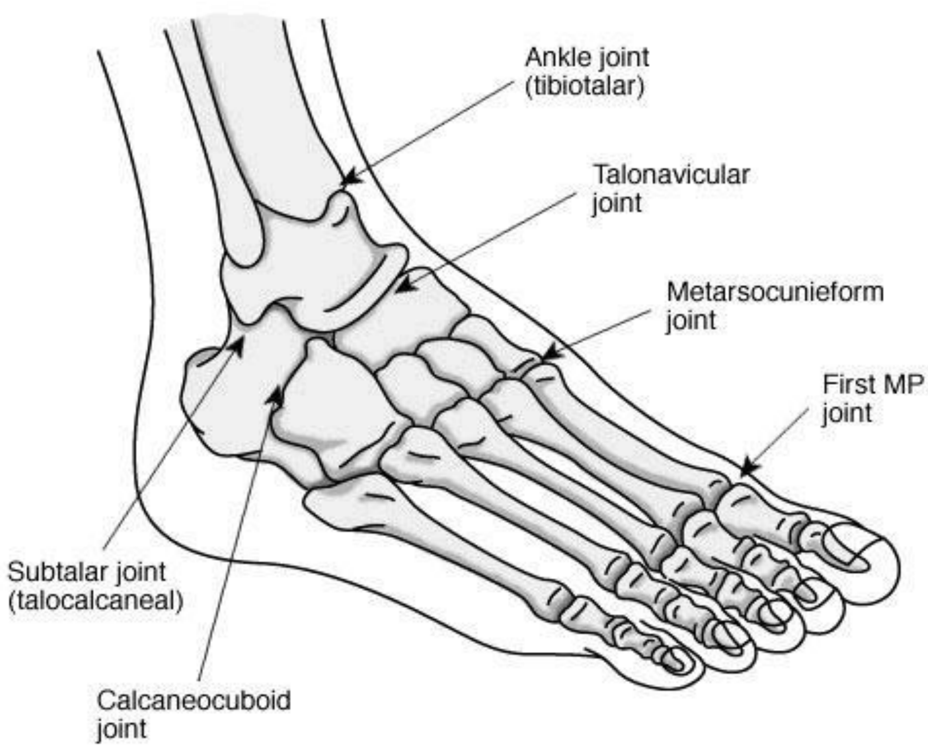

Fig 3: Joints of the foot

Self-Check 1	Written Test

Name: ___________________________ Date: _________________________

Time started: ______________________ Time finished: ___________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total Marks: 7)

1. The foot has two vital functions. These are ---------------------- and ---------------------------------------.
2. --------------------- are the soft fibrous tissues that attach bones.
3. ------------------- of the foot and leg balance the body and control the levers.
4. There are -----------------groups of muscles in the leg that act on the foot.
5. The foot has -------------- ligaments that serve as hinges to keep the bones and joints together.
6. The foot is made up of ------------- skeletal bones held together by muscles, ligaments and tendons.
7. The Metatarsus group consists of ------------- metatarsals (long bones). It is slender bones located in the front of the instep.

Short answer questions: (Total Marks: 10)

1. Briefly explain the main function of the human being foot. (2 points)
2. What is foot anatomy? (2 points)
3. Briefly explain the structure of the foot. (2 points)
4. What are the groups of bones in foot? Explain them. (2 points)
5. What is the three main parts of the foot. (2 points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**You can ask you teacher for the copy of the correct answers.

Information Sheet 2	Explaining foot abnormality

A **foot deformity** is a disorder of the foot that can be congenital or acquired. Such deformities can include hammer toe, club foot, flat feet, pes cavus, etc.

To say the main causes of foot problems are because of these deformities. There are some other different causes of foot deformities.

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It is better to identify it by foot problems symptoms.

Deformities of the forefoot are the commonest abnormalities encountered in orthopedic surgery.

A number of anatomically different deformities can slowly develop, and are differentiated conventially by terms such as “bunion”, “Bunionettes”, “claw toes”, “hammer toes”, “Morton’s neuroma”, “metatarsalgia”, “corns”, “calluses”, “hallux rigidus” and many more.

How Feet are damaged

There are five ways the human foot can be changed from a normal functioning part of the body to an abnormal, painful and even unless part.

These potential wreckers of the feet area:

1. Poorly fitted or ill-chosen shoes or stocking
2. Accidents- weights dropped, crushing bones: cuts which severe tendons, etc
3. Ill-health- this could weaken the muscle tone, e.g. neurological abnormalities
4. Hereditary tendency
5. Congenital abnormality (exists at birth)

The first cause poorly fitted or ill-chosen shoes or stocking is an area in which you can be help in the relief of discomfort due to these causes. It is in your power to prevent any customer from losing the normal use of his or her feet from poorly fitted or ill-chosen foot wear.

The other four causes accidents, ill health, hereditary or congenital abnormalities’ are in the hands of your customers and their doctors.

Many of these are demonstrated in this photograph. Notice two scars on each foot representing failed conventional surgery to bone,

Self-Check 2	Written Test

Name: ____________________________ Date: ___________________________

Time started: ______________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 3)

1. A ----------------- is a disorder of the foot that can be congenital or acquired.
2. These deformities are mainly "--------------------", and develop progressively in most people as a factor of time.
3. Deformities can include hammer toe, club foot, --------------, pes cavus, etc.
4. **Short answer questions: (Total points: 6)**
5. What is foot abnormality? Briefly describe it. (2 points)
6. What are the main causes of foot abnormalities? (2 points)
7. Describe briefly how human foot can be changed from normal functioning to abnormal functioning. (2 points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

3.1 Types of Foot Abnormality

Blisters

Blister is a soft fluid sacks that form between top layers of skin or a double on the skin filled with fluid. Although usually painful, its chief danger lies in the possibility of infection

The causes of blister are:

- Friction due to loose-fitted shoes.
- Friction produced by rough seams in shoes or socks.
- Lumps in the sole or inside of a shoe.
- A shoe that is too loose and which clips around on the foot.
- Too loose stockings or heavy seams in stocks or stockings.

- **Corns**

These types of abnormalities are caused by misalignment, which causes friction on top of the toes. It is a hard thickening of the skin, plus a central core or nucleus at a point where pressure is more. They may be a symptom of hammertoes. Excessive pressure of friction in the area, short or tight fitting shoes and misalignment of the foot structure are causes of corns.

- **Bunions**

An inflammation and swelling on the side of the joint formed over the metatarsal head of the big toe. Occasionally it also happens over the little toe.

Most bunions are behind the point of the large toe on the large metatarsal bone. "Bunionettes" are behind the little toe (the outside of the foot). Misaligned arches are usually the cause of bunions, pronation or supination. This abnormality also caused by prolonged compression of the toes in a short shoe so that the joint of the big toe is pushed outward often secondary to uncorrected metatarsus virus of childhood.

To the left is bunion which shows the sac enlarged with fluid and the sesamoids completely displaced, causing pain in this area.

Excessive pressure in the joint area will build up fluid and tissue inflammation in the bursa sac. The joint will build up calcium deposit in the area. Wearing high heels and shoes with tight toe boxes will exacerbate the problem. Bunions can be triggered by pronation of the heel.

Wearing shoes that have room in the foot bed will help to relieve pressure or rubbing in the area.

- **Ingrown Toenails**

The toe nails grow into the skin and flesh of the toe. It is extremely painful and since the outer section of the skin is broken, infection can take place. The cause of this abnormality is pressure on the nails from undue crowing of the toes, or from too short shoe or hosiery, poor hygiene, Incorrect cutting of nail and Tight shoes.

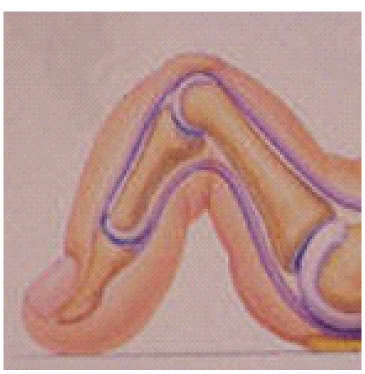
"Deformity of the toenail" means an abnormality resulting from injury to the nail or nail bed, from chronic infection (for example, tinea), or from a congenital malformation.

- **Hammer toe**

It is a condition in which the first joint of the toe is permanently bent downward.

A hammer toe or contracted toe is a deformity of the proximal interphalangeal joint of the second, third, or fourth toe causing it to be permanently bent, resembling a hammer. Mallet toe is a similar condition affecting the distal interphalangeal joint.

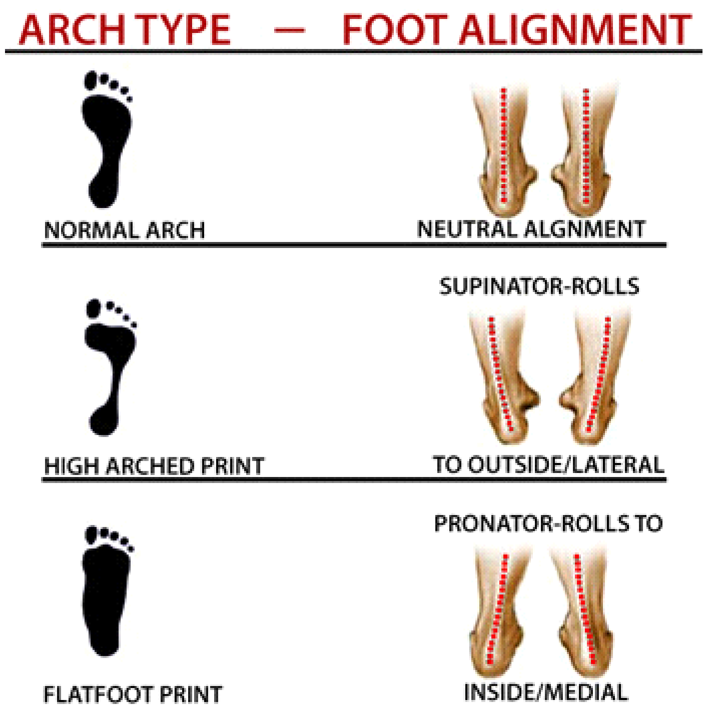
Hammer toe most frequently results from wearing poorly fitting shoes that can force the toe into a bent position, such as excessively high heels or shoes that are too short or narrow for the foot/narrow pointed shoe. Having the toes bent for long periods of time can cause the muscles in them to shorten, resulting in the hammer toe deformity. This is often found in conjunction with bunions or other foot problems. It can also be caused by muscle, nerve, or joint damage resulting from conditions such as osteoarthritis, rheumatoid arthritis, stroke, Charcot-Marie-Tooth disease or diabetes.



- **High arch /Supination**

This is the process by which some one shift his weight to the outside of his foot. His arches can be so high that he only walking on his bone structure, heel, ball and toes; all pressure areas.

Stability and shock absorption can be a problem. Neutralizing the foot by wearing the Corrective Orthotic can help bring down the high arched foot. Depending on the severity of the arch, two or three increases in the orthotic length. As the foot neutralizes, the metatarsal arch in the orthotic can move back towards the heel. Symptoms may reappear and the orthotic will press up into the bone structure in the middle of the foot, taking it out of the metatarsal arch of the foot.



- **Flat foot/Fallen Arches/Pronation**

We are all born with flat feet or muscle pad. Usually between the ages of five or seven, our arches start to develop or not. Pronation is the process by which you shift your weight from the outside of your foot to the inside. As your heel hits the ground, your foot has a rolling in motion, thereby flattening out your foot. This rolling in, pronation, may also effect your sciatic nerve. A pronated foot can also affect ankles, knees and hips.

Self-Check 3	Written Test

Name: ____________________________ Date: __________________________

Time started: ______________________ Time finished: ___________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Match the following words: (Total points: 5)

1. Blisters — A. Blister is a soft fluid sacks that form between top layers of skin or a double on the skin filled with fluid.
2. Corns — B. These types of abnormalities are caused by misalignment, which causes friction on top of the toes.
3. Bunions — C. The cause of this abnormality is pressure on the nails from undue crowing of the toes, or from too short shoe or hosiery
4. Ingrown toenails — D. An inflammation and swelling on the side of the joint formed over the metatarsal head of the big toe.
5. Hammer toe — E. It is a condition in which the first joint of the toe is permanently bent downward.

Short answer questions: (Total points: 6)

- At least mention four types of foot abnormalities and briefly describe them. (2 points)
- Describe briefly the main causes of abnormalities you listed in question number one. (2 points)
- Describe briefly the solution to be taken to avoid various types of foot abnormalities. (2 points) **Score = ______** **Rating: _________**
- ***Note:*** **Satisfactory rating – 100%**
- You can ask you teacher for the copy of the correct answers.

Information Sheet 4 Explaining basic feature for the footwear abnormality

The process of footwear evidence analysis begins long before the examiner considers the item of footwear. The examiner must have a good working knowledge of the foot that wears the shoe and makes the prints. This includes knowledge of the bones of the feet and an understanding of how each bone functions in making a footwear impression.

The uniqueness of the human foot may be described as:

Morphological: the visible form and structure of the foot;

Biomechanical: the function of the foot; and

The papillary ridge formations: the components that can provide positive identification based on the formation and unit relationship of the ridges.

The structural and functional components of the foot are composed of highly refined interrelated segments which provide a stable base for supporting the body when standing, running, walking and jumping

Not all bones of the foot are present when when first born, nor even in childhood. The final primary and secondary bony structures will have gradually emerged by puberty. The human body contains 206 bones, approximately 1/10th of which are confined to the foot. The largest bones, the tibia and fibula, are in the legs. Each foot is comprised of 26 bones, 32 joints, and 112 ligaments plus two sesamoid bones, small bean-size bones partially encased in a tendon under the heads of the first metatarsal bones, which are perfectly designed. Seven thick, short, tarsal bones compose the heel and back of the instep; five parallel metatarsal bones, forming the front of the instep, spread toward the front of the foot to form the ball. Fourteen smaller bones make up the toes; the large toe is composed of two phalanges and each smaller toe has three phalanges. All the bones are firmly connected by tough bands of tissues called ligaments; the plantar ligament runs from the heel bone to the metatarsal, keeping the bones in place.

Our foot structure is arranged in order to support the body, maintain the stability of the body, and propel the body during its movement. One part of the foot supports the body while the other functions to propel it. In jumping off a countertop on to the floor; the foot propells the body off the countertop and also supports the force as the body contacts the ground.

The foot is divided into three segments: 1) rear foot or hind foot, composed of the talus (ankle bone) and calcaneus's (heel bone); 2) midfoot, which is the navicular, cuboids, and cuneiform; and 3) forefoot, which is the metatarsal and phalanges. (DiMaggio, Dr. 1994) The tarsal and metatarsal bones form the two arches of the foot. The plantar arch runs from the heel to the ball of the foot and normally only touches the ground at each end. The metatarsal arch runs across the ball of each foot. These flexible arches, along with the thick layers of fatty tissue, absorb the pressure and the shock of walking and jumping, but because the foot cannot maintain the constant pounding of the human body, footwear-manufacturing companies have added extra support in the construction of shoes to assist in absorbing the pressure.

There are three basic foot types that affect the biomechanical needs of the feet. The normal foot has a normal sized arch and leaves an imprint that has a flare but shows the forefoot and heel connected by a wide band. The normal foot lands on the outside of the heel, then rolls inward (pronates) slightly to absorb shock. The flat foot has a low arch and leaves a nearly complete imprint. That is, the imprint looks like the whole sole of the foot. This imprint usually indicates an overpronated foot that strikes on the outside of the heel and rolls inward (pronates) excessively. The high-arched foot leaves an imprint showing a very narrow band connecting the forefoot and heel. A curved, high arched foot is generally termed a supinated or underpronated foot.

During the comparison of known shoes to unknown impressions, wearing characteristics that are observed can play an important part in an examination conclusion. Once the wear pattern begins it is hard to stop. That original pattern may not be unique, but as the wearing continues it will become unique to that individual. Since the foot can move in four different directions, this can influence the main portion of wearing characteristics on the outsole of a shoe: 1) plantar flexion, which it extends by pointing the toes downwards; 2) dorsiflexion, which it extends by pointing the toes upwards; 3) inversion, which it does during supination or inward motion; and 4) eversion, which it does during pronation or outward motion.

The human foot has its own uniqueness and in some cases, under specific circumstances, can be placed back to a particular shoe. It is important to remember that how a person walks and steps is not only controlled by the feet, but by the rest of the human body. Each part of the body contributes significantly to the activities of the feet and their process.

Let’s look at a few common foot ailments and see how they can affect the wear pattern of the outsole and possibly the inner sole.

Bunions: A bony growth on the side of the base of the big toe. Pressure from the shoe and motion at that joint can cause pain. The bunion is an arthritic condition that can result from a genetic defect and can cause biomechanical problems such as overpronation or tight fitting shoes.

Calcaneal Bumps: A bony protuberance behind the heel. They are most often associated with a high arched foot; the bony prominence pushes into the back heel counter of the shoe. With high arched feet, the heel bone (calcaneus’s) can change alignment, and this may cause an enlargement of the bone at the back of the heel. Sometimes the body will create a bursa, which is a sac of fluid that protects the tendon and other soft tissues. When wearing shoes, this bursa gets pushed up against the heel counter and becomes painful.

Hammertoes: The toe is usually bent or contracted. This condition usually occurs in the second, third, or fourth toes; also the little toe may be curved. Hammertoes result from a misalignment of the foot, and therefore the toes rub against the shoe. The condition may be inherited, but usually excessive overpronation causes the tendons of the toe to pull at an abnormal angle. Gradually, the toe will become bent, and eventually a corn will develop to protect the toe joint where it rubs against the shoe.

Sesamoiditis: Found beneath the ball of the foot, under the joint that moves the big toe, are two little bones called sesamoid bones. These bones can become bruised and inflamed, which will make the foot feel as if it were walking on a rock. Sesamoiditis usually occurs in runners with high arched, rigid feet. which don’t pronate enough. This combination causes a lack of pronation which in turn leads to an insufficient amount of shock to be absorbed. Also, if a bunion is present, there is a high chance of the development of sesamoiditis, as the bunion deformity can lead to more pressure on one of the sesamoid bones.

Each of the above mention medical problems can cause defects within the inner portion of the shoe, making it possible to establish the suspect as the dominant wearer of that shoe. In some cases these problems can also cause unique wear patterns on the outsole of the shoes. Naturally, wear patterns in a particular pair of shoes become more pronounced with increased activity in those shoes. For example, the feet of runners hit the ground an average of 1,500 times every mile. With each stride taken, the foot absorbs a force several times the weight of their body. They land, roll forward and push off, again and again and again. Each time this happens the conditions discussed above cause wearing, whether on the outsole or the inner sole. The question is whether this wearing is unique from person to person.

With regard to the idea that wear patterns have no relationship to underlying states, this is a highly unlikely conclusion. Studies using various forms of force plate technology have shown that characteristic motion and pressure patterns arise during gait cycles relating to specific states. If characteristic force and pressure pathways exist it must necessarily follow that any interface (the shoe sole) between the pressure source (the foot) and the ground must be affected in a similar way on each occasion that this interface is subjected to a characteristic pressure pattern. In short, extraneous variables must have an effect on shoe wear patterns.

Shoes as a whole can be manufactured from different materials which can wear at different rates. It is also conceivable that if the material is hard enough, foot function may be corrupted. Even more generally, the over-all shoe design can affect foot function such that wear patterns appear slightly different. For example, a well designed trainer that allows full foot function may allow a different characteristic representation of wear patterns than a shoe with ankle support, or a slip-on shoe. Similarly, if the shoe is too small, or too large, foot function and therefore wear patterns may also be affected. Different shoe manufacturing last types also exist, affording the possibility that shoes manufactured on different lasts may exert control over foot function in different ways, again affecting wear patterns. However, even with this multitude of variables it is important to remember that as shoes are worn in, the usual footstep will begin to produce a characteristic pattern for that foot/shoe relationship.

If all people are unique, then it's logical to conclude that foot impressions left by that person are also unique. For over 100 years forensic scientists have accepted the theory (which is no longer a theory) that fingerprints are unique from individual to individual. Sir Francis Galton (circa 1880's) stated that fingerprints would remain with an individual, never changing except in size, from before birth and until death. The ridge formations that make up an area of friction ridge skin will not be replicated in any other area of skin. They are unique in their unit relation and relationship order from one ridge to another. Now: let's ask ourselves, is the human body unique? Are we unique from each other? Remember, to be unique, we must be in a single group or category by ourselves. If the human body, meaning each of us, is unique from the other, then so also is the foot impression left behind by an individual at a crime scene, and the foot impression on the insole of the shoe. Feet are controlled by the rest of the unique human body. Dr. Louise

Robbins, an anthropologist, said, “No two individuals possess the same constellation of footprint traits. Ours is a growing science.” There may not have been volumes of experiments and data yet collected, but as with all forensic sciences we will not discontinue the ideas, concepts, and theories.

Self-Check4	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ______________________

Directions: True or false(8marks)

1. There are three basic foot types of biomechanical needs of the foot.
2. The flat foot has a low arch & leaves a nearly complete imprint.
3. A curved high arched foot is generally termed under prorated foot.
4. Feet are controlled by the rest of the unique human body.

LG#15	LO #2- Describe processes to produce footwear

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Introducing about history of footwear
- Identifying basic Processes used to produce footwear features
- Describing footwear features
- Identifying instances of specialized footwear for abnormalities

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Introduce about history of footwear
- Identify basic Processes used to produce footwear features
- Describe footwear features
- Identify instances of specialized footwear for abnormalities

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A Brief History of Shoes

Prehistoric

Shoes have come a long way over the past thousands of years. Shoes have been around for so long it’s really hard to pin point when they were first utilized. There are cave paintings that show the use of a foot covering/shoes. These coverings were very primitive made mostly of plants woven together just for protection and warmth. Some paintings found that date back to 8000 BC, and show foot coverings that resembled fur boots. The earliest evidence of European shoes was found on the Ice Man who was discovered in the Alps. He was wearing shoes made of rawhide bearskin woven together by plant fibers and stuffed with straw for insulation; obviously it didn’t help him with the getting frozen in ice part.

Flip Flops

Flip flops then flip flops now. The flip flop has always been a popular style dating back to the Ancient Egyptians. The first shoes made were said to be sandals which makes sense because they are simple and practical (just a sole and thong), especially in the

Egyptian climate. Basic sandals were made by making an imprint in the wet sand then braided papyrus was molded into the sole, and then held to the foot by palm fibers using the thong style. Over time sandals became more detailed and made of hides and leathers, also different designs for different ranks of people. The Pharaoh's shoes had a pointy tip, only he and his sons wear to wear that style. Color was also different depending on who you are. Gold for royals and people of court, Red and yellows for the middle class, and lower class and slaves wore no shoes.

Greek and Roman

The Greeks and Romans were known for their sandals. Greeks were master shoe makers by 400 BC sandal making was sophisticated. Social "rules" were set into place for shoes such as: shoes are only to be worn outdoors, once inside you must take off your shoes. The type of shoe you wore also depended on your occupation. The Romans cared more about the conquest than the fashion aspect of shoes. They made their shoes for a specific purpose, durable and sturdy, especially for their soldiers. The Romans also used colors and styles for rank identification. Red was only allowed to be worn be the Emperor, black and white were for senators and pale colors for the wealthy. Once again the slaves and the poor wore nothing or the plainest of sandals.

Middle Ages

When the middles ages rolled around it seemed all the sophistication of the Greeks and Romans became lost. People were separated from one another, very little communication and travel; basically people didn't have a clue. There were a lot of fads when it came to shoes in the middle ages ranging from exaggerated point toed shoes to "duck bill" shoes made of silk. These styles were turned shoes, shoes that are stitched then flipped inside out. Heels made their appearance around this time, but not for fashion. Thong style shoe on a wooden heeled platform were used to muck out stables and farm. Over the next couple centuries shoes evolved and devolved. From slippers to heeled slippers, poofy and pointy, the shoe scene was all over the place men being just as flamboyant as women. In the 1800's shoes started to be more conservative and plain, and men swayed away from the heel scene.

Modern

Around the 1900s shoes start to resemble styles we have today such as stilettos and oxford shoes. From basic rawhide and plant made shoes to shoes made of plastics and polyurethane, shoes really have come a long way.

Self-Check 1	Written Test

Name: ______________________________ Date: ______________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

True or false: (Total points: 3)

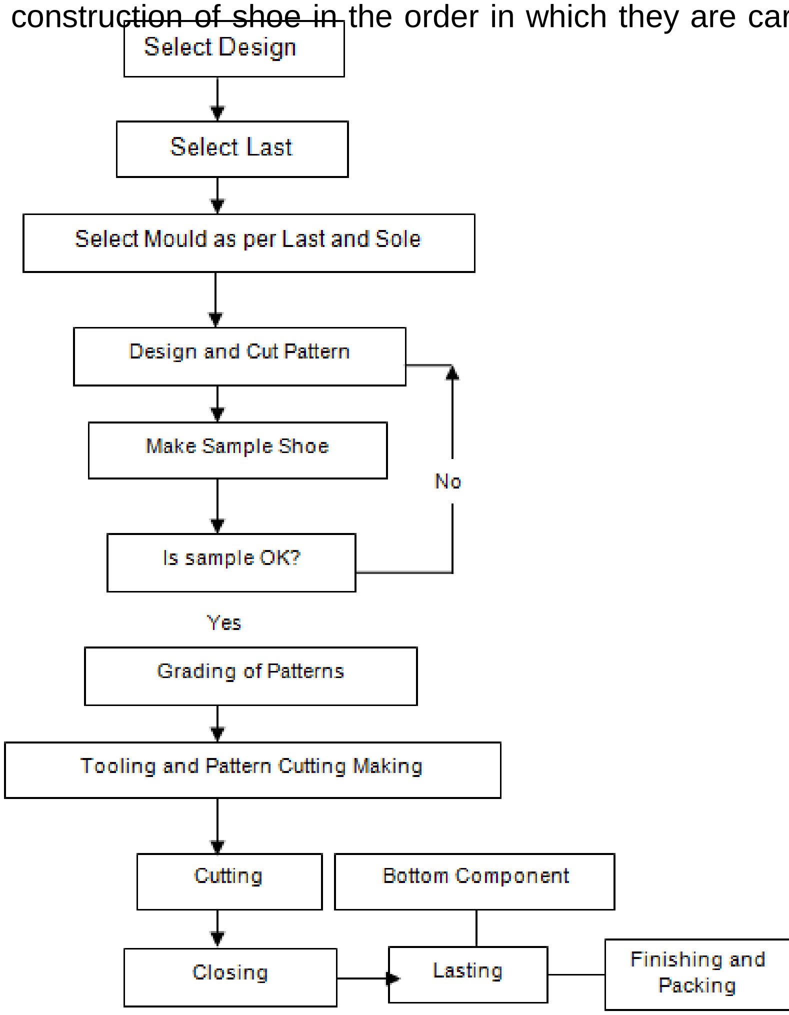
1. The earliest evidence of European shoe was found on the ice-man.
2. Slaves wore no shoes.
3. Around the 1900s, shoes start to resemble style such as stilettos.

Information Sheet 2 Identifying basic Processes used to produce footwear features

There are many ways to attach the sole to the upper but commercially only a few methods are preferred. Shoes were traditionally made by molding leather to a wooden last. Modern technology has introduced many new materials and mechanized much of the manufacture. Remarkable as it may seem the manufacture of shoes remains fairly labor intensive.

No matter the type of construction the first stage in construction is to attach the insole to the undersurface of the last. Then two main operations follow: Lasting operation (the upper sections are shaped to the last and insole).the second is bottoming, where the sole is attached to the upper.

Shoe making activity passes through different operation. The flowchart below shows the basic steps in construction of shoe in the order in which they are carried out in the shoe factory.



The following diagram shows the details of sequences of flow of activities in each department in construction of shoe.

Pattern Making	Cutting	Inspection
Stitching	Stamping	Skiving
Upper Ready	Lasting Dept	Toe Puffing
Side Lasting	Toe Lasting	Counter Lasting
Insole Fixing	Roughing	Sole Pasting
Finishing	De-Lasting	Heat Setting
Packing		

Selection of Last

Last is selected as per the style.

Designing and Pattern Cutting

Designing takes place in three steps:

- Marking of Last: The last is marked with marking tape to make mean form from which standard is to be made.
- Standard Making: Standard pattern is then made from the mean form.

- Pattern Cutting: Pattern is cut from the standard.

Cutting

The cutting is also called clicking. The cutting of uppers and linings is the first step in shoe construction and is done in the cutting room of the factory. These parts are cut to a pattern and are later fitted together in much the same way as parts of a suit or dress are cut and then sewn or assembled to provide the finished garment. Most of the cutting today is done by machine. There is still some hand cutting being done in factories. However, this method is used where economy is the factor.

Closing

As the construction, cost, design, function, material and style of the shoe vary, so too does its upper fitting. The number of different steps included in this group may range from more than 60 to as few as 15. In addition to the progressive assembly of the various upper parts by stitching, other operations may include such things as gimping and perforating the upper for decorative purposes; skiving which reduces the thickness of edges of leather parts that are to be assembled; seam rubbing and taping to remove the bulk of the material to ensure foot comfort, and so forth.

Component

While the upper is being fitted and assembled, other parts of the shoe are being prepared in the stock cutting department. These parts include insoles and outsoles; welting; counter stiffener – which are moulded to the shape of the last and which reinforce the shoe, preserve its shape and serve as protection for the foot; heels, toe puffs, both hard and soft – preserve the shape of the toe of the shoe during wear. Steel toes are used in the production of work shoes and boots.

Lasting

Lasting is a series of operations in which the shoe upper and lining are drawn tightly to the last over which the shoe is made, and then fastened to the insole of the shoe. Lasting is one of the most important parts of the shoemaking process. It is here that shape is built in for the life of the shoe.

Finishing

Finishing is a series of operations, which include attaching soles, heels, trimming sole edges, staining, setting and burnishing the edges of heel and sole. Finishing includes the preparation of outsoles for a final wax, gum or buffed finish; removal of the last, nailing of heels from inside when necessary; inserting sock lining and heel pads and branding the manufacturer's or retailer's name.

Flat lasting/ cement lasting

In recent years there have been many developments in machinery used for lasting in the cemented construction. The result has been that cemented lasting has been considerably simplified. Many firms now completely last the shoe in three stages. There are many systems available, this being of great advantage to the footwear manufacturer as he can select a system which is suitable for his particular product. Factors such as heel height, waist curvature, whether it is lasting for men's, women's or children's work will all have a considerable effect on the manufacturer's choice of system.

Insole cementing with last

↓

Insert stiffeners

↓

Back Molding

↓

Forepart Lasting

↓

Waist Lasting

↓

Seat Lasting

↓

Heat setting

↓

Bottom roughing

↓

Solvent Wiping

↓

Bottom Cementing

↓

Attach Filler

↓

Preparation of the sole

↓

Sole Cementing

↓

Drying

↓

Sole Adhesive Activation

↓

Sole Attaching

↓

Chiller

↓

De-Lasting

↓

Finishing

↓

Socks Attachment

↓

Lacing

Stitch- down Lasting:

In Flanged lasting the upper is attached onto the Runner (sometimes called insole) by adhesive, or (as done earlier) by a special stapling machine, or (as done earlier) by machine, which do the lasting and stitching in one operation. Today, pre-molding the toe of the upper prior flanged cement lasting is quite common.

Moccasin construction

It is a type of force lasting (i.e. the upper is forced over the front of the last with the back being pushed into right position) where the moccasin plug is stitched before lasting.

Good Year welted construction

It a construction type where the soles are attached to the welt or runner or any other intermediate component which are these already being attached to the lasted upper.

For high quality dress and town shoes the top section (or welt) is chain stitched to the upper and insole rib at the point where it curves under the last. This is supplemented by a lockstitch out seam bonding the welt and outsole. The outsole is then sewn to the welt around the edge. Goodyear Welt creates heavier less flexible footwear.

Lasting for Moulded Constructions

When vulcanizing was first introduced cement lasting was also in its infancy. Latex was used to last forepart, the remainder of the shoe being tack-lasted to the insole.

This method was unsuitable for vulcanizing as the latex would not withstand the heat of the vulcanizing machines. So it was necessary to revert to the older method of completely tack-lasting the shoe. It was several years before sufficient good synthetic adhesives were developed which would with stand the necessary temperatures. When this occurred, tack lasting was gradually phased out.

Direct Vulcanizing Process

The name vulcanizing is derived from Vulcan the Roman god of fire and metal working.

Indeed the process employs intense heat to achieve the curing of the rubber.

To produce a rubber which is solid enough to act as a soling material it is necessary to combine it with sulpher, which acts as a hardening agent, and to heat the mixture under pressure. This is the process of vulcanizing. It can be used to produce sole or heat units or to weld the sole directly on the shoe bottom, thus becoming direct vulcanizing.

Fillers and pigments are added to color the rubber and make the compound cheaper, plus accelerating agents to speed up the process time. This process time is known as the cure time. It will vary with the amount of rubber used and the mould temperature.

Bottom preparation for vulcanizing

Upper Trimming and Sanding

On the first types of work it was normal practice to trim and sand away any surplus lasting allowance to produce a flat bottom. Later this was emended to only sanding away toe pleats.

Roughing

Roughing is as critical for vulcanizing as for cemented construction. The grain surface is removed in the same way except that it must extend over the feather edge of the shoe. This is the necessary because the side moulds in the machine must grip around the sides of the shoe to form as absolute seal. If this is not a perfect seal, the rubber flowing inside the mould will be forced out over the side moulds by the high pressure. This spillage will harden around the feather line and is known as “spue”.

Attach filler blocks

The filler block is necessary to give an even substance of rubber over the shoe bottom. This gives an even cure through the sole and heel. It also reduces weight and expense.

Cement 1st way

Cement compounded from the same rubber mix as that used in the sole is applied to the shoe bottom. The first application acts as a primer and is applied liberally.

The correct result must be:-an even application over the whole roughed areas.

Cement drying

The shoe passes through a drying cabinet where infra-red heaters and blowing fans evaporate the solvent from the adhesive.

Cement 2nd way

A second coat of the same cement is applied but this is of higher viscosity than the first coat.

Cement Drying

The second coat of cement is also dried.

Vulcanizing

The machine is built to process a pair of shoes at a time. The moulds used consist of four parts- the sole mould or piston, two side moulds which join at the toe and heel, and the metal last.

The moulds of correct size, style and fitting are fitted in the machine and heated electrically to approximately 180*C. the side moulds are slightly cooler than the sole mould.

Because of the high pressures used, the moulds have to be securely fixed in the machine and are difficult to change quickly.

The shoe is slipped from the making last and the re-lasted on to the metal last.

A sole "blank" (cut to approximate shape and correct weight required) is pre-heated to 110*C. This reduces the time cycle in the machine.

The blank of unvulcanised rubber, is placed on the sole mould and the shoe on the alloy last is locked into the position over it.

By operating a switch, the side moulds close to grip the sides of the shoe at the insole edge, completely sealing the shoe into the mould. The sole mould moves upwards under hydraulic pressure of 600-800 ib. per sq. in. to a pre-set level. This determines the substance of the finished sole.

By virtue of the heat and pressure, the rubber blank melts, flows to fill the mould evenly, and vulcanizes itself to the bottom of the shoe. The cement film on the shoe bottom is also vulcanized so that the complete sole and heel unit is firmly attached to the shoe.

During the process the blank change from unvulcanised material which is plastic in nature to a vulcanized rubber which is hard-wearing and elastic in nature. The time taken for this curing cycle varies according to the type of rubber mix, the volume of rubber and the heat employed, but is usually about four minutes. At the end of the cycle the machine automatically opens.

The correct result must be:-

1. Clean and clear mouldings
2. No damage to upper
3. Good bond

Flash Trimming

Where the moulds meet, a thin film of rubber is formed along the sole edge and at heel and toe. This is known as “flash”. The flash has to be trimmed off, also any “spue” which has formed at the feather edge.

The correct result must be:-

a. All the flash removed cleanly from sole and heel
b. All spue removed cleanly without damage to the upper
c. No burst seams or top lines

The shoe is now ready to be taken into the treeing department.

Injection Moulding Process (PVC)

When injection moulding of PVC was introduced it was quickly recognized that the process and the product had a number of advantages over direct vulcanizing.

PVC compounds are essentially simple compounds, but for soling purposes, because of the adhesion problem, they must be of a specific formulation. They are readily converted, by an easily controlled process, into soles and heels. In a given formulation, properties are so predictable, that relatively small variations can be readily detected by reliable control lasts.

The wear properties of PVC are closely related to the softness of the material. Softness of PVC is measured in terms of SHORE a degree.

If the material is too hard the edges will chip and cracking will take place in cold flexing conditions. It will also slip easily. PVC which is too soft is difficult to bond because of the high plasticizer content.

Thus, a softness of 50-75 SHORE A degree is usually employed. For cold weather wear SATRA recommend 78-90 SHORE A degree.

One problem is that with thin substances with soft materials, “print through” of rough walking surfaces, such as sharp stones, takes place.

Bonding to the upper with modern one-part or two-part polyurethane adhesives is reasonably simple, but it must be remembered that the flexibility of the sole will have some bearing on the bond because of the force exerted at the sole-upper interface during walking.

Injection Moulding Process (Poly Urethane)

The advent of injection moulding polyurethane in the 1960's brought into shoe-making an outstanding example of the use of a chemical process into a previously traditional industry.

By injecting a stream of resin with a stream of pre-polymer (hardener) into a slightly warmed mould a chemical reaction is initiated which produces "blown" polyurethane (i.e. having a cellular structure). This material is considered by most shoemakers to be the best soling material yet devised being extremely hard-wearing, very lightweight and having considerable anti-slip properties. The process can be used to produce sole units or to direct injection mould sole and heel on to the shoe bottom.

The main advantages are:

a. No adhesives are required on the shoe bottom.
b. No roughing required on suede although it is usual to sand toe pleats flat.
c. High durability.
d. Good abrasive resistance.
e. Very light and comfortable.
f. Can be liquid at room temperatures.
g. High temperature and pressures not necessary
h. PU is chemically resistant to the oils, etc.

The main disadvantages are:-

a. Costly raw materials
b. Control of materials critical.
c. Requires careful chemical and processing control.
d. Adhesive properties very strong, therefore it sticks to machine and moulds.
e. Cannot be reprocessed.
f. Heavy substance soles can lead to flexing problems unless properly designed.

Self-Check 2	Written Test

Name: _____________________________ Date: ___________________________

Time started: _______________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 5)

1. Shoes were traditionally made by molding leather to a --------------------.
2. When injection moulding of PVC was introduced it was quickly recognized that the process and the product had a number of advantages over ----------------------.
3. The cutting is also called -----------------.
4. Roughing is as critical for vulcanizing as for ------------------------.
5. ------------------------ a construction type where the soles are attached to the welt or runner or any other intermediate component which are these already being attached to the lasted upper.

Short answer questions: (Total points: 8)

1. Describe briefly the basic processes to produce footwear. (2 points)
2. Discuss different activities through which shoe making operation passes and show the sequences of the flow process. (2 points)
3. Discuss the activities carried out in each footwear production departments. (2 points)
4. What is cutting, sewing, lasting and finishing? Briefly explain each of them. (2 points)

Score = ___________Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

3.1 Footwear feature

Soles

The sole is the layer of material which covers the bottom of the shoe and is the walking surface of that shoe. The sole may be made of a diversity of material, i.e. leather, pure rubber, resin rubber compound, plastic etc.

Laces

Shoelaces, which are also called shoe-strings, or boot laces, are a system commonly used to secure shoes, boots and other footwear. They typically consist of a pair of strings or cords, one for each shoe, finished off at both ends with stiff sections, known as aglets. Each shoelace typically passes through a series of holes, eyelets, loops or hooks on either side of the shoe. Loosening the lacing allows the shoe to open wide enough for the foot to be inserted or removed. Tightening the lacing and tying off the ends secures the foot within the shoe.

How to keep your shoelaces tied is a question asked many times. It is a chronic problem everyone has that wears shoes with shoelaces.

One reason shoelaces come untied is caused by worn and stretched shoelaces. With normal use, the location of the shoelaces knot (bow) wears and stretches the fibers of the shoelace. These worn and stretched shoelaces will come untied more easily than shoelaces that are not worn and stretched. The main reason of shoelaces come untied is because they are not properly tied.

Sizes

A shoe size is a numerical indication of the fitting size of a shoe for a person. Shoe size is represented by length and ball girth. The size and shape a shoe is determined by the shoe last on which it is manufactured. Foot size is used to determine the shoe size, and foot shape provides information on how to design the last shape. The size of the left and right foot is often slightly different for many people. In order to choose a shoe size, both feet should be measured and then the shoe size should be chosen based on the larger foot.

Shape

The shape of a shoe is determined by the shoe last on which it is manufactured and foot shape provides information on how to design the last shape.





Self-Check 3	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

True or False: (Total pints: 5)

1. The shape of a shoe is determined by the shoe last on which it is manufactured
2. Foot shape provides information on how to design the last shape.

3. Shoe size is represented by length and ball girth.
4. Shoelaces, which are also called shoe-strings.
5. A shoe size is a numerical indication of the fitting size of a shoe for a person.

Short answer questions: (Total points: 4)

1. Discuss briefly the main features of footwear as per their use. (2 points)
2. Describe briefly the features the footwear must have in relation with the function of the foot and also in relation with the structure of the foot. (2 points)

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 4 Identifying instances of specialized footwear for abnormalities

Sore feet? Sore back? Do you think orthotics or orthopaedic shoes will help? Your benefits plan is designed to help pay for orthotics and orthopaedic shoes that are medically necessary. A visit to your doctor or specialist will help determine if special orthotics or orthopaedic shoes are necessary.

Orthotics

Custom-made shoe inserts specifically to meet your particular needs designed to treat or adjust various foot disorders, help to keep the foot in proper alignment must be prescribed by a medical doctor, a podiatrist, or a chiropodist.

Prescription must be submitted with each claim, deeming the orthotics are medically necessary orthotics for sports, recreational activities or for your general comfort commercially-made devices, such as cushioned heel cups or insoles for shoes that are sold over-the-counter in pharmacies or other retail stores

Orthopaedic Shoes

- Made from raw materials by a qualified foot care specialist
- Uses an impression of your foot in order to make a shoe specifically designed to meet the needs of your medical condition
- Must be prescribed by a medical doctor, a podiatrist, or a chiropodist
- Prescription must be submitted with each claim, deeming the orthotics are medically necessary

Shoes that are advertised in catalogues are not custom-made orthopaedic shoes and therefore aren't covered by your plan. Stay away from 'specialists' who try to pass these off as custom-made

Selecting a Specialist

Choose a practitioner who is qualified to perform orthopaedic assessments and who is properly licensed within your province. Podiatrists and chiropodists are regulated by provincial colleges and must abide by certain standards of practice. You can check their credentials by calling the appropriate college or by visiting their website. It is improper for practitioners to offer discounts or coupons as an incentive to buy orthopaedic footwear. Don’t accept these offers from anyone for orthotics or orthopaedic shoes.

Self-Check 4	**Written Test**

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Total marks (5 marks)

1. Describe the dealings for orthopaedic Shoes.

LG#16	**LO #3-** Determine the sizing system

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Explaining the sizing systems and their purposes
- Identifying types of the size measuring tools
- Explaining the procedures of foot measurement
- Explaining the basic principles of fittings
- Explaining the types of lasts

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Explain the sizing systems and their purposes
- Identify types of the size measuring tools
- Explain the procedures of foot measurement
- Explain the basic principles of fittings
- Explain the types of lasts

Learning Instructions:
Read the specific objectives of this Learning Guide. • Read the specific objectives of this Learning Guide. • Read the information written in the "Information Sheets 1". • Accomplish the "Self-check. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you. • If you earned a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheets 1. • Read the information written in the "Information Sheet 2". • Accomplish the "Self-check 2". Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you. • If you earned a satisfactory evaluation proceed to "Information Sheet 3". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 2. • Read the information written in the "Information Sheet 3". • Accomplish the "Self-check 3". Request the key answer / key to correction from your teacher or you can request your teacher to check it for you. • If you earned a satisfactory evaluation proceed to "Information Sheet 4". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 3. • Read the information written in the "Information Sheet 4". • Accomplish the "Self-check 4". Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.

Information Sheet 1 Explaining the sizing systems and their purposes

1.1 Sizing system

A **shoe size** is a numerical indication of the fitting size of a shoe for a person. A shoe size is represented by length and ball girth.

Foot length versus shoe length

The size and shape of a shoe is determined by the shoe last on which it is manufactured. Foot size is used to determine the shoe size, and foot shape provides information on how to design the last shape.

The length of a foot is commonly defined as the distance between two parallel lines that are perpendicular to the foot and in contact with the most prominent toe and the most prominent part of the heel. Foot length is measured with the subject standing barefoot and the weight of the body equally distributed on both feet.

The size of the left and right foot is often slightly different for many people. In order to choose a shoe size, both feet should be measured and then the shoe size should be chosen based on the larger foot.

Each shoe is suitable for a small interval of foot lengths. The length of the inner cavity of a shoe must typically be 1520 mm longer than the length of the foot, but this relation varies between different types of shoes.

There are three characteristic lengths that a shoe-size system can refer to:

- The average length of foot for which a shoe is suitable. For customers, this measure has the advantage of being directly related to their feet. It applies equally to any type,form or material of shoe. However, this measure is less popular with manufacturers, as it requires them to test carefully for each new shoe model, for which range of foot sizes it is recommendable. It puts on the manufacturer the burden of ensuring that the shoe will fit a foot of a given length.
- The length of the inner cavity of the shoe. This measure has the advantage that it can be measured easily on the finished product. However, it will vary with manufacturing tolerances and provides the customer only very crude information about the range of foot sizes for which the shoe is suitable.

- The length of the last, the foot-shaped template over which the shoe is manufactured. This measure is the easiest one for the manufacturer to use, as it identifies only the tool used to produce the shoe. It makes no promise about manufacturing tolerances or for what size of foot the shoe is actually suitable. It leaves all responsibilty and risk of choosing the correct size with the customer.

All these measures differ substantially from each other for the same shoe.

Length unit

The following length units are commonly used today to define shoe-size systems

- Milimeter (mm) = 0.39 in
- Centimeter (cm)= 0.39 in
- Paris point = 2/3 cm = 6.67 mm = 0.26 in
- Balrlycorn =1/3 in = 8.47 mm

(All conversions between the **Metric system** and the **Us standard system** are approximate)

The length of a last or shoe and the length of the foot that will fit the shoe whereas, size wear, length, width and the volume (girth) are different due to certain user edge the style of the shoe (pointed toe etc.) and the allowances given for different styles. Further, when the weight of the body is borne by the foot, it results in increasing length and girth of the foot.

The length may increase from ½ to 1 size.

To accommodate these, some allowance is given to the foot in any shoe. In the case of English sizes for overall, the measured foot length plus 17 mm will give the size of the shoe required.

There are several different shoe-size systems that are used worldwide. These systems differ in what they measure, what unit of measurement they use, and where the size 0 (or 1) is positioned. Only a few systems also take the width of the feet into account.

Some regions use different shoe-size systems for different types of shoes (e.g., men's, women's, children's, sport, or safety shoes).

Some of the most common sizing systems used worldwide is listed below:

- English sizing system
- French sizing system
- American sizing system
- Mondopoint sizing system

The UK, USA and Continental are basic scales.

- **English (UK) sizing system**

The length scale for English sizes commences or starts with size 0 which is 4 inches long, and progresses 3 full sizes or 6 half sizes per inch until size 13 1/2 is reached. Here the numbering recommences after size 13 1/2 is reached and the next size being 1 and continuing to include the largest sizes. The smaller size scale is size 0 to 13 1/2 and measures from 4 inches to 8 3/6 inches and the larger scale size is size 1 to 12 and measures from 8 2/3 inches to 12 1/3 inches.

The English size scale:

- The English size stick begins with zero size at 4 inches.

<table>
<tr><th>Inches</th><th>(Foot sizes) English size stick</th></tr>
<tr><td>1</td><td rowspan="4">0</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td rowspan="3">5</td><td>1</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
</table>

6	4
	5
	6
7	7
	8
	9
8	10
	11
	12
9	13
	1
	2
10	3
	4
	5
11	6
	7
	8
Continued	

- It advances by one-third inch per size
- Half sizes are one sixth of an inch.
- Children's sizes run from 0 to 13 ½.
- Adult sizes recommended at 1.

Examples:

- A child's size 9 is 7 inches.
- A boy's size 2 is 9 inches.
- A man's or women's size 5 is 10 inches.

Fig: English size scale/stick

- **French sizing system (Paris points) or continental system**

The French Size Scale (Paris Points):

- The French size scale (Paris Points) is related to the C.G.S. (Centimeter Gram Second) Metric measurement system.
- French sizes are calculated on a scale of 3 sizes to 2 centimeters. There are no half sizes.
- The first size begins with the first centimeter and progresses consecutively down the scale.
- By referring to the English size scale and the French size scale a comparison can be made.

French(Paris points)	Centimeter
1	
2	2
3	
4	
5	4
6	
7	
8	6
9	
10	
11	8
12	
13	
14	10
15	
16	
18	12
20	
Continued	

Approximate equivalent French and English sizes are:

English child's 10 = French 28

English girl's 1 = French 33

English woman's 5 = French 38

English man’s 8 = French 42

Fig: French size scale/stick

- **American(USA) sizing system**

American size scale is identical to the UK scale except that it starts at 3 11/12 inches instead of 4 inches. In USA Size Scale:

Marking

USA sizes on ladies shoes are often shown multiplied by 10.

E.g. 6-1/2 = 65.

English = 5

American = 6-1/2 (65)

French (continental) = 38

Width Marking

It is common practice to indicate the width of a shoe by a letter or a number.

The exact notation is decided upon by the individual manufacturer.

Inches	USA sizes
1 11/12	0
2 11/12	
3 11/12	
4 11/12	1
	2
	3
5 11/12	4
	5
	6
6 11/12	7
	8
	9
7 11/12	10
	11
	12
	13

8 11/12	1
	2
9 11/12	3
	4
	5
Continued	

Fig: American size scale/stick

- **Mondopoint system**

The Mondopoint system is the same as measuring the foot (not the shoe) in millimeters (mm). However, some companies treat Mondopoint as centimeters (cm). For example: a shoe may be labeled either 240 (mm) or 24 (cm) if it is designed for a foot that is 240 millimeters long (including some wiggle room for socks). Some times Mondopoint sizes with two numbers separated by a slash is used (e.g. 240/95, the second number is the width of the foot in millimeters.

Sizing system conversion

The above basic sizing system can be converted from one sizing system to another sizing system. The following formula can be used for converting English to Paris point or vice versa.

For Shoe Sizes up to Size 13:

Paris Points = 1.27 (12 + English shoe size)

Or

English Shoe size = Paris points /1.27 (12)

For Shoe Sizes 1 and Above:

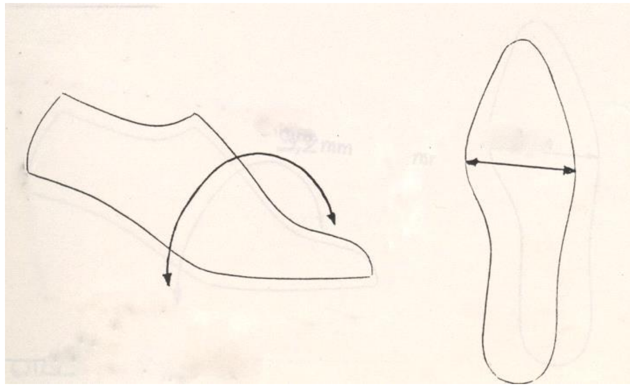
Paris points = 1.27 (25 + English Shoe size)

Or

English Shoe size = Paris points /1.27 (25)

Girth Measurement and Grade

Joint Girth: The Joint Girth Grade is the amount by which the last circumference grows from one size to another around the joint portion.



The amount of the grade will vary and depend on a variety of requirements, i.e. type of features to be made on the last.

As a general rule, there are two main girth grades

Children's Range – Sizes 0 – 10-1/2 = 3/16 (4.76 mm)

= 3/16 Girth Grade.

For this range the amount between fittings is 3/16 (4.76 mm)

Adult's Range – Size 11 – onwards = ¼ (6.35 mm)

= ¼ Girth Grade.

For this range, the amount between fittings is ¼ (6.35 mm)

Self-Check 1	Written Test

Name: _____________________________ Date: ___________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 5)

- A -------------------is a numerical indication of the fitting size of a shoe for a person.
- A shoe size is represented by length and ------------------.
- American size scale is identical to the UK scale except that it starts at 3 11/12 inches instead of -----------inches.
- When the weight of the body is borne by the foot, it results in increasing length and girth of the foot.
- The Joint Girth Grade is the amount by which the last circumference grows from one size to another around the ----------------.

Short answer questions: (Total points: 10)

- List the common shoe sizing systems and briefly describe each of them.(2 points)
- Discuss what is meant by shoe size. (2points)
- What are the three characteristics lengths that a shoe size system can refers to? .(2points)
- What is the size of a shoe in English sizing system which is 42 in Paris point? (2points)
- Describe briefly the deference between the English and French sizing system. (2 points

Score = __________ Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 2 Identifying types of the size measuring tools

- **Brannock Devices**

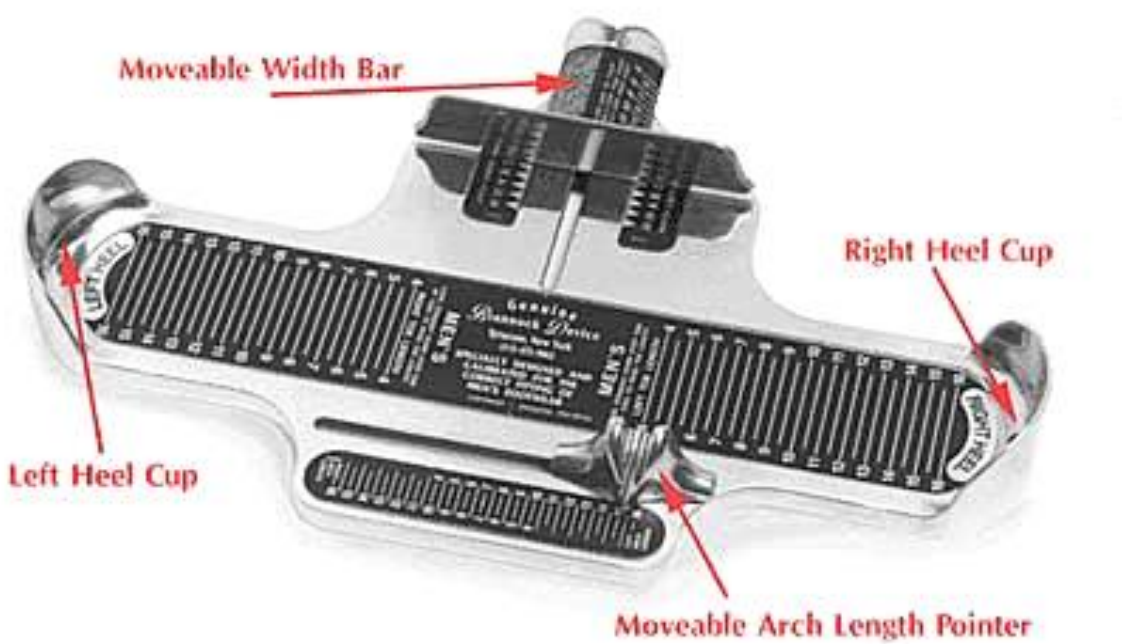
Brannock Device is a foot size measuring instrument invented by Charles F. Brannock in 1925 and now found in many shoe stores. The formula used by the Brannock device assumes a foot length ⅔ inch (1.7 cm) less than the length of the last; thus, men's size 1 is equivalent to a foot's length of 7 ⅔ inches. Women's sizes are one size up.

Male shoe size (Brannock) = 3 * foot length in inches – 22

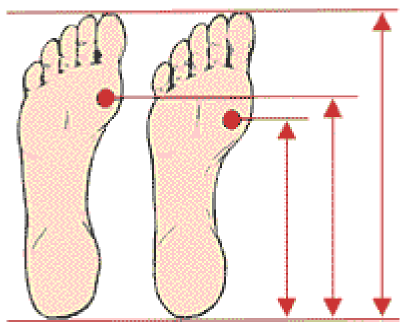
Female shoe size(Brannock) = 3 * foot length in inches – 2

The Brannock device also measures the length of the heel and the widest point of the foot. For that purpose, the device has another, shorter scale at the side of the foot. If this scale indicates a larger size, it is taken in place of the foot's length.
For children's sizes, additional wiggle room is added to allow for growth.

The device also measures the width of the foot and assigns it designations of AAA, AA, A, B, C, D, E, EE, or EEE. The widths are 3/16 in apart and differ by shoe length.



The Brannock device also measures the length of the distance of the heel and the widest point of the foot (heel to ball).

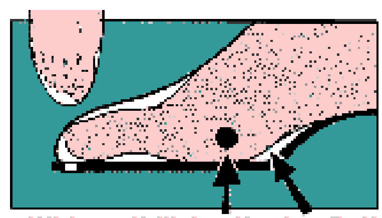


Why Heel-to-Ball Measurement Is Essential

This illustration shows two feet which are the same length, but each r There are different fittings for short-toed feet and long-toed feet. Prop not only overall length (heel-to-toe measurement) but also arch length Shoes are designed to flex at the ball of the foot. Correct fitting prope the shoe and provides room for the toes so they are not confined.

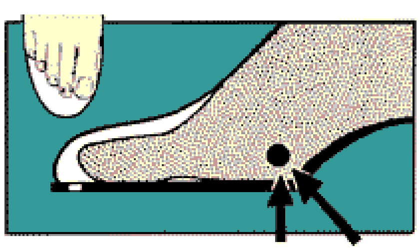
Without Utilizing Heel to Ball Measurement

Improperly fitted shoes (shown right) can cause a variety of foot problems in addition to general discomfort and shoe breakdown. If the arch of the foot is not positioned properly in the shoe, the foot will become fatigued and uncomfortable.



Without Utilizing Heel-to-Ball

The Brannock Foot-Measuring Device Ensures Correct Fit



The foot to the left is correctly fitted. The arch of the shoe and ball joint of the foot meet at the same point. The foot arch is correctly positioned in the shoe. The foot and shoe bend at the same location, with the arch fully supported, allowing the toes to remain straight. There is ample space in front of the toes to allow adequate ventilation. This will ensure a correct and comfortable shoe which will keep its shape.

- **Foot Measuring Tapes**

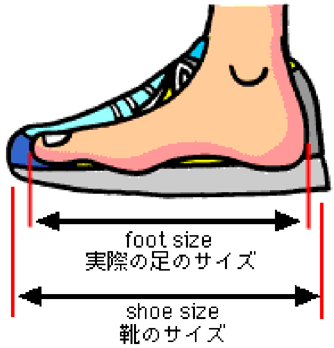
Measuring tapes are only one of many devices use for taken measurements but it is the most widely used in one form or another.

Measuring with tape:

- The tape can be used to measure length, but it is used mainly to take girth measurements, or distance around the foot.
- Care must be taken to use tape which will not stretch in use.
- A common error is to read the wrong side of the tape, or to use one side at the start of the measurement and transfer to the other side at the end.

  Here are the steps for measuring feet:

- Get a piece of paper large enough to trace the outline of the foot on, a pencil, and measuring tape.
- Trace the outline of the foot keeping the pencil perpendicular to the paper
- Draw parallel lines which intersect with the widest areas of the foot. You should have a rectangle, not a rhombus, not a trapezoid.
- Measure the length and width of the foot in inches.
- Use the conversion chart to convert the two measurements from inches to find the actual shoe size.



Self-Check 2	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

True or False: (Total points: 4)

- **Brannock Device** is a foot size measuring instrument invented by Charles F. Brannock in 1925.
- The tape cannot be used to measure length, but it is used mainly to take girth measurements, or distance around the foot.
- Measure the length and width of the foot in inches.
- Improperly fitted shoes (shown right) can cause a variety of foot problems in addition to general discomfort and shoe breakdown.

Short answer questions: (Total points: 8)

- What are the devices used to measure the foot sizes? (2points)
- Describe briefly the uses of the devices mentioned in question 1. (2 points)
- What is Brannock device? Define briefly. (2 points)

- What is the problem when any one measuring the foot if he will not consider heel to ball measurement? (2 points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 3 Explaining the procedures of foot measurement

Many shoes being made in America and England are made to the measurements of the Brannock fitting device, based on heel-to-ball measurements. This system recognizes that feel of the same overall length need different length shoes in order that the arch of the foot shall be correctly fitted and the ball of the foot correctly positioned in the shoe.

This system calls for lasts for feet with short toes and feet with long toes, putting the ball of the foot in its proper place and leaving enough toe-space to ensure that the toes are not cramped or twisted.

Three measurements towards a correct fit. The light aluminium Brannock Device which are adults, women's, growing girls and junior models, is designed to provide the three vital measurements toe-to-heel, ball to heel and width in relation to each other and at the same time.

Seat the heel of the foot firmly against the proper heel cup. Move the ball-to-heel length indicator to the ball joint of the foot and the pointer will indicate arch length.

Press down the toes so that they lie flat on the device and read straight down over the ends of the toes for toes length (toe-to-heel).

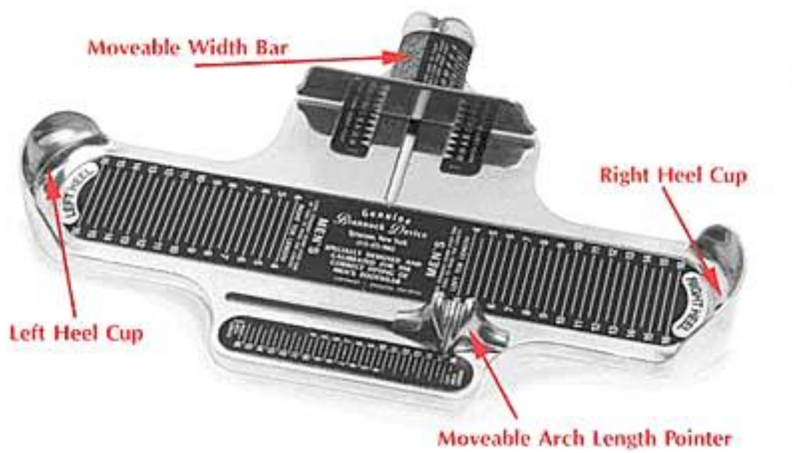
Compare arch and toe length and fit the longer of the two sizes. Although it would appear from the example illustrated here that the foot measuring size 7 in total length has a longer than normal length from heel to ball(size 7-1/2), tests have reaveled that this is in fact more like the average.

For width, push the width bar firmly to the foot, find the length size line on the width bar and note the width area line touches. If it touches between width marks, pick the wider size for a fleshy foot and the narrower size for a thin foot.

Procedure of Foot Measurement Using Brannock Device

1. Prepare the Device

Prepare the Brannock Foot-Measuring Device as shown in the photo below. The width bar shou position and the arch length indicator should be slid back, so the foot can be positioned easily on the d



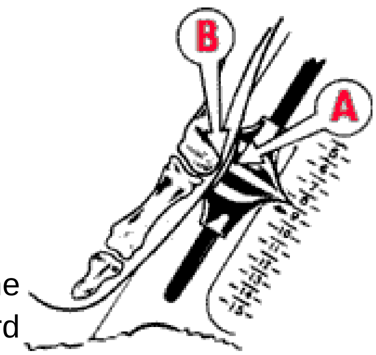
2. Position the Foot

Have the customer remove their footwear and stand, placing their right heel into the right heel cup. The customer should stand with equal weight on both feet to ensure that the foot being measured has elongated and spread to it's maximum size. Be sure the heel is properly located against the back of the heel cup, by grasping the customer's ankle and device together, as illustrated in photo.

3. Measure Lengths

Heel-to-Toe Length

Press the toes flat against the base of the device and look straight down over t read toe length. Make sure the customer's socks are snug against the toes (wi accurate measurement.



Arch Length (Heel-to-Ball)

Place your thumb on the ball joint of the foot (as shown in the photo to the right). Slide the pointer (A on diagram) forward so the inside curve of the pointer fits the ball joint of the foot and the two high ribs come in contact with your thumb. When the pointer is properly located, the lower middle rib will be against the ball joint on the side of the foot (B on diagram). This yields the arch measurement. The arch length represented in the diagram is 8 1/2.

4. Find the Correct Shoe Size

Compare the arch length to the heel-to-toe length. Generally you'll use the larger of the two measure toe length are the same, this will be the shoe size. If the heel-to-toe length is larger than the arch len heel-to-toe, then fit to arch length. Example**:**

It is important that both measurements be taken and compared to find the proper shoe size. Simply us

5. Measure the Width

Slide the width bar firmly to the edge of the foot. Locate the shoe size (as determined in step four) on the movable width bar and view the width measurement indicated by the properly determined shoe size. If the shoe size falls between widths, choose a wider width for a thick foot, a narrower width for a thin foot.

Cleaning the Device

Clean the Brannock Device with a damp cloth. Use liquid dishwashing detergent if necessary. Do not use spray cleaners or disinfecting solutions as they may adversely affect the measuring areas of the device.

6. Measure the Other Foot

Reverse the device end-for-end and measure the other foot following the steps described above. Be sure to measure both feet, and then fit the larger foot. It is common to have feet of different sizes.

7. Remember the Fitting Process

When used properly, the Genuine Brannock Foot-Measuring Device is designed to indicate the correct shoe size. This is the first step in the fitting process. It may be necessary to make compensation in sizing to achieve a proper fit for each individual customer. The fitting process often involves trial fittings to ensure that the proper size was selected.

Junior Model

The Genuine Brannock Junior Model, shown here, is designed excl
are constantly growing. With this in mind, the Junior Model device
allowing approximately one size for growth.

The method of measurement is the same as the adult model with
Instead of utilizing a width t-bar, the Junior device uses a slide to m
so the arrows point to the size determined from toe or arch length. Th
to the widest part of the foot.

Self-Check 3	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Short answer questions: (Total points: 4)

- Describe briefly the procedure to be followed when measuring the foot by using Brannock devices. (2 points)
- What are the three measurements helps to get correct fit a shoe. (2 points)

Score = ___________

Rating: ____________

***Note:* Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 4 Explaining the basic principles of fittings

Fitting

Studies by the Pedorthic Footwear Association show that no two pairs of feet, and no individual's two feet, are exactly alike. Therefore, perfect shoe fit is impossible. As you read this section on the principles of shoe fitting, you will see the complexity of proper fit and why you need to leave the fit of the shoes up to the professionally trained shoe fitter.

Most shoe fitting is done on a two dimensional scale: overall length and ball width. Yet the foot and shoe are three-dimensional objects. Thus, what we have is a shoe of one size, shape, and sectional proportions attempting to fit a foot of many or varying sizes, shapes, and proportions. It is obviously impossible for the shoe to fit and feel the same under all these variables. Now add to these challenges the fit of the foot while in the shoe when at non-weight bearing, weight bearing, walking, under conditions of heat, humidity and moisture, and faulty biomechanics of the leg and foot. As you can see, a perfect fit is next to impossible. Therefore, a professionally trained shoe fitter attempts to fit both feet proportionally.

This often requires some adjustments to the shoes to accommodate the intricacies of each foot.

Shoes that fit properly help you do the things you enjoy. They provide comfort and improved performance. They can also keep your foot healthy, which means you can stay as active as you want to be now and in later years. Here are the steps taken at

Murray's Shoes in assuring as proportional a fit as possible. It is important to note before starting that whatever size we end up with does not matter at all. What does matter is the fit.

Size

Probable cause of this fault is just guessed size, and not measure feet or not know what measure on a Brannock fitting device. The other cause this fault is did not follow the fitting guides. The solution for this fault is that measure both feet on a Brannock fitting device while standing and then follow that styles fitting guide to get the right size.

Wrinkles on upper

This fault is caused due to poor or improper lasting operation by operator.
This fault can be corrected by taking the following action.

a. Operator must take care while lasting.
b. Operator must be given good training procedure.

Sole opening

Sole opening or gaping is caused by the following factors:

a. Sole or shoe bottom is not fully covered with adhesive
b. Sole not prepared as per the procedure
c. Not enough activation is carried out
d. Cycle time on press too short
e. Insufficient pressure on sole press
f. Wrong adhesive used

This fault or sole opening or gaping can be corrected by taking the following action.

a. Make sure that the whole surface on the sole and the shoe are fully covered with adhesive.
b. Follow the sole preparation procedure.
c. Increase flash heat cycle time.
d. Increase cycle time on the press.
e. Increase pressure on the sole press.

Broken toe-puff

Broken toe puff fault occur when the operator applies too much force during toe lasting operation or when using low quality toe puff. This fault can be reduced by using appropriate force and quality toe puff during lasting operation.

Loose top line

Loose top line fault is caused when a reinforcement material is not used or the reinforcement used is of low quality. This fault can be avoided by using reinforcement materials.

Alignment of upper

This fault is caused by the following factors:

a. Poor upper putting by the operator.
b. Operator not trained correctly.

This fault can be corrected by taking the following action.

a. Operator must take care while putting the upper on to the sole.
b. Operator must be given good training procedure.

Alignment of sole

Sole layed too far forward:

This fault is caused by the following factors:

a. Poor sole spotting by the operator.
b. Operator not trained correctly.

This fault or Sole layed too far forward can be corrected by taking the following action.

a. Operator must take care while spotting the sole on to the shoe bottom.
b. Operator must be given good training procedure.

Sole layed too far back:

This fault is caused by the following factors:

a. Poor sole putting by the operator.
b. Operator not trained correctly.

This fault or Sole layed too far back can be corrected by taking the following action.

a. Operator must take care while spotting the sole on to the shoe bottom.
b. Operator must be given good training procedure.

Sole layed to one side:

This fault is caused by the following factors:

a. Poor sole putting by the operator.
b. Operator not trained correctly.

This fault or Sole layed to one side can be corrected by taking the following action.

a. Operator must take care while spotting the sole on to the shoe bottom. Operator must be given good training procedure.

When a retailer buys his stock he selects from the manufacturers a range of styles which, he believes, will meet the appearance, performance and price needs of the customers he serves. He also chooses those styles in a range of sizes and fitting that will enable him to meet their fit requirements.

To help he selects quickly the correct size and/or fitting for a particular customer he uses a foot measuring device, or foot gauge.
A good manual foot gauge includes a size (length) scale, plus a girth measuring tape which can be aligned correctly to the true joint angle of both left and right feet.
Electronic foot gauge measures length and width automatically, displaying size and fitting on a panel.
When fitting foot wear a set of rules should be applied:

- Foot gauge are only a gauge. They measure only two dimensions, and indicate which size and fitting is likely to fit correctly.
- Both feet must be measured.
- The larger should be fitted.
- When using a manual foot gauge, body weight must be off the feet.
- When using an electronic foot gauge body weight must be on the foot being measured.
- The foot must be correctly positioned on the foot gauge.
    - The stool must be in line with the leg.
    - The heel must be right back to the pillar.
    - The angle between leg and foot must be 90 degrees.
    - The foot must be correctly aligned.

Length Fit

 The first step upon standing is to check the overall length of the shoe in relation to the foot inside. There is no scientific space between end of toe and end of shoe, but the rule of thumb is between 3/8" and 5/8." We take into consideration foot expansion upon weight bearing.

Heel to Ball Fit

The next fit check is from heel to the ball of the foot. The big toe joint needs to be at the widest part of the shoe. This is important because the shoe has been designed to bend at this point and this is where the foot also bends. If these two don't match up, then excessive pressures will be placed on both the foot and the shoe. In addition to this, if the ball of the foot doesn't line up, the arch of the foot will not be properly supported by the support in the shoe.

 As we check both overall length and heel to ball, we must take into consideration that the foot may be longer in the toes or shorter in the toes in relation to the heel to ball fit. If heel to ball is longer, meaning short toes, try to fit heel to ball or a little shorter if possible. If necessary, fit heel to ball and pad with layered cork to keep toe from toeing up. Try to fit in a short toe last. If overall length is longer, then we must fit the heel to toe. Try to fit in a long toe last so as to get the best fit.

Ball Width Fit

Quite often people either fit or are fitted with the width too tight. The idea is that the upper will stretch. But this does not always happen. When fit this way, not only can the shoe wear out faster due to excessive forces on the upper, but the pressure on the foot can cause a variety of problems, such as corns, metatarsal pain, as well as foot dysfunction.

The ball width fit is challenging in another sense because the foot has three different widths at the ball: foot at rest, foot on weight bearing, and foot under conditions of heat, humidity, and moisture. The shoe, fitted with one width, must provide proper width fit under these conditions. Here again, it is a matter of experience and judgment in selecting the width.

When checking for the width fit, we look for the foot to fit flat in the shoe and to able to spread out naturally inside. We should be able to pull the upper with a slight pinch. There should not be any excess on the little or big toe. Should there be a bunion on the big toe or little toe, going wider quite often will cause the heel to be loose. In this case, we would normally spot stretch these areas in order to take the pressure off the toes and still give us a snug heel fit.

Top line Fit

The top rim of the shoe should fit snugly against the foot. There should be very little or no gapping at the side. The exception to this rule applies to dress flats or heels which will gap on the sides when the foot and shoe flexes at the ball. As we slide our hand down the sides, we also check for the top line rubbing under the ankle. If this occurs, we either look for a shoe with a lower heel counter or put a small heel lift in the shoe to take the pressure off the ankle.

Arch Fit

In good-fitting shoes, the arch area hugs closely to the foot. But sometimes stress or torsion wrinkles will be seen in the upper, on the inner under side of the arch. This could be due to fit of the shoe or due to the foot over pronating. In the event of a dysfunctional foot, one might consider an arch support added to the shoe.

Heel Fit

This is the fit of the heel of the foot into the heel space of the shoe. The fit should be snug in order to stabilize the foot at heel strike when walking. We also need to check the top to make sure that it doesn't bite into the Achilles tendon, causing a "pump bump." Slippage under certain conditions, such as tight calves, can occur even when the heel appears to be snug.

Throat Fit

The shoes' throat and throat line are the entry point for the foot into the vamp or forepart area. There must be throat room for the waist and instep to move forward during the weight bearing and step action. If the throat is too tight, then heel irritations can occur by being shoved back into the heel. As the foot expands in size throughout the day, the throat line pressure increases. If severe or prolonged enough it can cut off blood circulation to the toes and cause uncomfortable sensations of numbness or tingling in the toes, plus swelling around the waist and instep.

Volume Fit

Shoe fitters traditionally think of fit in terms of linear measurement, overall length, heel to ball, and ball width. The fitter should know beforehand that volume fit is every bit as important as traditional size fit. After all, the fitter is constantly dealing with a wide range of foot types- fleshy, fat, bony, stocky, muscular, spready, etc. Each presents its own challenge to volume fit. And unless the volume or inter-space fit is as accurate as the conventional fitting sites (length, width), we not only don't have a proper fit, but also often cannot expect fully efficient shoe performance and comfort satisfaction.

Walk Test

Finally, after all aspects of the shoe fit have been checked, you should walk around and tell the fitter of any uncomfortable feelings. This will help the fitter to determine if a different size should be tried, adjustment should be made, or whether to bring a pedorthist into the fitting to determine if a dysfunction of the foot is occurring causing the shoe to be uncomfortable.

Foot Orthosis Fit

For the most part, the fitting of a shoe with a foot Orthosis is the same as just fitting the shoe to the foot. All the same parameters must be assessed. Some styles and shapes of shoes may work better than others. This is best determined by those professional shoe fitters with training and experience.

Self-Check 4	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 6)

- A good manual foot gauge includes a size (length) scale, plus a ------------------ tape which can be aligned correctly to the true joint angle of both left and right feet.
- Foot gauge are only --------------. They measure only two dimensions, and indicate which size and fitting is likely to fit correctly.
- Both feet must be ---------------------.
- The larger should be --------------.

- When using a manual foot gauge, body weight must be ----------- the feet.
- When using an electronic foot gauge body weight must be on the foot being measured.

Short answer questions: (Total points: 6)

- What rules should be applied when fitting foot? (2points)
- How do you know what shoe fits best? (2points)
- When checking for fit what are the things you are going to carry out? (2 points)

Score = ___________

Rating: ____________

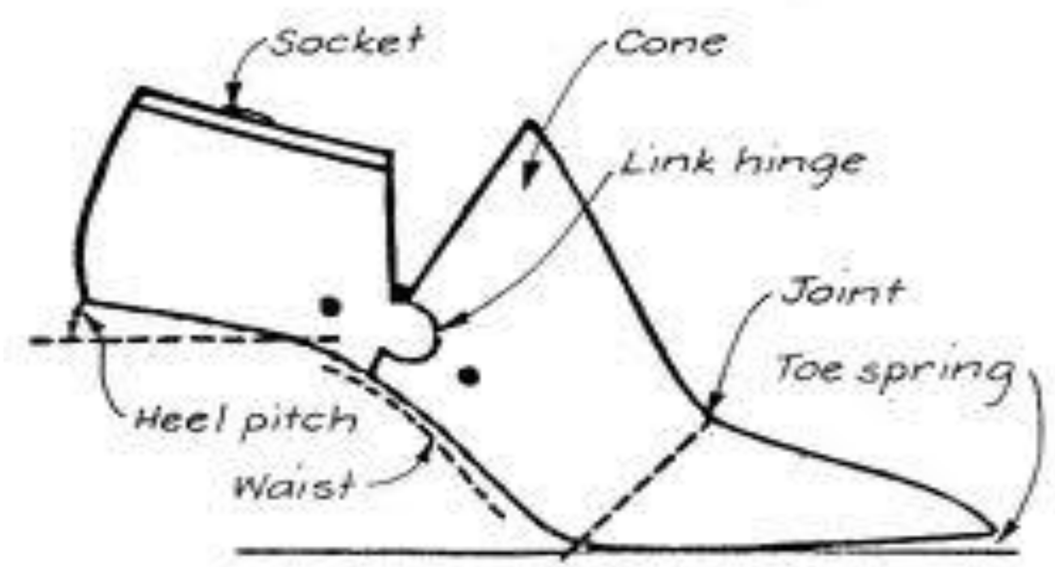
***Note:* Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 5 Explaining the types of lasts

The **last** is template or model upon which the shoe is built. The last is a solid 3D plastic or wooden model. The Shape of the shoes is determined entirely by the last upon which it is made. A last is measured at several points including:

- Heel to toe
- Heel to ball
- Circumferential measurement at the ball
- Waist
- Instep & Heel



Back curve: the area that is shaped to fit closely to the heel of the foot.

Cone: a solid shape, become narrower at the top.

Feather edge: the boundary line around the upper where it joins the welt or the sole or the corresponding line around an insole or last.

Forepart: the front part of the last from the waist forward.

Heel pitch: an angle between heel and baseline

Joint: the main line of flexing of the foot.

Toe spring: angle of the sole forepart and baseline.

Waist: area anterior to the seat.

Different manufacturers use different types of lasts

The fit of a shoe depends on the design shape and volume of the Shoe Last. The shoe last must represent the anatomical information of the foot, at the same time giving the finished shoe a pleasing and fashionable appearance.

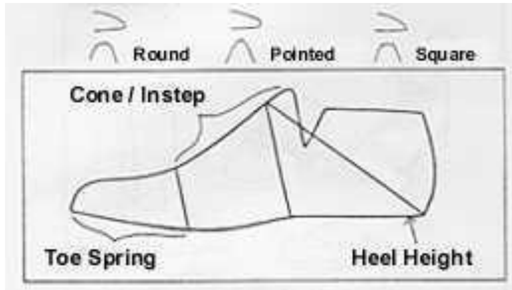


Chart showing the main parts of a " Shoe Last "

Solid Last

These kinds of shoe lasts are the simplest and are used for low-heel shoes and sandals.

Hinge Last

These lasts are used for all kind of shoe production. The lasts have a fore part and a back part and are connected by a spring. When slipping, the last is bent to shorten at the V-cut. Then the last is removed from the shoe without damaging or deforming the back part of the shoe.

V-hinge Last

Telescopic Last: These lasts are similar as the Hinge lasts but without a V-cut. The last will slid and reduce in length when slipping.

Scoop black last

These lasts are used for the manual shoe production. The shoe-lasts have a wedge on the top and can be detached from the main body. The lasts can be easily taken out of the lasted shape by removing the wedge.

Three Piece Lasts

These lasts are mainly used for the forced lasting boot or reversed slipper in the past. These kinds of shoe-lasts consist of three pieces. The center and the back pieces will be removed when slipping. After the removal of the center and back parts, it becomes easier to remove the front part.

The shoe trees one finds in most shoe stores are usually of twin-tube model. The trees have inset springs, conforming in length and width, which lead to satisfactory fit on most shoes. Other, certainly more rarefied options are three-piece shoe trees. This model is usually offered only by cordwainers or specialized, artisanal shoemakers due to its laborious production and restrictions on fit. Instead of springs, these trees rely on exact fit. Like the name suggests, the model is crafted from three pieces of wood, of which the middle piece is inserted last. The pieces are often connected with a string or chain. The model is either hollowed partly or fully on the ball of foot and heel; this allows moisture to dissipate faster and shows the skill of the last maker. Three-piece shoe trees are higher on the instep and heel as the fit must be exact. When inserted, they keep the shape of the shoe better than any other shoe tree model. In truth, the trees are closer to wooden sculptures than mere commodities.

Other Lasts

Ladies Last

Gents Last

Children Last

Plastic Lasts

Wooden Last

Self-Check 5	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Short answer questions: (Total points: 10)

- What is last? (2points)
- Explain briefly the points at which the last is measured? (2points)
- What is the use of last? (2points)
- List the different types of lasts used in footwear industries? (2 points)
- Describe briefly the use of any two types of lasts you mentioned in question 4. (2 points)

Score = ___________

Rating: ____________

***Note:* Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

LG#17	**LO #4-** Identify parts of shoes

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Describing upper parts of a shoe
- Describing lining and interlining parts of a shoe
- Describing bottom parts of a shoe

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Describe upper parts of a shoe
- Describe lining and interlining parts of a shoe
- Describe bottom parts of a shoe

Learning Instructions:

Read the specific objectives of this Learning Guide.

- Read the specific objectives of this Learning Guide.
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- Read the information written in the "Information Sheet 2".
- Accomplish the "Self-check 2". Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 3". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 2.
- Read the information written in the "Information Sheet 3".
- Accomplish the "Self-check 3". Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.

Parts of a Shoe

The parts of shoe can be grouped broadly into those which make up the upper and those which constitute the sole and heel at bottom. The aim of this section is to identify the basic parts which go to make up uppers and bottoms.

A. Upper Part

A simple upper consists of three basic parts:

- The **vamp**, which covers the toes and forepart or front of the shoe.
- The q**uarters** which covers the middle of the foot.
- The **counter** which covers the back of the foot.

The top of the shoe which surrounds the opening for the foot is called the **top line**. The lower extremity where the upper meets the sole or insole is called the **feather edge**. When the patterns are cut, an additional margin is added to the feather edge which allows the upper to be attached to the rest of the shoe. This is called the **lasting allowance.** Example of Shoe and its Parts:

1. Vamp

Vamp often consists of a single piece of upper material. They may, however, consist of two separate pieces stitched together to make a whole. I.e. for example,

Toecaps and wing caps

A conventional toecap is set squarely across the shoe. A wing cap is angled back to give a streamlined effect. This may cover the toes in an intricate flowing curve or may lie simply round the wall edge of the last. In both cases, however, the wing cap and vamp extend to the lasting edge.

Aprons and Vamp Wings

Alternatively, the vamp may be divided into an apron covering part of the top of the foot and wings enclosing the sidewall of the foot. Although the relative positions of vamp and apron can vary, the seam joining them will follow more or less and wall edge of the last where it changes from the horizontal to the vertical plane. It will be noted that the wings alone extend to the lasting edge.

2. Tongues and Tabs

A vamp may have a separate tongue or the vamp and tongue may be cut all in one piece. An apron may have a separate tab to cover the instep or the apron and tab may all be cut in one piece.

3. Quarters

Quarters too may be simple or complicated. The front panels (where the eyelets of a lace up shoe are positioned) are often separate pieces called **facings**. Even where the facings are not separate pieces, this area of the quarter is known as the facing area. Less common is the division of the quarter into foxing enclosing the heel or seat and an insertion at the waist. This insertion will certainly comprise part of the top line and may or may not comprise part of the feather line. As an example, foxing and insertions are normal in brogue oxford shoes, of which the essential feature is the perforation along the various edges.

4. Counters

It has been stated earlier that an elementary shoe is made up of two quarters which are joined at the back. It is sometimes desirable to eliminate this heel seam so that the back of the shoe is cut as one piece. This one piece is called a **counter.** This is normally joined at the waist to the vamp or wings but an insertion could be also included. Below is a pattern for a counter. Compare this with the foxing patterns.

It will be noticed that even with a one piece counter it is necessary to have a small back seam to maintain the shape of the counter to the last shape at the back. However, shoes are now being produced which have this seam eliminated completely. The back is moulded to the shape of the last by a combination of heat and pressure.

5. Appliqués

The essential fact about the different parts of a shoe described so far is that they are all separate pieces joined together to make a whole vamp or quarter. Each is performing an individual function essential to the composition of the shoe.

Different styles can, however, be achieved in an entirely different way. Duplicate pieces are attached to vamps or quarters which are already complete. These extra pieces – **appliqués** – do not perform functions essential to the composition of the shoe although they affect its appearance. They add to the strength of a shoe by providing a double layer on the upper. They will cover seams which might otherwise be subjected to considerable strain in lasting and wear.

Although more material is used, this does not necessarily increase the cost as it is sometimes possible to make use of inferior parts of a skin under an appliqué.

Saddles and Bars

The vamp may have a saddle or bar across it from joint to joint. This may serve two purposes:

- To reinforce the shoe especially at the throat where it bears the continued strain of flexing.
- To cover a seam or gusset. This could be the vamp/quarter seam or could be the seam joining an apron to a tab or tongue.

Back Straps: The heel seam is subject to considerable strain both in lasting and wear. It is common to reinforce it either with a counter or with a blackstrap.

While these various appliqués do serve a subsidiary purpose they are not essential to the composition of the shoe. In addition, appliqués can be added which serve no purpose at all except to enhance the appearance of the shoe.

Self-Check 1	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Short answer questions: (Total points: 5)

- Mention 3 upper parts of shoe? (3points)
- What is the use of backstrap? (2points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 2   Describing lining and interlining parts of a shoe

The lining is the material inside the shoe that comes in contact with the entire foot: the sides, top and heels. The main purpose of the lining is to cover the inside seams of the shoe and lengthen the shoe's lifespan. Linings made out of certain materials cushion and comfort the foot or draw out moisture.

The materials used to line leather shoes are as important (or more important) than the materials used to construct the uppers. Premium shoes will use higher quality linings that are more comfortable and more durable. You can feel the difference the second you slip on a pair of shoes lined in luxurious leather.

Textile linings like fabric and cloth are commonly used on inexpensive leather shoes because they're less expensive to manufacture and are moderately comfortable. However, textile linings are quicker to absorb moisture and slower to dry out, which leads to sweaty feet and smelly shoes. They also wear out faster, which limits the lifespan of the shoes, because shoe linings are not easy or cost effective to replace.

Leather

Not surprisingly, leather is an ideal lining for leather shoes. Here are some of the reasons why:

Durability

For one, leather outlasts other materials used in the interiors of shoes. Leather shoe linings hold up better over time than textiles. Leather is a more robust material and is less likely to rip, tear, or develop holes, especially when it is cared for properly.

Breathable

Since leather is a hide, it's breathable and less likely to retain moisture than other materials. It won't absorb sweat as quickly and leather lined shoes are less likely to develop a smell over time.

Comfortable

Leather is often more comfortable. Quality leather will conform to your feet, and soften over time to become buttery soft. A better fit means less chafing and fewer blisters. This is the reason that Samuel Hubbard uses full glove-leather lining for a buttery soft feel and to eliminate pressure points.

Construction

Leather lining is more complex and time intensive compared to a fiber-based textile. Whereas textiles have a consistent man-made quality, each cut of leather is unique and needs to be carefully processed to achieve the same finish throughout the lining of each shoe.

Not all leather is created equal. Inexpensive leathers require more processing and can dry out and crack over time. Premium leather will actually become softer and more comfortable as it ages.

Shearling

Shearling is a hide similar to leather, but is sourced from sheep instead. One side will have a suede surface while the other side will have a soft wool layer. Shearling is a great lining for cold conditions because wool is an incredibly effective insulator that retains heat in even the coldest temperatures.

Shearling linings will commonly be found on boots, or shoes and slippers geared towards winter use. For other seasons, it’s too warm and will cause excessive sweating.

Self-Check 2	**Written Test**

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.
Total marks (6 marks)

1. Write the definitions of lining and interlining shoes.
2. Write the differences b/n lining and interlining part of shoes.
3. Write the types of lining part of shoe.

Information Sheet 3 Describing bottom parts of a shoe

Bottom Part

1. Insole

This is the inner sole of the shoe, which is next to the foot under the shoe sock. Insoles may be made all in one piece or, alternatively in two pieces.

When an insole is made from two pieces it is known as a blended insole. The blended insole is made from a flexible forepart and a rigid backer.

2. Sole

The layer of material which covers the bottom of the shoe and it is the walking surface of that shoe. The sole may be made of a diversity of material, i.e. leather, pure rubber, resin rubber compound, plastic etc.

3. Heel

It is the under part of the shoe which supports the heel of the foot, and may be stuck or nailed to the shoe bottom. It is a support placed under the quarter to ensure that the footwear lies correctly. The seat part of the footwear bottom, sometimes are attached separately and sometimes as an integral part of the sole.

It can be made of leather, wood, plastic, rubber, leather board, poly urethane, Masonite and etc. Heel shapes can be classified under these headings.

The level of support at the back of your ankle and heel is more important than you may think. If it's too loose and soft, it'll provide very little support and after walking for a while it may become uncomfortable. it could rub causing blisters. There are various heel shapes as shown in the following figure

Heel Lifts : It is layers of material such as leather or leather board, which are built up together and shaped to form built heels.

Top-piece

It is the top surface or walking surface of a heel.

Self-Check 3	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Short answer questions: (Total points: 5)

- Mention 3 bottom parts of shoe? (3points)
- What is the use of sole? (2points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers

LG#18	**LO #5-** Describe footwear types, styles and construction

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying the types of footwear and describing their uses
- Explaining footwear designs/styles
- Identifying design characteristics
- Describing common client requirements for footwear designs
- Identifying basic design tools used to develop design concepts
- Identifying accessories used to accent footwear designs
- Explaining footwear basic constructions

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify the types of footwear and describing their uses
- Explain footwear designs/styles
- Identify design characteristics
- Describe common client requirements for footwear designs
- Identify basic design tools used to develop design concepts
- Identify accessories used to accent footwear designs
- Explain footwear basic constructions

Learning Instructions:

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- Accomplish the “Self-check 2”. Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 3”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 2.
- Read the information written in the “Information Sheet 3”.
- Accomplish the “Self-check 3”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 4”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 3.
- Read the information written in the “Information Sheet 4”.
- Accomplish the “Self-check 4”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.

Information Sheet 1 Identifying the types of footwear and describing their uses

Footwear can be designed for various purposes. These basic designs are described as follows.

1. Safety boots

Safety boots are designed to protect the user from potential hazards or prevent injuries. There are different components that made up safety footwear. These components include safety toe guards, metatarsal guards, electrical hazard ratings, electro static dissipating ratings and the soles of the shoes.

Safety footwear protects the foot in areas where there is a danger of foot injuries due to falling or rolling objects or objects piercing the sole.

Safety toe guards: - It originated in safety boots in 1925 with the intention to ultimately reduce the danger of foot injuries

There are many types of safety toes, such as steel toe, composite toe, alloy toe and Timberland's own Titan toe (made from titanium).

Metatarsal guards:-These protect the upper foot and toe area from potential "drop" hazards. The metatarsal guards can be attached to safety shoes both internally and externally. Each foot contains 26 bones. Most of those bones are found on the upper foot and are called the metatarsal bones, from which the name of this protective device originates. Keeping each and every bone protected is very important so one can work freely without pain or injury.

Electrical Hazard (EH):- This type of footwear is designated to protect the wearer against open circuits up to 600 volts. EH footwear is great for employees working around a plant or factory, such as plant operation personal, are usually most susceptible to EH conditions. EH safety footwear construction consists of a heel and sole combination usually molded into one single piece to the upper boot without any nails or metal. EH ratings are tested by an independent lab to be able to withstand applications of 14,000 volts (V) at 60 Hertz (Hz) for one minute, with leakage in excess of 3.0 mill amperes (ma). EH ratings can also protect the wearer against open circuits up to 600 V or less under dry conditions.

Electro Static Discharge (ESD):- Electric shock that is felt when a person walks across a carpet and touches a door knob and a discharge of electricity occurs between that person and the door. That shock was actually a discharge of electricity in the range of 2,000 to 3,000 volts. The shock voltage has to be at least 2,000 volts before the human body can feel it. The reason the 2,000 volt ESD discharge does not kill someone is that the current is very low, but that same voltage can kill electronic components or possibly ignite volatile chemicals or explosives. To be marked as Electric Static Dissipating Footwear, a shoe must pass testing requirements established. ESD footwear can be classified as SD Type I or SD Type II. Footwear with this designation prevents the build-up of static electricity. This is done through the construction of the footwear with a special silver thread used to stitch the soles to the uppers or with carbon inserts in the sole or foot bed. Static Dissipating (SD) Type I must offer electrical resistance between 1 mega ohm to 100 mega ohms

Sole: - Safety is measured in three ways; slip-resistance, wear and comfort.

Slip resistance ratings for footwear are determined by independent laboratories. To determine slip-resistance, the soles are tested under dry, wet, oily, and oily/wet conditions.

The wear of the safety shoes includes many different types of material used in the construction of a shoe sole, each offers a different benefit. The durability of a shoe sole is at the mercy of the use and the work environment. Always try to match the shoe to the type of work and the working conditions. Most of the safety boots sold today have passed slip-resistance and wear tests.

The comfort level of safety shoes includes different composites used to construct a shoe sole which all offer different comfort levels. Everyone has a different perception of comfort and each foot has its own special requirements. Only the person wearing the shoe can determine the comfort level.

The previous information about safety toe guards, metatarsal guards, electrical hazard ratings, electro static dissipating ratings and the soles of the shoes is meant to inform and help protect workers. When workers know what kind of foot protection they need and why they need it, the overall work environment will be much safer for everyone.

Fig: Different types of safety boots

2. Work boots and shoes

Work boots and shoes are used primarily at the construction, agricultural and cold work place. Work boots and shoes should offer good flex properties right down to low temperatures; tough, hard-wearing, improved anti-slip outsoles; oil, micro-cellular biological and hydrolytic resistance; and insulation of both foot and leg, which is particularly important in the cold area. Work shoes are designed to stand heavy wear, to protect the wearer, and provide high traction. They are generally made from sturdy leather uppers and non-leather outsoles.

3. Fashion shoes

A shoe is an item of footwear intended to protect and comfort the human foot while doing various activities. Shoes are also used as an item of decoration. The design of shoes has varied enormously through time and from culture to culture, with appearance originally being tied to function. Additionally fashion has often dictated many design elements, such as whether shoes have very high heels or flat ones. Contemporary footwear varies widely in style, complexity and cost. Basic sandals may consist of only a thin sole and simple strap. High fashion shoes may be made of very expensive materials in complex construction and sell for thousands of dollars a pair.

4. Casuals

Casual shoes are characterized by sturdy leather uppers, non-leather outsoles, and wide profile.

5. Sport shoes

Sport shoes are a shoe that worn during performing different sport activities. Serious sport enthusiasts and professionals require footwear which will both protect and enhance performance. Microcellular polyurethanes are the ideal material for producing high quality midsoles, which reduce the risk of leg joint and muscular injury without impeding performance. In addition, the ability to encapsulate inserts within the mould has allowed leading sports shoe manufacturers to enhance cushioning by inserting energy return devices into the midsole.

Self-Check 1	Written Test

Name: _____________________________ Date: ___________________________

Time started: _______________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 5)

1. ------------------ are designed to protect the user from potential hazards or prevent injuries.
2. -------------------- protect the upper foot and toe area from potential "drop" hazards.
3. Each foot contains ----------- bones.
4. ------------------ are a shoe that worn during performing different sport activities.
5. -----------------------type of footwear is designated to protect the wearer against open circuits up to 600 volts.

Short answer questions: (Total points: 8)

1. What are the various purposes for which footwear is designed? (2 points)
2. Describe briefly the safety boots and its uses. (2 points)
3. Describe briefly the function of work boots and shoes. (2 points)
4. Discuss the uses of fashion shoes, sport shoes, casual shoes and their features. (2 points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Footwear can be designed for various purposes. These basic designs are described as follows.

1. Safety boots

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The wear of the safety shoes includes many different types of material used in the construction of a shoe sole, each offers a different benefit. The durability of a shoe sole is at the mercy of the use and the work environment. Always try to match the shoe to the type of work and the working conditions. Most of the safety boots sold today have passed slip-resistance and wear tests.

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Fig: Different types of safety boots

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SB-8061B


Self-Check 2	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 5)

1. ------------------- are designed to protect the user from potential hazards or prevent injuries.
2. --------------------- protect the upper foot and toe area from potential "drop" hazards.
3. Each foot contains ----------- bones.
4. ------------------- are a shoe that worn during performing different sport activities.
5. ------------------------type of footwear is designated to protect the wearer against open circuits up to 600 volts.

Short answer questions: (Total points: 8)

1. What are the various purposes for which footwear is designed? (2 points)
2. Describe briefly the safety boots and its uses. (2 points)
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4. Discuss the uses of fashion shoes, sport shoes, casual shoes and their features. (2 points)

***Note:* Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers

Information Sheet 3	Identifying design characteristics

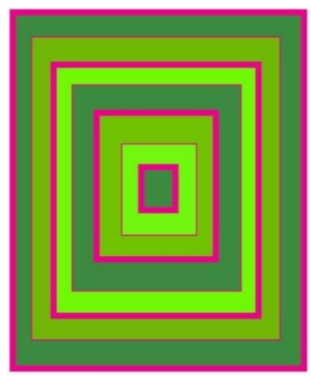
A characteristic of something is simply an attribute or quality. Hence, the type of design characteristic we are interested in is a specific attribute or quality of a body of solution logic that we document in a design specification and plan to realize in development.

PRINCIPLES OF DESIGN

Some combinations of design elements (line, shape, color, texture, and space) work better than others. Here are some guidelines to help you understand why some combinations work and others do not work as well. These guidelines—**rhythm, proportion, emphasis, balance, and unity**—are the principles of design.

RHYTHM :

Rhythm is created when one or more elements of design are used repeatedly to create feeling of organized movement**.** You have felt rhythm in music. Rhythm is also a part of things you see. It allows the eye to move from one part of a design to another part.



Rhythm can be created by:

• Repeating a color, shape, texture, line, or space when designing.

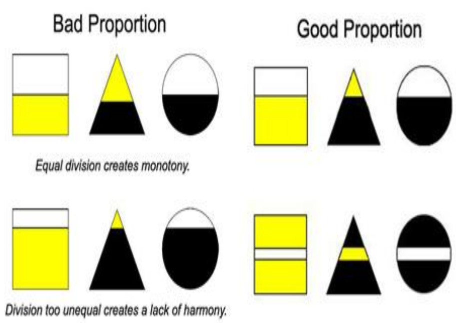
• Varying the size of objects, shapes, or lines in sequence (small to large).

• Using a progression of colors from tints to shades (light blue to dark blue).

• Shifting from one hue to a neighboring hue (yellow to yellow-orange to orange to red-orange to red).

PROPORTION :

Proportion refers to the relationship between one part of a design and another part or to the whole design. It is a comparison of sizes, shapes, and quantities. For example, the relationship between the vertical and horizontal measurements of a wall hanging may be pleasing because the unequal lengths produce an interesting contrast.



Proportion refers to the relative size and scale of the various elements in a design. The issue is the relationship between objects, or parts, of a whole. This means that it is necessary to discuss proportion in terms of the context or standard used to determine proportions.

EMPHASIS:

Every design needs an accent a point of interest. Emphasis is the quality that draws your attention to a certain part of a design first. There are several ways to create emphasis:

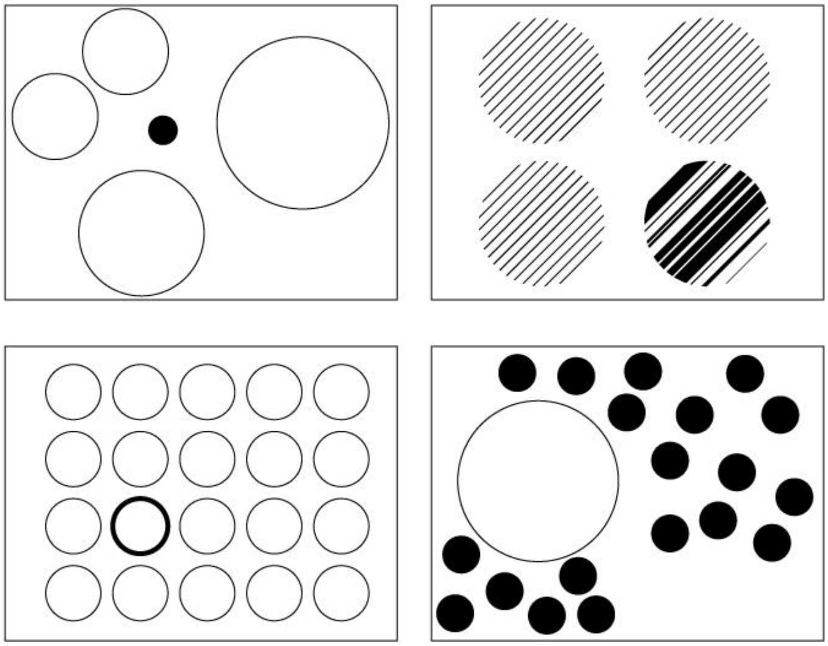
• Use a contrasting color.

• Use a different or unusual line.

• Make a shape very large or very small.

• Use a different shape.

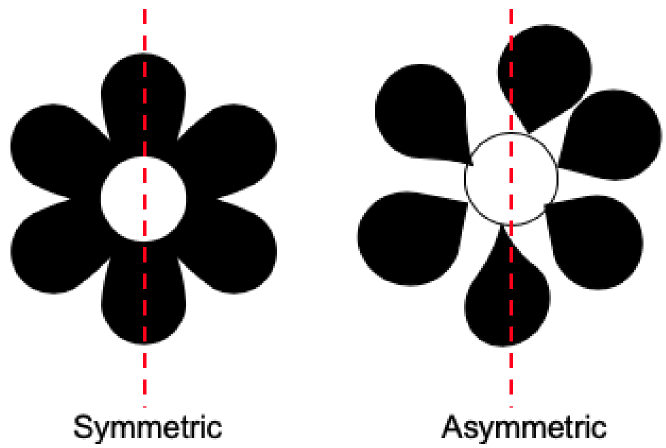
• Use plain background space.



Balance :

Balance is the distribution of visual weight of object, colors, texture and space. If the design was a scale these elements should be balanced to make a design feel stable. In symmetrical balance, the elements used on one side of the design are similar to those on the order side; in Asymmetrical balance the sides are different but still look balanced. Balance gives a feeling of stability. There are three types of balance.

Symmetrical, or formal balance, is the simplest kind. An item that is symmetrically balanced is the same on both sides. Our bodies are an example of formal balance. If you draw an imaginary line from your head to your toes dividing your body in half, you will be pretty much the same on both sides. Designs that have a radial balance have a center point. A tire, pizza, and a daisy flower are all examples of design with radial balance. When you look through a kaleidoscope, everything you see has a radial balance. Asymmetrical balance creates a feeling of equal weight on both sides, even though the sides do not look the same.



Asymmetrical designs also are called informal designs because they suggest movement and spontaneity. Asymmetrical balance is the hardest type of balance to achieve and often takes experimenting or moving elements around until balance is achieved.

UNITY:

When things look right together, you have created unity or harmony. Lines and shapes that repeat each other show unity (curved lines with curved shapes). Colors that have a common hue are harmonious. Textures that have a similar feel add to unity. But too much uniformity sometimes can be boring. At the same time, too much variety destroys unity. Pleasing visual combinations are harmonious. Each part fills a need to create a pleasant whole with interest using a theme with variations often produces unity or harmony.

Unity through reparation

Self-Check 3	Written Test

Name: ______________________________ **Date:** __________________

(Total marks:-8)

Instructions: Write all your answers in the provided answer sheet on page

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Fill in the blanks:

1. -------------------is the response of the eye to differing wavelengths of radiation with in the visible spectrum. (Mark 1)
2. ------------is an element which is characterized by length & direction. (Mark 1)
3. ------------- refers to the area that a shape or form occupies. (Mark 1)
4. ------------- refers to the relative size and scale of the various elements in a design. (Mark 1)

Test II: One word answer:

1.When one or more elements of design are used repeatedly to create feeling of organized movement is called? (Mark 1)

2.The distribution of visual weight of object, colors, texture and space is called? (Mark 1)

3.A color lightened by adding white is called. (Mark 1)

4.Surface quality that can be seen and felt is called. (Mark 1)

Information Sheet 4 Describing common client requirements for footwear designs

Comfort

Choosing the right shoe can prevent or alleviate foot pain; the wrong shoe can exacerbate or cause foot problems.

Today's shoes are quite specialized to provide a higher level of performance for specific activities, from walking to running. The various designs, materials and technologies used affect the function and fit of a given shoe. For maximum performance and comfort, these functional elements must be correctly matched with a person's foot type, body type and activity level. The right shoe can prevent or alleviate foot pain, while the wrong choice can exacerbate or cause foot pain. Consider the following shoe functions:

Cushion

Cushion is a term used to describe a specific type of athletic shoe. These shoes use soft material in the midsole and are intended for people with high arches that do not collapse.

Extra Depth

These shoes are more generous with space inside the shoe; they are deeper and provide additional room for orthotics or arch supports, as well as for bunions and other fitting challenges.

Most shoes are constructed on a last; the shape of the last determines the shape of the shoe and the type of foot or function best suited to that shoe. It is described as follows:

Lasts: Curved

It is intended for people with high arches that do not collapse.

Lasts: Semi-curved

It s intended for people with higher arches and little to no pronation.

Lasts: Semi-straight

It is intended for flat feet or moderate to heavy pronators.

Lasts: Straight

It fits a wider, rectangle-shaped foot that is extremely flat, with a low or collapsed arch.

Maximum Motion Control

Maximum motion control is a term used to describe a specific type of athletic shoe. The midsoles of these shoes are made with a maximum amount of dense material along the medial side of the shoe (under the arch) to help support the foot. Shoes with maximum motion control are designed for the individual who has flat feet.

Metatarsal Support

Many people require additional support in the forefoot, at the metatarsal arch, to alleviate pressure. In some shoes over-the-counter arch supports can provide for this additional support.

Moderate Motion Control

Motion control is a term used to describe a specific type of athletic shoe. The midsoles of these shoes are made with denser material along the medial side of the shoe (under the arch) to help support the foot. Intended for flat feet or moderate to heavy pronators, depending on the size of the individual (height and weight) and intended activity.

Rocker Sole

Shoes with rocker soles are very stiff in the front of the shoe and have a little rounded, creating a rocking effect. This rocking effect helps alleviate foot pain due to conditions affecting the forefoot or ball of the foot, such as arthritis and neuromas. Rocker soles can also be used for walking or standing for long periods.

Stability and High Stability

Stability is a term used to describe a specific type of athletic shoe. These shoes are designed for a more curved foot with a higher arch. Much of the weight is on the outside of the foot.

Structured Cushioning

Structured cushioning is a term used to describe a specific type of athletic shoe. These shoes have a cushioned base, with light support under the arch. They are intended for people with higher arches.

Velcro: Athletic Shoes

For some people tying laces or buckling buckles is just too difficult, but a securely fitted shoe is critical for their safety and comfort. Velcro is the perfect solution.

Velcro: Casual Shoes

For some people tying laces or buckling buckles is just too difficult, but a securely fitted shoe is critical for their safety and comfort. Velcro is the perfect solution.

Velcro: Sandals

For some people tying laces or buckling buckles is just too difficult, but a securely fitted shoe is critical for their safety and comfort. Velcro is the perfect solution.

Fitting

When a retailer buys his stock, he selects from the manufacturers a range of styles in which he believes, will meet the appearance, performance and price needs of the customers he serves. He also chooses those styles in a range of sizes and fitting that will enable him to meet their fit requirements.

To help he selects quickly the correct size and/or fitting for a particular customer he uses a foot measuring device, or foot gauge.

A good manual foot gauge includes a size (length) scale, plus a girth measuring tape which can be aligned correctly to the true joint angle of both left and right feet.

Electronic foot gauges measure length and width automatically, displaying size and fitting on a panel.

For fitting footwear a set of rules should be applied:

A. Foot gauge are only a gauge. They measure only two dimensions, and indicate which size and fitting is likely to fit correctly.

B. Both feet must be measured.

C. The larger should be fitted.

D. When using a manual foot gauge, body weight must be off the feet.

E. When using an electronic foot gauge body weight must be on the foot being measured.

F. The foot must be correctly positioned on the foot gauge.

  I. The stool must be in line with the leg.

  II. The heel must be right back to the pillar.

  III. The angle between leg and foot must be 90 degrees.

  IV. The foot must be correctly aligned.

Self-Check 4	Written Test

Name: _____________________________ Date: ___________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

True or False: (Total points: 6)

1. Choosing the right shoe can prevent or alleviate foot pain.
2. Cushion is a term used to describe a specific type of athletic shoe.
3. Both feet must not be measured.
4. Larger feet should not be fitted.
5. When using a manual foot gauge, body weight must be on the feet.
6. When using an electronic foot gauge body weight must be off the foot being measured.

Short answer questions: (Total points: 8)

1. What do you mean by comfort and its effect on foot? (2 points)
2. What are the parameters that affect the function and fit of a given shoe?(2 points)
3. What is fitting and how it affects the foot? (2 points)
4. What are the sets of rules that should be applied when fitting the foot? (2 points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 5 Identifying basic design tools used to develop design concepts

Storyboards

This is a visual representation of a new fashion trend, sometimes called 'Mood Boards' because they describe the 'mood' of a trend. The storyboard is used by the footwear designer to 'set the scene', before they start designing. It is often used by clients to understand a trend, or to explain a trend to a colleague. It can help a client decide the focus of a range of footwear, if it is relevant to their customer before the designer starts to design.

Storyboards are usually made from fashion magazine photos; they may include notes, material swatches, other inspirational pictures, sketches or photos. There is usually an element of forecasting involved. We look at current trends, we look at what the opinion formers are doing and wearing, we look at what is happening in the world generally and use this information to predict what might be popular next.

1. Catalogues, pictures

Catalogues and pictures are important materials that are used for shoe designing purpose**.** A designer is used this materials as a source for designing different style of shoes.

2. Drawings and illustrations

Drawing is the art of the draftsman. It is an art or technique of producing images on a surface, usually paper, by means of marks in graphite, ink, chalk, charcoal, or crayon. In its broadest sense it includes every use of the delineated line and is thus basic to the arts of painting, architecture, sculpture, calligraphy, and geometry. The word drawing is commonly used to denote works in pen, pencil, crayon, chalk, charcoal, or similar media in which form rather than color is emphasized. For centuries drawings have been made either as preparatory studies (see cartoon) or as finished works of art. Preparatory drawings sometimes reveal a vigor and spontaneity lacking in the completed work.

Drawings are often used as illustrations and are reproduced by such processes as etching, engraving, and lithography.

Drawing vs. Illustration

Whenever we communicate, there are certain instances when we need to utilize some tools, in order to make sure that the message we intend to convey is understood. This can include the use of visual arts. Drawings and illustrations are two of the most common types of visual arts that are used by speakers in order to convey their message to a group of people. Not only are visual arts more able to get the message across, the utilization of visual arts such as drawings and illustrations are able to keep the attention of the speaker's target audience, in order to ensure that they remain attentive to the given speech.

Due to this, it is common for many people to use the terms drawing and illustration interchangeably. After all, both drawings and illustrations are visual representations of the message that is being conveyed, but, as far as graphic artists, and fine arts students and professionals are concerned, these two are completely different.

A drawing, by definition, is a type of visual expression that is often conveyed in two-dimension. It is often created through the use of paper, and a variety of different tools such as charcoal, colored pencils, pen and ink and the like. A drawing is often an exploratory form of visual art. This means that drawings pay considerable emphasis on observation, problem solving and composition. In most cases, drawings serve as a draft, or an outline, for other types of visual arts, such as painting. When an artist creates a drawing, he or she is focused more on the artistic rendition of a particular image. As such, the drawing may or may not exactly replicate the subject matter in real life. This is because drawings are predominantly utilized to convey the feelings and emotions evoked within the artist.

On the other hand, an illustration is defined as the visual representation to provide emphasis or to accentuate a particular text. In this case, the rendition of the illustration is as close to the message of the text as possible, and is rarely created without having to tap into the impression that the viewers will get from viewing it. Illustrations are often used to provide faces to characters within a story, in order for the readers to be able to visualize the characters better, or to provide a visual representation of a particular theory presented in a textbook. Illustrations are not limited to visual representations of things in real life. Illustrations can also be graphs, charts and other forms of visual representations.

In general,

1. Both drawing and illustration are visual representation used to convey a particular message.
2. Drawings are visual expressions used to convey feelings and emotions evoked within the artist. On the other hand, illustrations are visual expressions that help people further understand and visualize the accompanying textual content.
3. Drawings can stand alone, and still convey message. On the other hand, illustrations require text to accompany it, for it to be appreciated.

Self-Check 5	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Match following the words: (Total points: 4)

1. Storyboards	A. This is a visual representation of a new fashion trend, sometimes called 'Mood Boards' because they describe the 'mood of a trend'.
2. Catalogues, pictures	B. is the art of draftsman
3. Drawings	C. are used for shoe designing purpose**.**
4. Illustration	D. visual representation to provide emphasis or to accentuate a particular text

Short answer questions: (Total points: 6)

1. Describe briefly the various types of designing tools used in footwear design and their uses? (2 points)
2. What are storyboard and its uses? (2 points)
3. What is the difference between drawings and illustrations? (2 points)

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 6 Identifying accessories used to accent footwear designs

Once the main design of a shoe is completed, the designer may also choose to add several accessory components to the model. These include laces, fasteners, and ornaments. The geometric variation on these components is almost limitless, and therefore almost any CAD operation provided by any system may be required to design these models. Any footwear design company will typically maintain large libraries of such components, to allow designers to quickly browse through earlier, similar designs for reuse. Most CAD systems provide for users to create libraries, or catalogs of such components or assemblies. A component or subassembly model of these accessories can easily by incorporated at the appropriate location on the shoe model. The steps for this process are used to load the models as components of an assembly model, and to specify its positioning constraints between the shoe model and the accessory model (e.g. coincidence of pairs of plane, points, or axes selected from the respective models).

Trims

Accessories are decorative pieces that are functional or non functional components of the shoe. Accessories include materials such as decorative metal Trims, eyelets, rivets, buckles, eyelets, D- Rings, zippers, decorative laces, rivets and etc.

These are made in material similar to that of the shoe or a contrasting material. These are applied by means of a clip, or staple.

Fig: trim

Buckles

A buckle for fastening the shoe on the foot, generally by means of a latchet or strip passing over the instep, of the same material as the shoe. Shoes were secured by buckles throughout the latter part of the seventeenth century and nearly the whole of the eighteenth. They were worn by both men and women. Such buckles were sometimes of precious material, and even set with diamonds. In the present century the fashion has been restored at intervals, but most contemporary shoe-buckles are sewed on merely for ornament.

Fig: buckles

Self-Check 6	Written Test

Name: _____________________________ Date: ___________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Fill in the blanks: (Total points: 4)

1. Accessories components include laces, fasteners, and ------------------.
2. The geometric variation on these components is almost -----------------.
3. A ------------ for fastening the shoe on the foot, generally by means of a latchet or strip passing over the instep, of the same material as the shoe.
4. Most ------------ systems provide for users to create libraries, or catalogs of such components or assemblies.

Short answer questions: (Total points: 8)

1. List the accessories used in footwear design. (2 points)
2. What is trim and its use? (2 points)
3. What are buckle and its function? (2 points)
4. From what materials can trim and buckle prepared? (2 points)

Score = ___________

Rating:____________

***Note:* Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Construction

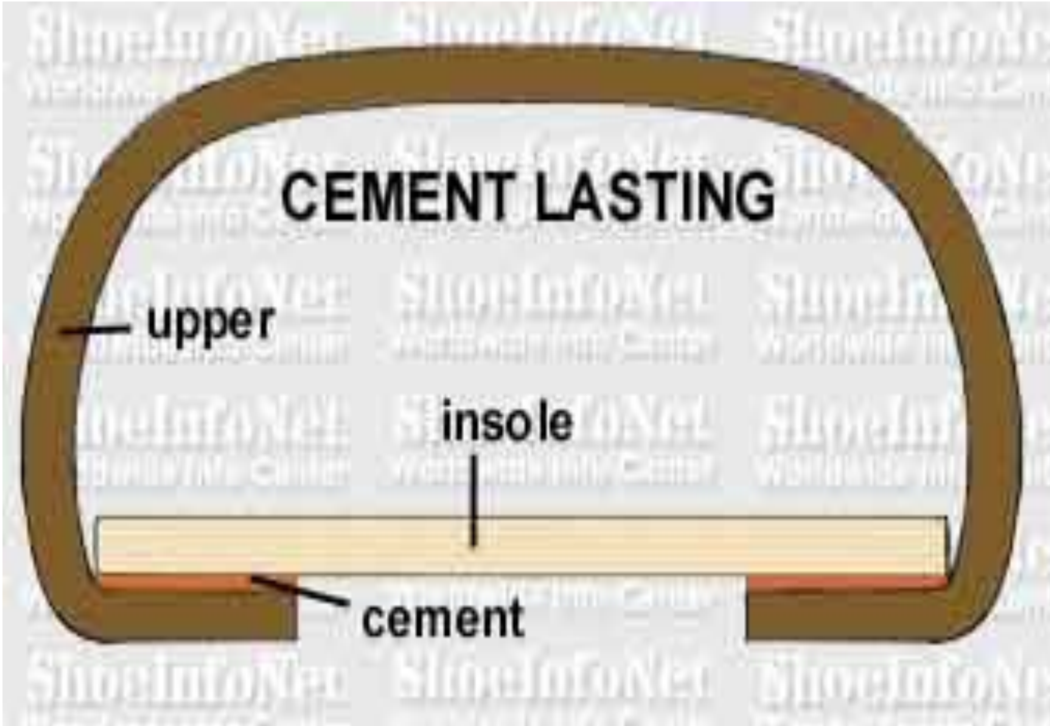
Definition: Construction is a method of assembly of the footwear. This is variable feature and in some product's application, special constructions are applied. In footwear manufacturing the 'construction' is associated with some specific operations in the making department, which is carried out in order to attach out sole, etc. with the upper.

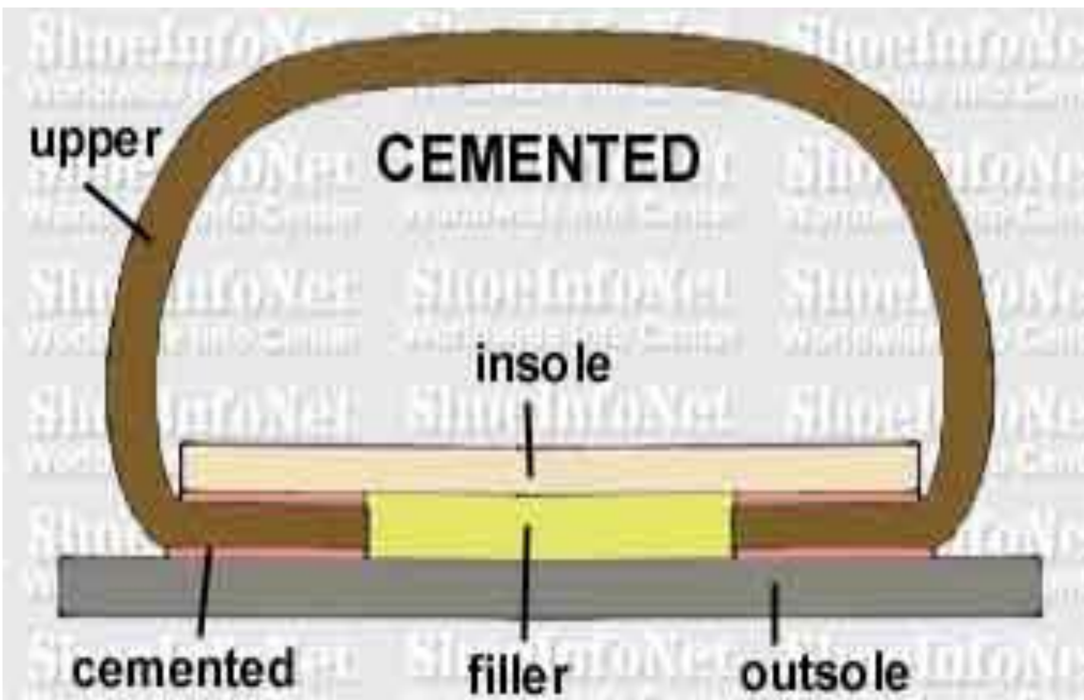
There are different types of footwear construction. These are described as followed.

- Cemented construction
- Good year Welted construction
- Stitch down construction
- Moccasin construction
- California construction
- Direct Injection process (DIP)
- Strobel construction

A. Cement lasting /Stuck-on/flat lasting/construction

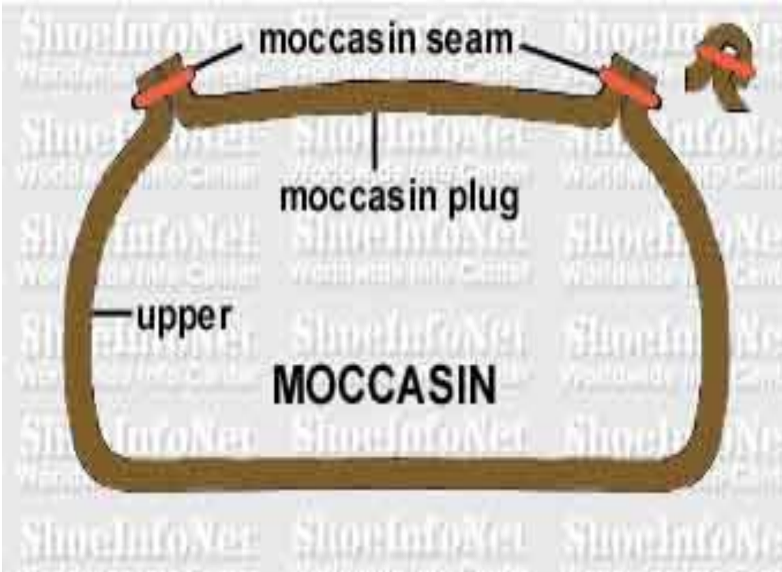
It is a type of construction where Lasted upper is directly attached with the outsole by means of adhesive. Prior to sole attachment, the upper is mounted on the last (Lasting) and the lasting margin is secured with the insole by means of adhesive and/or tacks. Bottom filler is used to fill up the cavity between insole and lasting margin.

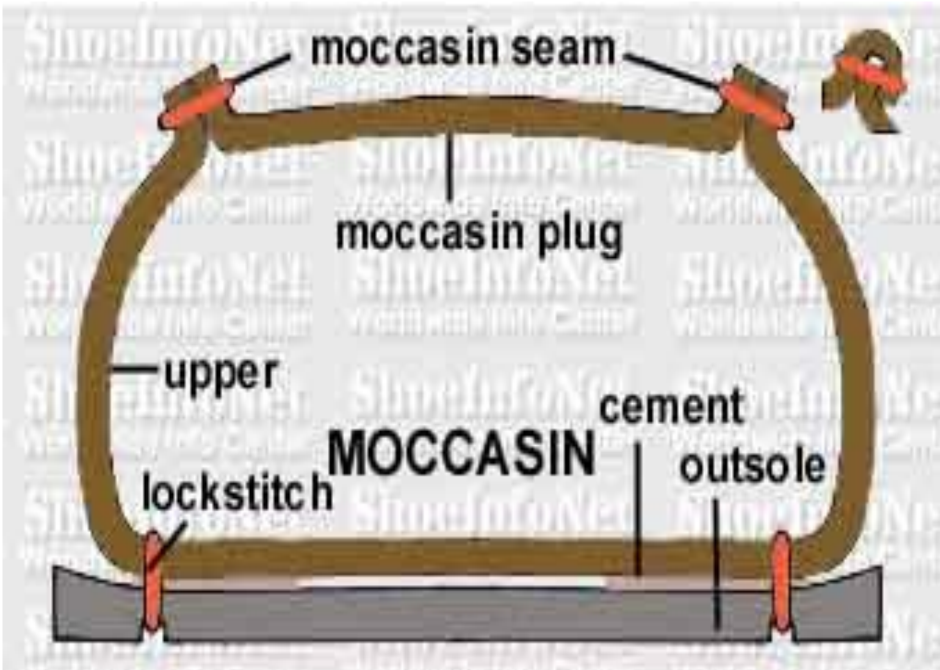

CEMENT LASTING
upper
insole
cement


upper
CEMENTED
insole
cemented
filler
outsole

B. Moccasin construction

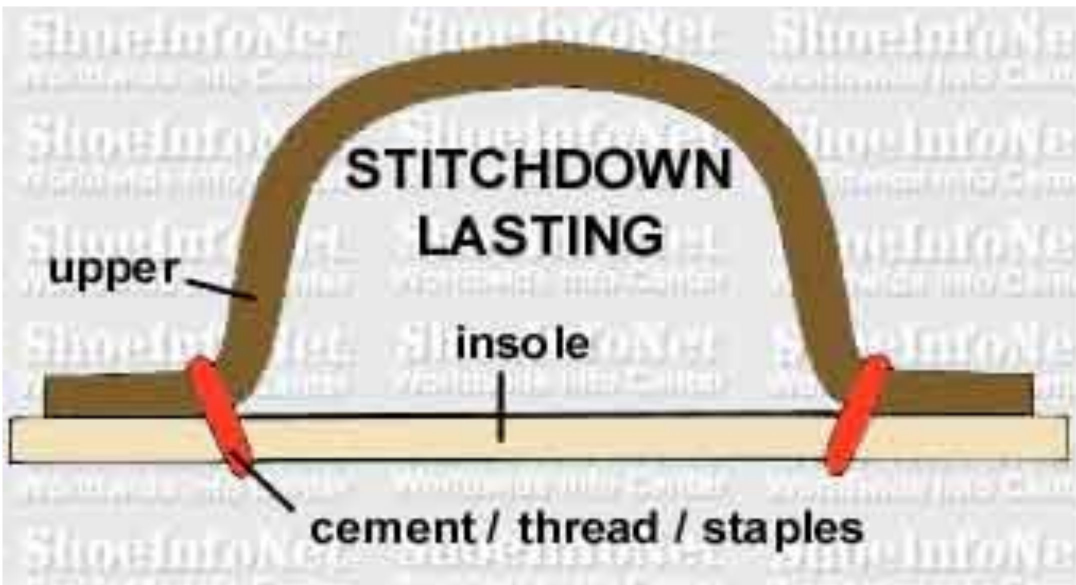
It is a type of force lasting (i.e. the upper is forced over the front of the last with the back being pushed into right position) where the moccasin plug stitched before lasting.





C. Stitch down constructions

Stitched construction is where functional stitching is used during assembly of upper to the bottom components. Amongst the existing manufacturing processes where stitching plays important role in fastening the upper with any of the components mentioned below is known as stitched construction. These components can be midsole, runner, welt and the outsole.



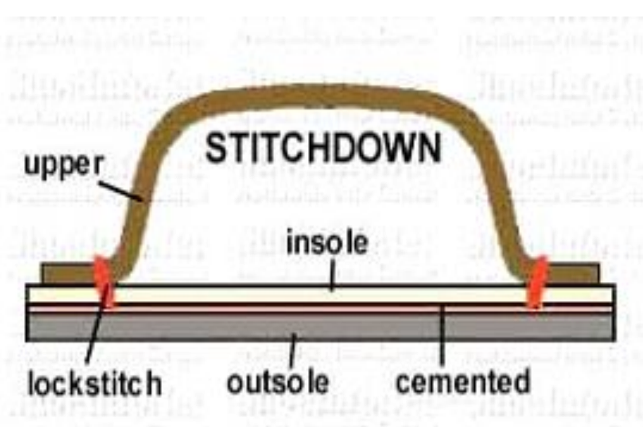


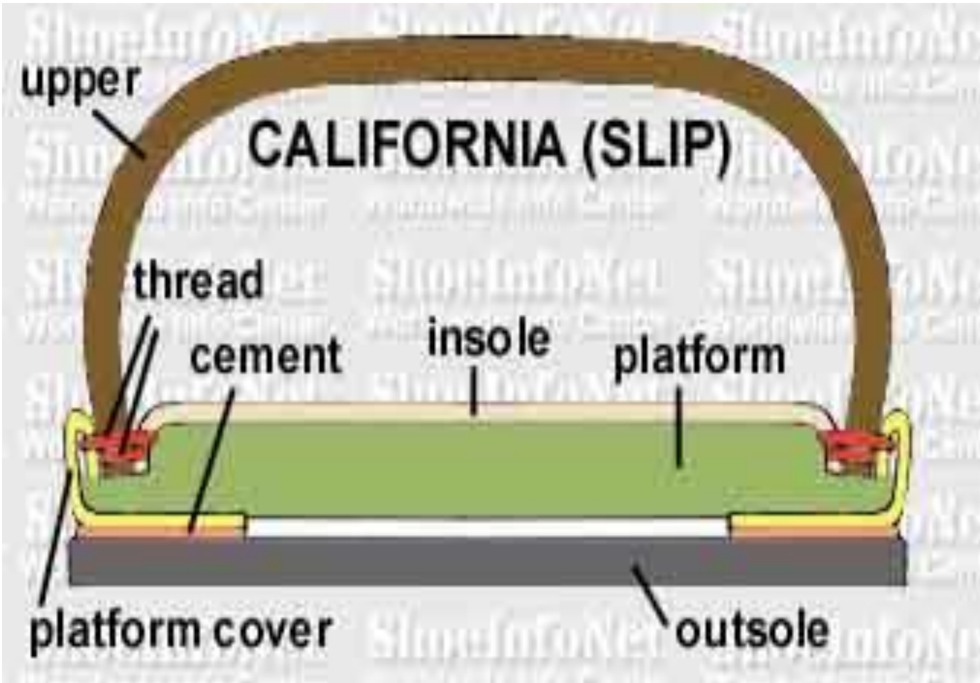
Fig: basic stitch down construction

There are different types of stitch construction. These are:

- **VeldtSchoen:** In this construction the upper is pulled over the last and attached over to the extended part of the insole (runner), and then sole is stuck on. Then the raw edge leaved (the upper materials, runner, insole and sole) is trimmed and coloring is done. A cheaper method used to produce lightweight flexible soles for children's shoes and some casual footwear describes the upper turned out (flanged) at the edge of the last. This is then stitched to the runner.
- **Directly stitched to sole:** in this construction the upper is hand sewn or machine sewn directly through the out sole.

D. California construction

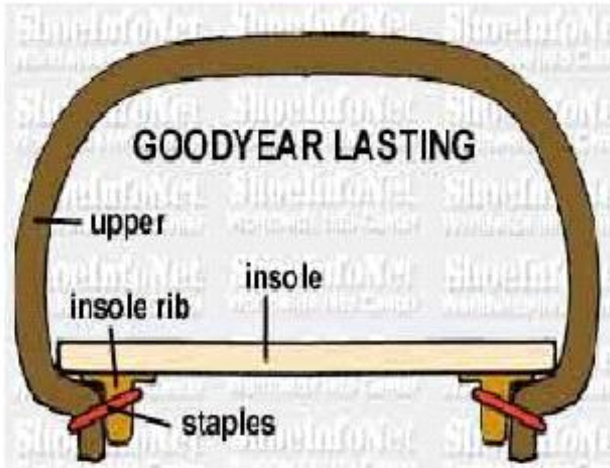
This construction follows a process of cementing, drying, activation and then finally sole press.



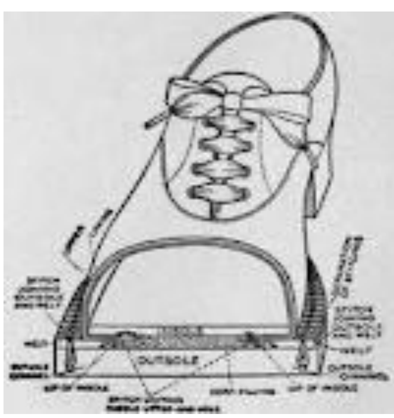
E. Good Year welted construction

It a construction type where the soles are attached to the welt or runner or any other intermediate component which are these already being attached to the lasted upper.

For high quality dress and town shoes the top section (or welt) is chain stitched to the upper and insole rib at the point where it curves under the last. This is supplemented by a lockstitch out seam bonding the welt and outsole. The outsole is then sewn to the welt around the edge. Goodyear Welt creates heavier less flexible footwear.


GOODYEAR LASTING
upper
insole
insole rib
staples


DE MARCHI



F. Strobel construction

It is known as force Lasting (Strobel-stitched method or sew in sock). In strobel construction (sewn-in –sock) the upper is forced over the front of the last with the back being pushed into right position. Force lasting has evolved from sport shoes but is increasingly used in other footwear. The Strobel-stitched method (or sew in sock) describes one of many force lasting techniques. The upper is sewn directly to a sock by means of an overlooking machine (Strobel stitcher). The upper is then pulled (force lasted) onto a last or moulding foot. Unit soles with raised walls or moulded soles are attached to completely cover the seam. This technique is sometimes known as the Californian process or slip lasting.

G. Molded Methods

The lasted upper is placed in a mold and the sole formed around it by injecting liquid synthetic soling material (PVC, urethane). Alternatively, the sole may be vulcanized by converting uncured rubber into a stable compound by heat and pressure. When the materials in the molds become cool the sole-upper bonding is complete. These methods combine the upper permanently into the sole and such shoes cannot therefore be repaired easily. Molded methods can be used to make most types of footwear.

The vulcanized sole shoe: Almost all rubber-soled canvas footwear has been made by this process since the turn of the century, however, advances in machine design and rubber technology have made it practical to mould in place and vulcanize a complete rubber outsole and heel unit on an assembled leather upper in one operation.

The injection moulded sole shoe: This relatively new process of simultaneously moulding and attaching sole and heel units. This process is becoming increasingly popular, especially for casual footwear. The method used is fundamentally similar to the vulcanizing process as far as the lasting of the shoe upper is concerned. Canvas shoes to be soled by the injection moulded process; however, may be lasted by a process known as string lasting. The injection moulded process uses vinyl plastic material instead of rubber for the sole and heel.

H. String lasting

It features a special heavy gauge drawstring sewn by over locking sewing machine round the margin of the flat upper.

Self-Check 7	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

True or False: (Total points: 5)

1. **Construction** is a method of assembly of the footwear.
2. Cement lasting is a type of construction where Lasted upper is directly attached with the outsole by means of adhesive.
3. Moccasin is a type of force lasting.
4. Goodyear welted a construction type where the soles are attached to the welt or runner or any other intermediate component which are these already being attached to the lasted upper.
5. In VeldtSchoen construction the upper is pulled over the last and attached over to the extended part of the insole (runner), and then sole is stuck on.

Short answer questions: (Total points: 4)

1. What do you mean by footwear construction? (2 points)
2. What are the different types of footwear construction? Discuss each of them briefly. (2 points)

LG#19	LO #6- Identify footwear materials

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying materials used in footwear production
- Identifying types and sources of materials
- Identifying characteristics of materials
- Identifying generic and trade names for materials

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify materials used in footwear production
- Identify types and sources of materials
- Identify characteristics of materials
- Identify generic and trade names for materials

Learning Instructions:

Read the specific objectives of this Learning Guide.

- Read the specific objectives of this Learning Guide.
- Read the information written in the "Information Sheets 1".
- Accomplish the "Self-check. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheets 1.
- Read the information written in the "Information Sheet 2".
- Accomplish the "Self-check 2". Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 3". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 2.
- Read the information written in the "Information Sheet 3".
- Accomplish the "Self-check 3". Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 4". However, if

your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 3.

- Read the information written in the “Information Sheet 4”.
- Accomplish the “Self-check 4”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.

Introduction

There are different types of materials with different characteristics that are used in foot wear production. These are the upper and lining materials, soling materials, adhesives, chemicals, fabrics, nails and tacks, toe puff and counter stiffener, and other materials.

- **Different types of upper leather**

Leather can be made from the skin of any animal, bird, fish or reptile although only that from cattle and a few other farm animals, such as sheep, are of major commercial importance. It can be produced through different manufacturing processes, ranging from cottage industry to heavy industry. Upper leather is the leather that forms the upper of a shoe or the leather suitable for making uppers.

There are different types of leather used for upper making in shoe-making today. Upper leather can be prepared from the following.

- Cow leather
- Sheep leather
- Goat and Kid leather

Cow leather

Cow leather is leather made from cattle hides. It is the most common leather used for bath shoe uppers and soles.

It used for all types of shoes and goods. Cow leather is mostly used for making upper.

Calfskin: Skin of very young cattle, usually only a few months old. It is soft, fine grained, supple and strong. Widely used for uppers in higher priced shoes.

Sheep leather

Sheep leather is used for lining and uppers for certain types of footwear (men's and ladies shoe lining and upper), gloves and garments. The sheep upper leather is soft and supple leather and found with lesser defects.

Goat and Kid leather:

They are made from skins of goats. It is soft and suited to women's fashion shoes.

''Kid'' is the term applied to full chrome leather made from the kid of goat skin for use as footwear uppers (men's and ladies upper). Even though goat skin is relatively thin they are strong and have a very hard-wearing grain. Glace kid is used for making upper of high quality dress shoes. This leather has a highly polished but natural grain appearance and with regular cleaning and polishing, retains its high polish and well gloomed look. It is also used for glove making. Old goat skin is used for making suede and printed leather as they have coarse grain.

- **Different type of lining leather**

Lining is the material which constitute the inside of the footwear i.e. the materials against the foot. Lining can be prepared from the leather of following animals:

- Cow
- Sheep
- Goat

Cow Lining

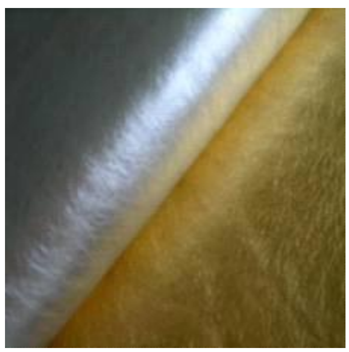
Cow lining is thinner leather made of cow. It is preferably used in the natural form as Drum Dyed (DD) lining in the high value shoes and is also available as finished leather. Cow lining is stronger leather and is used in the thickness range of 0.7-0.9 mm.

Sheep Lining

Sheep Lining is known for its softer, supple and warm feel. This type of lining leather is generally used in the thickness range of 0.6-0.8 mm.

Goat Lining

Goat Lining stronger compared to sheep lining leather.. The grain of goat leather is compact and hence the abrasive strength of goat lining leather is better. The preferable thickness range of goat lining is 0.6-0.8 mm.



- **Different type of soling material**

Sole is a bottom piece of any variety of footwear which comes in contact with the ground. Leather was always the main soling material in past. In recent years this has been largely superseded by other materials, for example, rubber (both vulcanized and microcellular), crepe, synthetic resins and more recently PVC (plastic) and polyurethane.

Many types of shoe bottom materials, other than leather, are used in modern shoe making. Almost 80% of all shoe soles today are non-leather. Man-made materials permit the production of shoe bottoms that may be tailored to meet the requirement of specific end uses.

Shoe bottom materials for industrial work shoes, for example, can be made oil and acid-resistant by the use of neoprene or nitrile rubber types. Cellular soling also enters into the picture, and it contributes to the insulation of such types of footwear, as do cork and rubber compounds. These materials have an added safety advantages in that they can be made relatively non-slip.

In general, it may be said that synthetic soling is used for reasons of price and wearing qualities. Synthetic rubber compounds were first used as soling in lower priced shoes. Today, these materials have been developed so that they can be handled like leather. That is, they may be stitched, cemented or edge finished in the same manner.

Soling materials are of two types. These are:

- Synthetic soling materials
- Leather as soling material

Synthetic soling materials

There are different types of synthetic soling materials. They can be described as follows.

Poly vinyl chloride Sole (PVC)

Polyvinyl Chloride (PVC) soling is used extensively where superior wearing qualities are required. PVC soles may be cemented or moulded directly to the shoe. Such soling is lightweight, long wearing and will not mark floors.
The advent of PVC as an injection moulded material for soles in the early 1960's was rapidly adopted by the footwear trade as an alternative to vulcanized rubber. It is suitable for direct moldings on to shoe bottoms or can be used to produce a wide variety of moulded unit soles. Fairly soft grades of PVC are used so that a good bond and good wearing properties (similar to that of a medium grade rubber) can be obtained. PVC needs to have a patterned surface to overcome a tendency to slip.

Poly Urethane Sole (PU)

Polyurethane [PU] soling are formed by a process called reaction moulding. It is a sort of polymerization process, compounding process, and moulding process rolled into one.

A polyurethane sole is made by metering the necessary chemical ingredients in liquid form (or ingredients rendered liquid by heating) into a mixing chamber, mixing them, and transferring the mixture into a mould. While they are still in the mould, they react to form polyurethane. Gas is produced during the reaction, and this causes the polyurethane to assume a cellular structure. The basic chemical ingredients of a polyurethane soling are a polyhydroxy compound and a diisocyanate. These two chemicals react together and build up the polymer chain structure. Cross-linking agent catalysts (the equivalent of the accelerators used in rubber), silicone blowing agent, and pigment coloring (if required) are necessary additional ingredients.
To produce the soling, the two streams are mixed together by the moulder, in the right proportion and injected or poured into the mould. The measuring, mixing and moulding are also done in the machine. The two streams are usually called resin and hardener.

Rubber Sole

Solid rubber is mainly used in the trade for vulcanized footwear. The main attribute of solid rubber is that is can be compounded to any quality required. It tends to be rather heavy due to its density (specific gravity 1.2).

Microcellular Rubber is the same compound as solid rubber with a blowing agent added, which turns to gas at a certain temperature in the vulcanizing temperature range. The specific gravity of 0.85 makes it light in weight and cushions the foot better than solid rubber.

Thermoplastic rubber Sole (TPR)

Thermoplastic Rubber is a range of rubbers possessing the moulding and processing characteristics of a thermoplastic and the physical properties of vulcanized rubber. These properties are obtained by synthesizing a rubber that contains chemical groups or chemical arrangements of that can act like cross link under end - use conditions but can be dispersed under moulding and processing conditions by the action of heat simply, thermoplastic rubbers are polymers containing movable cross link. Only two kinds of these materials are used in the shoe industry. One is the thermoplastic form of polyurethane which is quite hard and used mainly for football boots and spiked running shoes and some top-pieces. The other is another form of the styrene-butadiene copolymer. The shoe industry broadly refers to the styrene butadiene copolymer as thermoplastic rubber. In this particular styrene butadiene rubber, the two base monomers are polymerized so that they each form blocks within the polymer rather than having a random structure. This block structure, for which reason the polymer is called styrene -butadiene-styrene [SBS] rubber to differentiate it from the vulcanizing version [SBR], provides the necessary strength to use the rubber without vulcanization and to process it like a thermoplastic.

EVA & Phylon Sole

EVA [Ethylene Vinyl Acetate] is a chemically blown compound which in appearance is similar to microcellular rubber. EVA is used as a substitute for microcellular rubber as soling material for sandals in the cheaper end of the trade. It does not have such good wearing qualities as microcellular rubber, and good bonds to the shoe are difficult to obtain.

Crepe Sole

Plantation Creep is a material made from pure rubber. It is produced by coagulating the rubber latex taken from the trees directly into sheet form. It is not extensively used because it is expensive and cannot be bonded directly to leather uppers, although it is hard wearing. It is adversely affected by oils and petrol and that it softens and spreads in wear.

Resin rubber

The introduction around 1950 of synthetic material manufactured from a combination of butadiene (synthetic rubber) and styrene (plastic) revolutionized finishing operations. This brought about a complete change in shoe manufacturing processes, in so much as old finishing operations have been eliminated by refinishing the complete sole and heel unit before it is attached to the bottom of the shoe. The majority of resin rubbers are used for women's footwear but a proportion has been used for men's and children's styles. Resin rubber is a uniform material and so lends itself to refinishing. It may be used in sheet form or as a moulded unit.

Leather as soling material

Leather sole: Leather can be used for making leather sole. Leather sole should be Solid, bold and flexible. It should not wear out easily, it must not increase in area as a result of shoe wearer's body pressure and at the same time it should not crack when subjected to a certain degree of bending on a specified metallic ball or rod.

Vegetable tanned sole leather

The real secrecy of vegetable tanning of heavy leathers like the sole lies mainly with their degree of tannages, which can be defined as the quantity of vegetable tannins fixed by 100gms of the hide substance. For high value of D.T. (Degree of tannage) a large quantity of tannins should enter into pelt and at the same time chemically react with collagen, so that the tannins cannot be extracted out with water.

The degree of tannage of sole leather is highest and lies between 90 & 95, even though this D.T. for leather can be raised up to 120 or more. When D.T. exceeds 100 the fiber structure of leather gets disoriented or destroyed and the leather becomes hard like piece of horn which cannot be made flexible with the best lubrication.

The D.T of the softer type of sole leather for which there is heavy demand in the Indian market should be much less than 90 degree. The term "Sole" in the international market means leather with D.T. of not less than 90 degree.

Leather sole has the following advantages:-

- It is one of the most hygienic soling materials with ease of perspiration as the upper leather
- It gives product the unique/ antique class & appearance as desired in high class footwear.
- Good sole bonding with upper cement due to fibrous structure present.
-

The main disadvantages of its usage are:-

- It is very expensive sole and the cost further increase due to restriction of various quality regions of hide.
- It is inflexible and sufficiency heavy.
- Its processing is quite time taking, skilled and expensive.
- It is less durable especially in wet conditions
- Cannot blend with modifiers as in polymeric soles to give a variety of properties.

- **Different types of adhesives**

An adhesive is a material used for holding two surfaces together. It is a substance capable of holding the material together by surface attachment.
An adhesive must wet the surfaces, adhere to the surfaces, develop strength after it has been applied, and remain stable.

The material must remain unaffected by age, environmental conditions and other factors as long as the bond is required. An adhesive used in shoe industries are:

- Latex
- Rubber Solution
- Poly Chloroprene or Neoprene
- Polyurethane
- Hot-melt Poly amide
- Hot-melt Polyester

Latex/ Natural rubber

Natural rubber is a product existing as a milky substance known as latex. Latex is a colloidal dispersion of rubber particles (hydrocarbons) in water.

Adhesives of natural rubber are prepared by:

- Dispersing latex in water(water based latex)
- Mixing in suitable solvents
- By grafting with a polymer

It is used in shoe manufacture mostly for temporary attachment before stitching of various components. The commercial names used are water based latex and solvent based rubber solution.

Rubber Solution

It is prepared by milling latex, together with the compounded rubber (crepe or smoked sheets) and dissolving the same in a solvent such as benzene or gasoline. It is used for establishing temporary bonding for edge folding, upper to lining attachment and socks lining attachment to insole and so on.

Poly Chloroprene or Neoprene

A Polychloroprene adhesive is used extensively today in footwear industry. All types of shoe sole except PVC, TPR & PU can be attached by Polychloroprene adhesives. But different materials require the correct type of adhesives and the right method. Much of the art of adhesive bonding is concerned with preparing the substrate surfaces before the adhesive is applied and making sure there's no roughness of the surfaces and all dust particles are removed.

Polychloroprene cementing has the property of auto adhesion, which enables the footwear manufactures to freshly cement the two components apart. Then after considerable open time, the adhesive film can be re-activated by heating with infra red lamps until tack is fully restored. Then the surfaces are joined together and subjected to maximum pressures.

Poly Urethane

A Polyurethane (PU) is used extensively today in footwear industry. The introduction of new polymer materials for soles and uppers has introduced new problems for the adhesives manufactures. Polychloroprene systems no longer hold the PVC soles to uppers satisfactorily. Bond failure happens on occasion, due to migration of plasticizers into the adhesive films. The solution of this problem is presented in the form of a solvent based polyurethane adhesive, which is unaffected by these chemical compounds. It is used for sole attaching purpose.

The following points should be taken into account when materials are bonded with PU adhesive:

- 7-10% hardeners must be mixed with PU adhesive before use.

- Leather uppers & soling materials must be properly roughed to remove loose fibers from the surface.
- PVC & resin rubber soles must be wiped with dilute iso-cynate solution in MEK before application of cement.

Cemented surfaces must be heat reactivated under infra red lamp before joining two surfaces together & press while hot.

Hot-melt polyamide

Most polyamide resins are used with epoxy adhesives; however those resins similar to nylon, (i.e. based on dimmer acids) are used as the thermoplastic adhesives in shoe and electronic industries. Hot-melt polyamide adhesive is used for seat and side lasting operation in shoe industry.

Hot-melt polyester

It is a synthetic resin having ester linkages in the main chain. Saturated - thermoplastic type mainly used in shoe lasting operations. Hot-melt polyester rod is used for toe lasting operation in shoe industry.

- **Chemicals**

The different chemicals used during stages of footwear manufacturing are:

Toluene

Toluene or methylbenzene C_7H_8, is colorless liquid aromatic hydrocarbon that melts at −95°C and boils at 110.8°C. It is insoluble in water but highly soluble in most organic solvents. Toluene is obtained from coal tar and petroleum by distillation. It is used as a solvent and as a starting material for the synthesis of many compounds, including dyes and explosives. When toluene is treated with a mixture of nitric and sulfuric acids (a process known as nitration), trinitrotoluene (TNT) is produced. Toluene is an important organic solvent, but is also capable of dissolving a number of notable inorganic chemicals such as sulfur.

Methyl Ethyl Ketone (MEK)

Methyl ethyl Ketone (MEK) is a colorless liquid with a sharp, sweet odor. Methyl ethyl Ketone (also known as 2-butanone) is a man-made chemical that is also found in nature. MEK is produced in large quantities. Nearly half of it is used in paints and other coatings. It is used for these products because it quickly turns into a vapor. It also dissolves in many substances. Other uses are glues and cleaning agents. In nature, MEK is made by some trees. It is also found in small amounts in some fruits and vegetables. Manmade MEK is released into the air from car and truck exhausts.
Methyl Ethyl Ketone (MEK) is the chemical that is used for PVC sole cleaning or wiping purpose in footwear industry.

Ethyl Acetate

It is a colorless, fruity-smelling liquid ester, CHCOOCH, formed from acetic acid and ethyl alcohol and used as a solvent, in flavoring, in manufacturing synthetic resins, etc. it is a colorless volatile flammable liquid, $CH_3COOC_2H_5$, used in perfumes, flavorings, lacquers, pharmaceuticals, and rayon and as a general solvent.

TPR Primer

TPR primer is the chemical that is used for TPR sole cleaning purpose in footwear industry.

Rubber Primer

Rubber primer is the chemical that is used for rubber sole cleaning purpose in footwear industry.

EVA Primer

EVA primer is the chemical that is used for EVA sole cleaning purpose in footwear industry.

- **Fabrics**

A variety of fabrics are used as upper and ling materials as per the fashion or choice of end user. The commonly used fabrics for footwear are:

Woven Fabric

A woven fabric comprises two elements of yarn known as warp and weft which are interlaced at right-angles to each other. Depending on the interlacement of weft and warp yarn they are classified as

Plain weave: The crimp in the warp and weft thread which alternate in the pattern of one up and one down in a plain or 1/1 weave.

Twill weave: One warp thread crosses over two weft threads and then under two. The next warp thread has similar interlocking but on subsequent weft threads.

Drill weave: There are two kinds of drill wears. The first, jean has the warp crossing over two weft threads and under one, the second the Florentine, which has the warp crossing over three weft threads and under one weft threads.

Satin weave: In the simplest satin weave the warp thread interlock over four weft threads and under one.

Non-woven Fabric

Non-woven is prepared by blending of polyester, nylon, polypropylene viscose rayon, and acrylic and by the help of needle loom it will be compacted. Then the fibres are passed through a bonding agent and pressed through a milling machine.

Non-woven fabrics are produced directly from fibres, bypassing the yarn style although they are often more expensive than woven & knitted fabrics. For the footwear industry the main disadvantages of uncoated non-woven are their lack of strength and their poor handle. Non-woven's are widely used however, as base fabrics for coating were there limitations are partly overcome.

The two main types of non-woven are felts & bonding fibre fabrics. Felts are generally too weak for upper linings. Their main application is as bottom fillers.

Knitted fabric

Knitted fabrics can be produced more cheaply and rapidly than woven fabrics, but fewer structural variations are possible. They stretch further and more easily than woven fabrics, especially, across the roll, but are less stable and tend to ladder from cut edges and stretchiness.

There are mainly of two types - Warp knitting and weft knitting. Fabrics in both categories consist of a series of interlocked loops. The horizontal row of loops are called courses & the vertical lines are called wales.

The footwear industry uses rather more warp knitted than weft knitted. The three main warp knit structures are: Tricot, Locknit and Satin. Tricot is used for linings laminated to other fabrics. It has a soft handle, good drape and elasticity.

Term tricot may be applied to many other types of warp knitted fabrics, most of which are used with foam or other fabrics to give combined upper materials & linings. Locknit is known for its smooth face and good resistance to laddering. This is laminated with foam to produce the skin fit linings used in slippers and general footwear.

Coated fabrics (Synthetics)

The fabrics coated with Poly Vinyl Chloride (PVC) or Poly Urethane (PU) for the development of leather look-a-like material known as synthetics.

In coated fabrics the coating provides the attractive finish and good wearing properties, whereas, the fabric provides most of the strength. The Colour, types, finishes & embossing which can be given to coated fabrics are unlimited and are difficult to differentiate from leather.

The two main types of coated fabrics are PVC coated & PU coated fabrics. PUCF's have a more attractive appearance and handle than PVC coated fabrics and are permeable. They are however, generally weaker, and the PU coating is less robust than PVC.

- **Rivets**

Rivets are used in footwear manufacturing especially in children sandals.

Main parts of rivets are:

- Head- this can be in silver, gunmetal, bronze etc.
- Base- this is a shaft with flat base. The shaft must be just 1mm longer than the thickness of the material to be riveted.

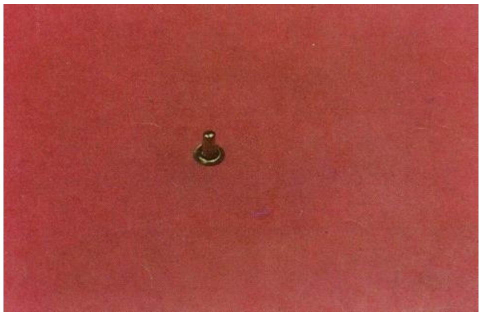


Figure: Base of rivets

Figure: Head of rivet

Pre punched holes are required to fix the rivets.

- The hole must be large enough for the base shaft
- The shaft is placed through the holes
- The head is then pushed firmly in to place by hand.

- When pressure is applied to the head, the shaft and head collapse around each other, locking them together. Thus holding the piece together.
- Single thickness material can also be riveted for decoration.

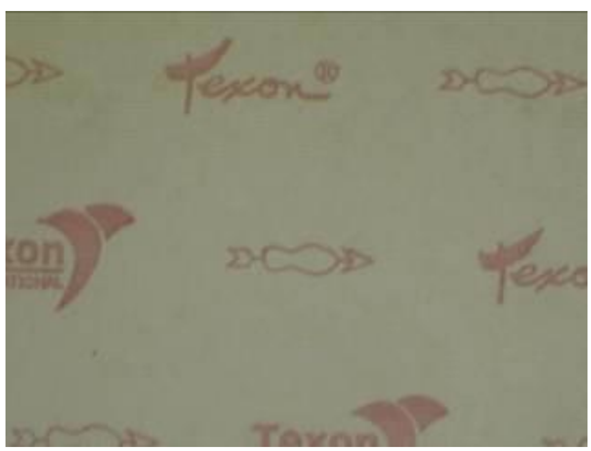
 

- **Shank board**

Shank Board/Becker board is a very hard and strong fiber board, able to withstand the tremendous loads which occur in the waist and heel of the shoe. It is again produced in much the same as way as paper.

However the main raw material is mixture of waste and recycled paper which, together with the vegetal bonding resins used in its manufacture, make shank board a very environmental friendly product. The molding quality of this type of board is less than cellulose board.

The standard sheet size of shank boards are 100 x 150 centimeter and the thickness is 2 – 3 mm.



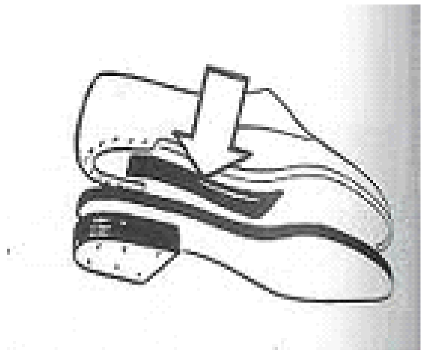
The following raw materials are used for the manufacture of backer board;

- Paper pulp
- Dye
- Hard resin binder
- Aluminium sulphate
- Preservative

- **Steel Shank**

It is a thin strip of material usually wood or steel used to stiffen or to prevent excessive bending of the plantar arch**.** Steel shank is one of the most vital components in a shoe. In providing essential support for the arch of the shoe, it has to withstand heavy bending and torsional stresses whilst maintaining accurate alignment of forepart and heel throughout all the stresses of the shoe's life. A steel shank is probably the most severely stressed component in a shoe. It can be:

- Steel shank(chrome /non chrome)
- Wooden shank
- Single Flute
- Double flute



- **Insole board /Cellulose board**

Cellulose board for insole is made from wood pulp, resin and bonded with latex. As with leather boards it is supplied in sheet in various thicknesses, and in different grade.

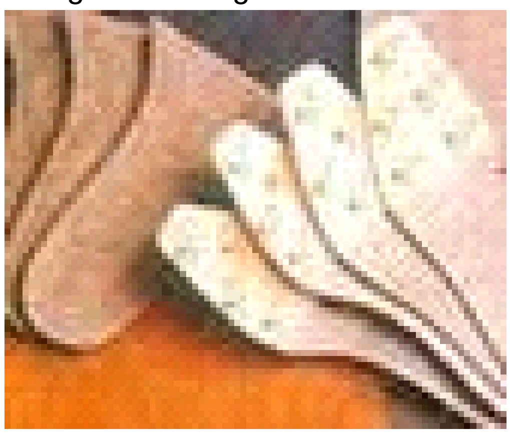
This material has better dimensional stability than leather boards.(i.e. does not shrink or grow). It is a flexible board. Common trade names are Texan, Bontex.

Typically women's insole use cellulose board of thickness 1.25 – 1.75 mm and men's insoles boards of thickness 1.5 – 2.25 mm. from a standard sized sheet of dimensions 150 x 100 cm about 33 pairs of men's insole can be obtained which translates to a usages norm of 450 square centimeter per pair of insoles. Similarly for women's insoles about 38 pairs can be produced from a sheet of 150 x 100 centimeter which is equivalent to suage norm of 395 square centimeter per pair of insole.

The characteristics of this material are:

a) Its ability to absorb moisture
b) Uniformity of substances
c) Resistance to shrinkage or growth (in change of humidity and heat)

- Resistance to hardening or cracking due to moisture or perspiration.



- **Eye-lets**

Eyelets are metal fittings, which are clenched in the holes of the quarters or tongues through which a string, ribbon or thong is passed to hold the shoe on the foot. It is a small metal disc with hole in the center used to reinforce lace holes. In footwear industry designs change rapidly. The use of eyelets in various shapes and sizes are sometimes used to effect these style changes. Eyelets can be fitted by hand held setting tool or by manual eyeletter or by electric powered eyeleting setting machine.

Eye-let selection

When a designer selects the eyelets to be used, he must ensure the eyelet dimension is suitable for the material being used no matter which shape of eyelet he chooses, whether it is round, oblong, oval or square. The size of the eyelet is measured as inside diameter or opening of eyelet and depends on the material and choice. Eyelet parts consist of:

- Barrel length,
- Head and
- Opening of eyelet.

Opening is usually measured in millimeters across the internal diameter.

Width of the head depends on the designer choice and material to be eyeleted. Technically, the eyelets having wider head is found most suitable for softer the material

The barrel length is measured in millimeters along the barrel. The length required would be decided by the thickness of material the eyelet will hold onto. Barrel must go through the material and flange over approximately the same width as head.

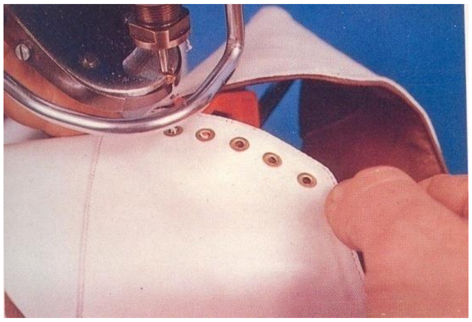
When eyeleting synthetic, fabrics and canvas a washer is normally used, it is placed over the barrel and locked in place by roll spreader. The washer should fit tightly over the barrel and should be slightly wider than the eyelet head. Now days plastic or other similar material kind of eyelets are in use for delicate and sifter kind of materials.

Visible eye-lets

Visible eyelets are ornamental and shown on the surface. The eyelet must clench to the material being worked on, whether the shoe may be lined or unlined, if shoe is lined, then the eyelet must clench on the lining firmly enough to hold the two pieces together. Visible eyelet is also known as ordinary eyelet. Eyelet holes should be reinforced with suitable reinforcement material. These eyelets can be fixed manually or by machine.

Invisible eye-lets

Invisible eyelets are not seen from the surface. And they clench only to the lining. They are also known as blind eyelets. A hole is made in the lining and upper and eyelet is inserted from the lining side. Then it is curled by roll spreader for invisible eyelets.



Tools and accessories required for invisible eyeleting is same as for visible eyeleting, but care should be taken during selection of punch and star spreader.

As it has already been made clear that the eyelets are fixed over the lining quarter during invisible eyeleting. When shoe is made and wear, the eyelets fixed on the upper are not visible that is why they are called invisible or blind eyelets. The lining material used in upper making is always soft and thin as compared to the upper leather. If any kind of metal fixing (eyeleting) is done on lining, it is obvious that the size of the eyelets should be smaller than the visible eyelets as per the amount of strain and stress lies on the material. A small eyelet refers to the diameter of head and length and width of the barrel. To meet such requirements, punch and star spreader tools are used during blind eyeleting is selected as per the dimensions of the punch and spreader.

D-ring

D-ring is an item used for lacing footwear, usually a metal ring shaped like the letter D. It may be secured to a surface with a metal or fabric strap. D-rings are used in place of eyelets as per the design or fashion requirements.

Hooks

Many shoes, sneakers and boots come with lugs instead of eyelets. These are usually flat loops made of cloth or leather, though they can also be rings, hooks or tubes made of metal or nylon. The shoelaces run through these lugs along the surface of the shoe rather than between the inside and outside of the shoe, resulting in somewhat different lacing.

- **Laces**

Laces are used to secure shoes, boots and other footwear. They typically consist of a pair of strings or cords, one for each shoe, finished off at both ends with stiff sections, known as aglets. Each shoelace typically passes through a series of holes, eyelets, loops or hooks on either side of the shoe.

How to keep your shoelaces tied is a question asked many times. It is a chronic problem everyone has that wears shoes with shoelaces.

One reason shoelaces come untied is caused by worn and stretched shoelaces. With normal use, the location of the shoelaces knot (bow) wears and stretches the fibers of the shoelace. These worn and stretched shoelaces will come untied more easily than shoelaces that are not worn and stretched. The main reason shoelaces come untied is because they are not properly tied.

- **Nails & Tacks**

There are many types of nails and tacks used in the manufacture of shoes designed to suit numerous lasting and assembling operations. Machine tacks with special finishes to enable trouble free running in machines are produced in various lengths to suit the material being used.

Types of nails and tacks

(A)

Square machine tacks

(B)

Round machine

(C)

(D)

Hand tack

Heel building nail

(E)

Screw eclipse nail

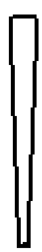
(F)

Buttress heel attaching nail.

(G)

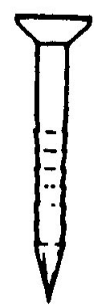
Rubber heel nail

(H)



Lightning nail

(I)



Temporary attaching nail

Fig: different types of nails

Use of nails and tacks

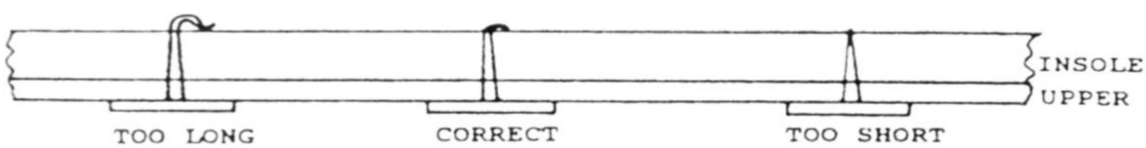
The nine tacks and nails illustrated are made for the following operations: -

- Used for seat, side and toe lasting
- A general-purpose tack used for hand lasting sandals and repair works
- Building leather heel and heel attaching
- The inside attachment of wooden heel
- The inside attachment of plastic heels
- The outside attachment of rubber heels
- The outside attachment of leather built heels

While deciding on the length of the tack required for lasting purposes, it is generally accepted that the tack is 1m.m longer than the thickness of material or materials it has to penetrate, to allow clenching. The tack or nail clenches when it hits the last bottom plate.

When uppers are lasted, the tacks penetrate the insole and must be turned over (clenched) so as not to stick into the foot.

Clenching



Hand lasting tacks and Machine nails

Hand lasting tacks are much sharper than machine tacks and have a much rougher finish to help penetration while hand lasting

Machine lasing tacks

Hand lasting tacks

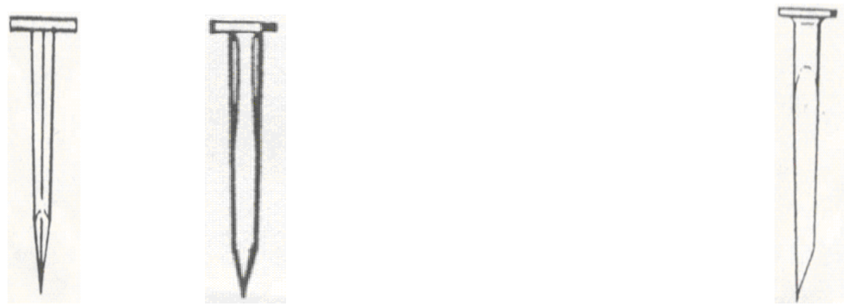


Fig: Machine and Hand lasting tacks

A hand tack has to be pushed by hand into the material before being driven home, a rough sharp tack gives a temporary hold into the material, whereas a smooth machine tack would not hold. A smooth finish is given to machine lasting tacks to enable the tack to run easily in the machines. Special points and spirals are put onto heel nails to ensure correct penetration and grip during wear.

Staples

There are numerous ways of attaching heels whether they are wood, plastic or leather. The heels may be attached by an ordinary staple, a specially designed nail or an ultrasonic staple Staples are used for various shoe making operations like:-

- Insole attaching
- Side lasting for stitch down or welted footwear
- Heel attaching in leather sole with knock on heels

Generally there are two types of staples are used, they are

a) Pre-formed staples
b) Wire staples

Pre-formed staples

Preformed staples are used for insole attaching or heel attaching in case of knock on heels. A driver fitted in to the machine drives the staples. In most cases the staplers are pneumatically driven.

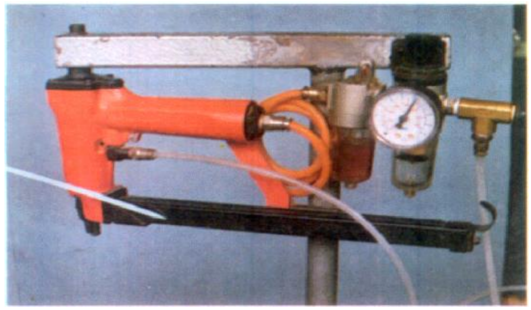
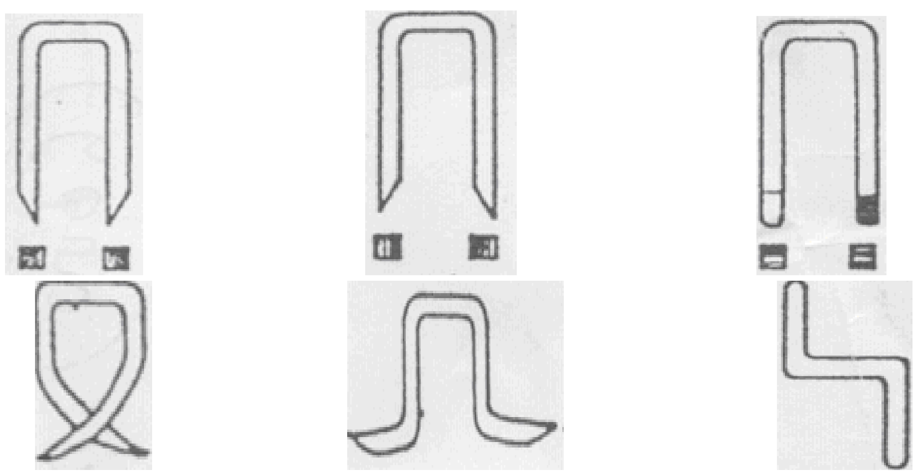


Fig: Pneumatic stapler

Wire staples

Wire staples Wire staples are used while side lasting of welted footwear or Stitch down lasting. The wire from a coil cut in a certain length by the lasting machine subsequently it takes the shape of a staple pin by an in built bending mechanism before being driven into the lasting margin.

A. B. C.



Convergent Divergent Twist

Fig: Wire staple types

- **Toe-puff**

It is a reinforcement used to retain the original contour of the toe part of the shoe. The choice of the toe puff for any given footwear type is influenced by many factors such as last shape, upper material type, production methods to be used, fashion and the views of industrial customers. The basic types of toe puff used in footwear industries are as follows.

Solvent activated toe-puff/ solvent dip toe-puff

It is a type of toe-puff which is activated/become ease for use when dipped in the solvent dip such as MEK and etc. These toe puffs are impregnated with either nitrocellulose or polystyrene resin. The solvent blend should contain toluene, which dissolves readily with the resin.

Thermoplastic toe-puff

It is a type of toe-puff which is activated/become ease for use when heated.

Steel toe-puff

It is a type of toe-puff used in construction of safety shoes.

Paint-on toe-puff

This is mostly done for the veldtschoen sandals. For this purpose, a light puff is adequate and shellac or a celluloid solution is painted. In this case there are problems of contamination of the upper and the adhesion.

Filmic toe-puff

Filmic puffs are a further development of the celluloid impregnated puff, are made from such polymers as ABS, Surlyn A and EVA. All filmic puffs developed recently are thermoplastic, having a heat sensitive adhesive in the bonding press in the same way as the impregnated types are activated. Some filmic puffs can compress and thereby absorb the creasing action of the upper.

Textile (impregnated fabrics)

The fabric used to make this type of toe puffs are woven, non woven, needle punched and stitched- bounded. These types of toe puffs are in two forms or types.

> **Thermoplastic type**: is which can be softened by heat and rendered sufficiently extensible and malleable to accept pulling over the lasting operations.

Solvent activated type: in which the toe puff is rendered soft and extensible in the factory by being treated with the solvent dipping or conditioning machine, again to make it receptive to shoe making operations.

- **Counter Stiffener**

Stiffeners are stiff materials similar to that of toe puff which may be moulded to the shape of the last back part or, alternatively, inserted flat and moulded during the subsequent process. It is normally inserted between the lining and the upper to support the back part of the shoe and grip the foot. Apart from the materials used which are similar to that used for toe puff except for the thickness, leather board can be used.

There are three types of stiffener:

- Flat stiffener
- Semi-moulded stiffener
- Fully-moulded stiffener

Stiffener can be:

- Solvent dipped
- Thermal activated
- Pre molded leather board

Self-Check 1	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. **(Total points: 14)**

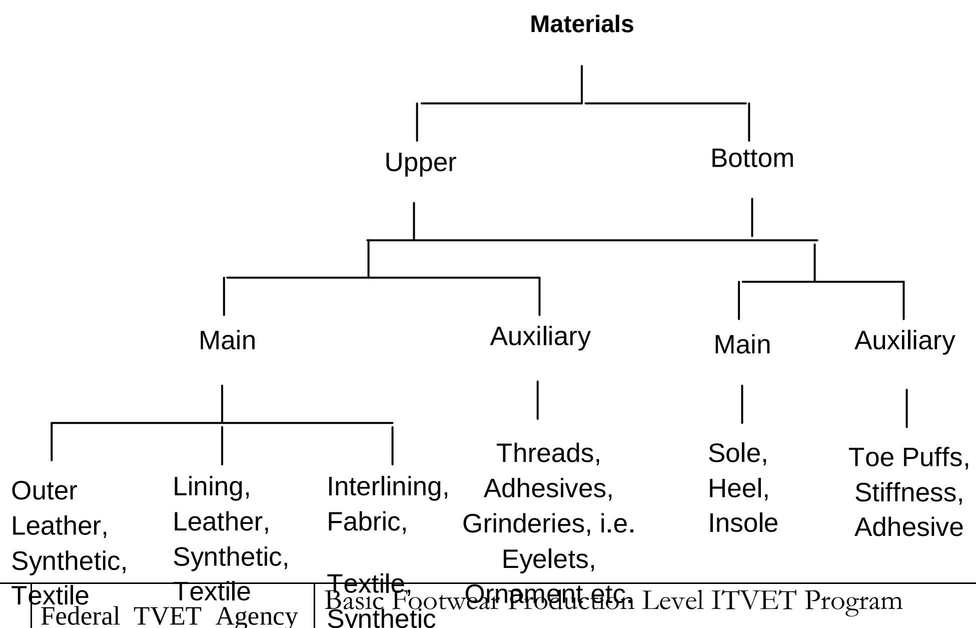
- What are the different types of leather upper materials that are used in footwear production? (2 points)
- What are the different types of lining materials that are used in footwear production? (2 points)
- Write down about the toe puff and counter stiffener (2 points)
- Write down about the different types of soling materials? (2 points)
- Write down about the PVC sole. (2points)
- Write down about the different types of adhesives used for making the footwear. (2 points)
- What is insole board? (2 points)

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 2 Identifying types and sources of materials

Shoe making materials are broadly classified into two groups. These are upper materials and bottom materials.



Leather upper and lining

Leather is a natural product, which is derived from the raw hide and skin of the animals.

Varieties of leather derived from cow, buffalo goat, sheep etc. are used for upper and lining making in various finishes and colors. Leather is the most suitable material to be used as shoe upper because of its breathability, texture, elasticity and plasticity properties etc.

Upper: is the material that constitutes the outside of the footwear. It can be leather or synthetic.

Lining: the material which constitutes the inside of the footwear i.e. the materials against the foot and it can be leather or synthetic.

Lining and upper materials can be made from different animal's skin and hide.

A. **Cow leather**: - is the leather derived from the hide of cow. It can be used for both upper and lining making purpose.
B. **Goat leather**: - is the leather derived from the skin of Goat. It can be used for both upper and lining making purpose.
C. **Sheep leather**: - is leather made from the skin of Sheep. With proper selection and processing they could be used as lining and upper leathers.

Footwear materials (non leather materials)

These are any fabricated or semi fabricated component made of various kinds of materials or combination of materials such as leather, textile, wood or synthetics for use in the manufacturing of the footwear.

Some these materials are:

1) Shank board   5) Foam   9) Inter-linings

2) Threads
3) Insole
4) Boxes
6) Counters
7) Soles
8) Laces
10) Toe-puffs
11) Adhesives
12) Eyelets

A. Insole board

Insole is the inner sole of the shoe which is next to the foot under the shoe sock. It is component usually multilayer (removable or not) covering the insole to improve the performance of the bottom assembly. Insole may be made of in one piece or, alternatively, in two pieces. When an insole is made from two pieces it is known as a blended insole. Insole can be made from the following materials.

- Cellular board
- Jelly filled PU insole
- Shank board
- Mid sole-Rubber
- Leather board

B. Shank board

Shank board is used in the shoe industry for supporting the sole of the footwear.

C. Toe-puff and counter stiffener

The function of the toe puff & Counter Stiffener is basically to provide shape to the forepart of the shoe, and in certain case, in the industrial boots, to give protection to the foot of the wearer. It is the mean by which the shape of the last forepart is reproduced in the finished shoe, and thus plays an important part in the appearance and the general performance of the majority of the footwear types.

Toe-puff

It is a reinforcement used to retain the original contour of the toe part of the shoe. The function of the toe puff is basically to provide shape to the forepart of the shoe, and in industrial boots to give protection to the foot of the wearer. It is the mean by which the shape of the last forepart is reproduced in the finished shoe, and thus plays an important part in the appearance and the general performance of the majority of the footwear types. The choice of the toe puff for any given footwear type is influenced by many factors of the last shape, upper material type, production methods to be used, fashion and the views of individual customers; all must be considered before a decision can be reached.

The basic types of toe puff used by the footwear industry are:

1. Paint on liquids
2. Impregnated Fabrics
3. Thermoplastic /Thermo adhesive (heat activated)
4. Solvent activated
5. Print on Hot-Melt Resin
6. Steel toe cap and etc.

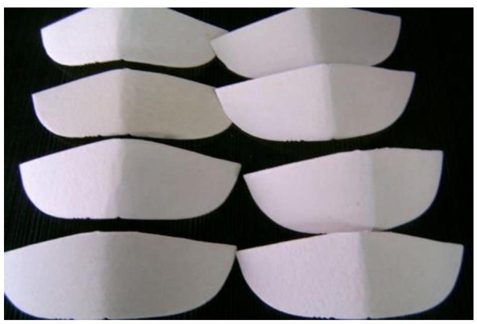


Fig: Extruded film (heat activated) toe puff

Counter stiffener

Counter stiffener materials are used to give stiffness, inserted between the lining & upper over the heel area. Stiffeners are stiff materials similar to that of toe puff which may be moulded to the shape of the last back part or, alternatively, inserted flat and moulded during the subsequent process. It is normally inserted between the lining and the upper to support the back part of the shoe and grip the foot. Apart from the materials used which are similar to that used for toe puff except for the thickness, leather board can be used. There are three types of stiffener:

- ✓ Flat stiffener
- ✓ Semi-moulded stiffener
- ✓ Fully-moulded stiffener

Stiffener can be:

- ✓ Solvent dipped
- ✓ Thermal activated
- ✓ Pre molded leather board



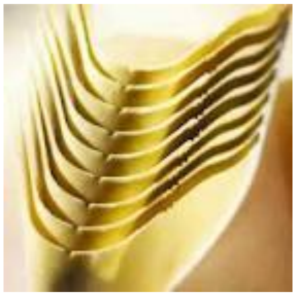


Fig: Counter Stiffener

D. Thread

It is a material used to join the components of footwear during stitching process.

Threads are made from fibers. Fibers used to make industrial sewing threads come from two major sources: man- made fibers or natural fibers. The ones used commonly in shoemaking are:

Natural Fibers

Natural Fibers come from plants and animals and are spun or twisted into yarns. Cotton is the most common natural fiber used to make thread. Other natural fibers include silk, wool, jute, ramie, hemp, and linen. Natural fibers are generally not as uniform as synthetic fibers and are affected by climatic changes.

Synthetic Fibers

Synthetic Fibers are made from various chemicals or regenerated from cellulose such as wood pulp and cotton waste. We select our synthetic fibers based on their sewing ability characteristics, seam performance, ease of dying, colorfastness, and pricing. Examples are: polyester, nylon, etc.

E. Adhesives

A general term for any of the several substances capable of bonding materials to each other by a chemical or a mechanical action, or both, and which may be activated either by water, non-aqueous solvents, pressure, heat, cold or other means.

An adhesive is a material used for holding two surfaces together. It is substance capable of holding the material together by surface attachment. An adhesive must wet the surfaces, adhere to the surfaces, develop strength after it has been applied, and remain stable.

In the closing room, the commonly used adhesives are: Latex, Rubber solution, Neoprene, and hot melt adhesive.

Generally two category of adhesives used in the closing room are **liquid** and **solid adhesives**. This category can be also divided further into **water base** & **solvent base** adhesives. Latex, Rubber solution and Polychloroprene come under the liquid category, while the solid category is followed by hot melt adhesive called Polyamide, which is used in thermo folding machines for folding purpose.

Latex, is rubber adhesive generally used for temporary attachments. This is mostly used for attaching the upper component and before some edge treatment (e.g. folding) before securing them with stitching. Spraying is the best method of application to avoid lump formation on the component. In case of bottom components, roller is the most suitable method known for applying this adhesive.

Rubber solution is used for lining attaching. While attaching the components from flesh-to-flesh, we can use rubber solution. This is a temporary adhesive, as the bond produced by this is not very strong. This is applied with the help of brush.

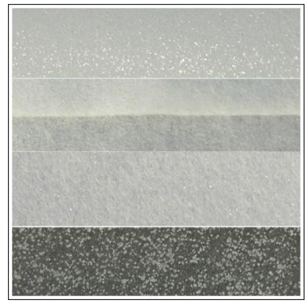
Polychloroprene is the adhesive, which comes under permanent category and used for attaching purposes, where normal adhesive cannot serve that purpose. This is most suitable for attaching grain-to-grain surface like vamp and quarter or quarter and eyelet facing etc. After attaching by this adhesive, one can avoid stitching operation, hence known as permanent adhesive. This is solvent base adhesive and hence costly than water base adhesive. But too much use of this adhesive on the material surface makes the product more stiff, rigid and increases material cost.

Water-based adhesive is not suitable for oily type of leather

Fig: Different types of adhesive

F. Inter-lining

It is any material inserted between upper and lining for the purpose of improving the upper or lining materials' strength.



G. EVA Sheets

Eva sheets (Ethylene Vinyl Acetate]):- It is a chemically - blown compound which in appearance is similar to microcellular rubber. EVA is used as a substitute for microcellular rubber as soling material for sandals in the cheaper end of the trade. It does not have such good wearing qualities as microcellular rubber, and good bonds to the shoe are difficult to obtain.

H. Textiles

Textile (fabric) is the term describes any woven or non-woven or knitted materials. Textile (fabric) derived from Fibers. Fibers may be of natural or synthetic (man-made) origin e.g. cotton, wool, silk, jute are the natural fibers whereas, nylon, viscose, Orion etc. are the synthetic fibers. Fibers are produced either as staples or filaments.

Fabrics and other man-made materials are being used more and more in shoemaking. Brocades have been used in footwear for hundreds of years, but today a wide range of fabrics and non-leather materials enters into the construction of all types of footwear. Textiles in all the well-known natural synthetic categories are specially produced to meet the particular needs of the shoe industry

Self-Check2	Written Test

Name: ______________________________ Date: __________________________

Time started: ________________________ Time finished: ___________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers

Fill in the blanks: (Total points: 6)

1. Shoe making materials are broadly classified into ----------- groups.
2. ------------------- is a natural product, which is derived from the raw hide and skin of the animals.
3. -----------------is the material that constitutes the outside of the footwear. It can be leather or synthetic.
4. ----------------- the material which constitutes the inside of the footwear i.e. the materials against the foot and it can be leather or synthetic.
5. ----------is the inner sole of the shoe which is next to the foot under the shoe sock.
6. ---------------------is any material inserted between upper and lining for the purpose of improving the upper or lining materials' strength.

Short Answer Questions: (Total points: 24)

1. Mention and discuss the two shoe making materials classification. (2 points)
2. Leather is most suitable material to be used as upper. Why? (2 points)
3. Describe briefly the terms upper and lining. (2 points)
4. Discuss the sources of upper and lining materials. (2 points)
5. Discuss non leather footwear making materials. (2 points)
6. Briefly explain the following footwear materials. (6 points)
   a. Shank board
   b. Insole board
   c. Toe puff and counter stiffener
   d. Thread
   e. Adhesive
   f. Textile
7. Discuss the uses of materials listed in question number six. (6points)
8. List the category of adhesive used in foot wear industry and explain them. (2 points

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 3	Identifying characteristics of materials

3.1 Leather

Leather is a durable and flexible material obtained from animal hide or skin, primarily cattle hide.

The hide or skin is converted into leather by a process known as tanning. The two main methods are chrome tanning and vegetable tanning. Most shoe leather is chrome tanned although mixed vegetable/chrome treatments are also popular. Chrome tanned leather has good resistance to heat, moisture and perspiration.

The skin or hide of most animals consists of three main layers: the epidermis, the dermis (grain layer & corium layer) and the hypodermis (flesh layer).The epidermis is the outermost layer responsible for the colour of skin or hide. In Dermis, grain is upper layer and the corium is the main layer with thicker fibers and provides most of the strength of the leather. The hypodermis is a thin layer between the corium and actual flesh of the animal.

The epidermis and hypodermis are partly or wholly removed during leather making and the leather actually consists of grain layer and corium layer

Most skins are split down in thickness and the best leathers have the grain layer intact with varying amounts of corium.

Flawed leathers have the grain bulled or corrected before finishing. Most suede's are made from splits without the grain. A split may also be coated to simulate a grain surface.

Leather is usually sold as whole skins or as sides. A side is one half of a whole hide cut along the backbone.

1.2.2 Line of stretch and tightness

The direction of lines of tightness and lines of stretch play a major role in cutting of pattern from hide or skin.

Lines of tightness are defined as the direction in which the material does not extend in length or very little increment in length takes place on applying force by two thumbs.

Whereas, in the direction of **lines of stretch**, material is increased in length or stretches more by applying the same amount of pulling force.

Normally, the line of tightness is just at 90° to the lines of stretch.

T

S

These lines are important in cutting because the upper component must be cut in such a way that the lines of tightness cut along the length of the shoe for proper shape retention in other words, we say that the component are cut “tight to toe”.

This rule is strictly adhered to in cutting most types of footwear. It is disregarded only in special circumstances e.g. open toe sandal, boots etc. The diagram shown below illustrates lines of tightness and lines of stretch on a hide/side.

Lines of tightness **Lines of stretch**

1.2.3 Grain structure

Cow leather has a very durable and rough grain surface up on the age. It has fine grain structure depending up on its defects.

Sheep leather has finer and softer grain surface and varies in grain structure depending on the age. Young sheep has close and smooth grain structure. Old sheep has firm and solid skin with coarser grain structure.

Goat leather has fine and compact grain surface and varies grain structure depending on the age. Young goat has close and smooth grain structure. Old goat has firm and solid skin with coarser grain structure.

1.2.4 Size

Skin of different animals have different size. The size of sheep and goat leather ranges from 2-10 sq.ft while cow side leather size ranges from 25-30 sq.ft.

1.2.5 Nap

Nap is leather softness and silky touch, and needs to be finished in a delicate manner.

1.2.6 Substance

Skins of different animals have different thickness. The thickness of sheep and goat leather ranges from 0.4mm-1.2 mm. while cow upper leather thickness ranges from 1.0 mm-2.5 mm

- **Properties of leather**

For making footwear, leather is being replaced nowadays by varieties of synthetic materials available in the market due to the cost factor. But leather is still the most suitable material for making footwear and is superior to synthetic leather or any other leather substitutes.

The leather is fibrous in nature and due to this it can perspire giving the feet extra comfort. Also, the leather has got poor thermal conductivity, keeping the wearer cool in the summer heat and warm when it is cold. The elasticity and plasticity of leather allows it to adjust individual foot shape. The tensile strength, bursting strength, tear strength, flexing endurance, shrinkage temperature etc. are also observed to be considerably high when compared to synthetic materials.
Additionally, the leather is repairable and eco-friendly justifying its suitability as the best material. The structure of hides and skins and the tanning methods involved determine the actual properties of the given leather.
Suitability of leather for upper materials is due to its:

- Elasticity and plasticity
- Strength and stretch
- Permeability
- Surface characteristics
- Ease of working and maintenance

1.2.8 Adhesives

For a material to perform as an adhesive it must have four main requirements:

- It must "wet" the surfaces - that is it must flow out over the surfaces that are being bonded, displacing all air and other contaminates that are present.
- It must adhere to the surfaces - That is after flowing over the whole surface area it must start to adhere and stay in position and become "tacky".
- It must develop strength - The material must now change its structure to become strong or non-tacky but still adherent.

- **Soling materials**

The ideal qualities for a soling material are as follows:

- Durability
- Flexibility

- Water proof
- Lightness in Weight
- Slip resistant
- Uniformity/Dimensional stability
- Cement holding
- Temperature resistant
- Stitch / Tack holding

Testing of soling materials

It is obvious that soling material possess some basic requirements in order to make them suitable for soling purposes. Testing is done to evaluate the required properties and to ensure the fitness for use. Very common tests are essential in case of soling materials are:

- General state of soling
- Flex crack resistance
- Abrasion resistance
- Dimensional stability
- Sole adhesion
- Slip resistance
- Durability

- **General state of soling**: Soling materials are to have some basic properties like light weight, flexible, offer adequate strength, water resistance etc. Those are very common responsible factors for selection to solve the purpose as well as to feel comforts. To evaluate them following are very usual tests. (a) Hardness/Softness (b) Density (c) Tensile strength (d) Water proofness (e) Water absorption

- **Flex crack resistance:** The shoe is repeatedly subject to compression forces and flexing deformation at each step during walking. The area gets increased when it is bending during stepping and comes to the normal state when the step is completed. The sole should posses adequate flex resistance to prevent from flexing deformation**.**

- **Abrasion resistance:** The sole as the bottom surface of the shoe is in continuous friction with the ground under body pressure during walking. It can be abraded of gradually by reducing its volume by contact area. Such abrasion may be quiet significant or quiet justify.

- **Dimensional stability**: The shoe while in wear is subject of repeated compression forces, which may spread cellular soling material and thus make the sole deformed and ugly. To evaluate this property some sort of testing is carried out which are (a) Compression set (b) Heat shrinkage (c) Shrinkage due to all change in moisture content

- **Sole adhesion**: It is one of the very important properties of the soling materials that it should readily stick on to the upper with a permanent strong bond to avoid bond failure during wear. The sole adhesion and bond strength depend upon various factors like type of material, type of adhesives quantum of pressure, heat reactivation, temperature and preparation of soling upper.

- **Slip resistance**: Slip resistance is expressed as coefficient of friction which is obtained numerically by dividing the horizontal force required to cause slip by a vertical force applied on a material.

- **Durability**: Durability of soling material in a combination of property such as abrasion resistance, hardness, stress applied, and density of the soling material. All these characteristics can influence the tear and wear resistance or as such durability.

- **Textile materials**

Textile (fabric) is the term describes any woven or non-woven or knitted materials. Textile (fabric) derived from Fibers. Fibers may be of natural or synthetic (man-made) origin e.g. cotton, wool, silk, jute are the natural fibers whereas, nylon, viscose, Orion etc. are the synthetic fibers. Fibers are produced either as staples or filaments.

Fabrics and other man-made materials are being used more and more in shoemaking. Brocades have been used in footwear for hundreds of years, but today a wide range of fabrics and non-leather materials enters into the construction of all types of footwear. Textiles in all the well-known natural synthetic categories are specially produced to meet the particular needs of the shoe industry.

- **Toe-puff and Counter stiffeners**

Even with the current demand of less structure footwear, particularly in the search for foot comfort, the toe- puff & stiffener are still one of the most important ingredients in the production of footwear. Whether it is the high fashion, welted, or even sports shoes most of it requires reinforcement at the front and back side of the shoe. We have a wide variety of both the materials and also the several application techniques to suit both the application as well as artistic look of the footwear.

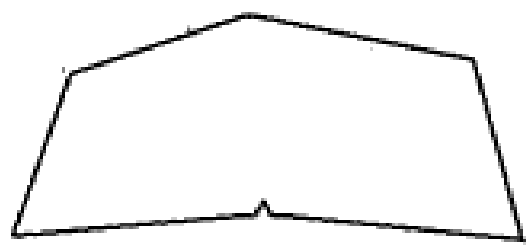
From the wearer's point of view both perform a similar function in maintaining the shape of the footwear and both must have a good wear performance which necessitates the ability to retain their shape & strength when repeatedly collapsed or exposed to moisture.

Additionally, a toe-puff should be able to flex with the foot in wear without causing discomfort or creasing.

The required hardness of the toe-puff and stiffener depends on the type of footwear. In lightweight casual shoes, soft materials are sufficient. Also the properties and shape of toe-puffs & stiffeners are influenced by fashion trends.

- **Flat Stiffener**

  This could be both solvent activated and Heat Activated and Cut from the sheets as per pattern to insert at the time of lasting.



Laminated type

- **Semi Molded Stiffener**

  Stiffener is added in closing section itself, Stiffener is finger molded before insertion. This type of stiffener is thermoplastic and needs to be softened by heat at some stage of lasting process.

Semi-moulded stiffener

- **Fully Molded Stiffener**

High quality shoemakers who wish to use high-grade leather board stiffeners often use this type of stiffener. The stiffener manufacturer molds it to the shape of the back of the last and the flange is molded in.

Fully moulded

- **Solvent Activated**

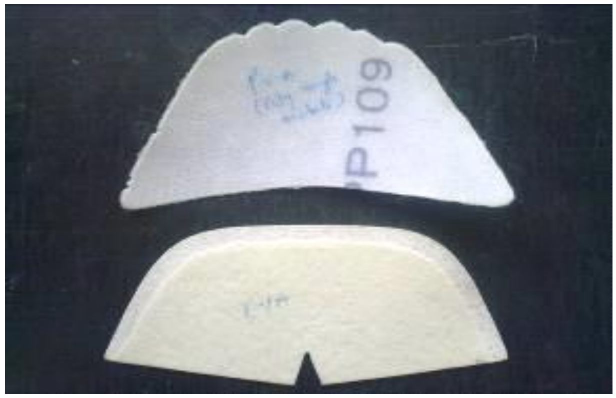
These puff are impregnated with either nitrocellulose or polystyrene resin. Polystyrene has recently become popular as the impregnating resin in solvent activated puffs. Production of the polystyrene sheet material is similar to that for the nitrocellulose type. The solvent blend to activate the puff should contain toluene, which dissolves more readily then the resin.

With all solvent activated materials, thorough activation is essential so that the materials easily conforms the shape of the back & fore part of the last. It is also essential that some portion of solvent is still present while lasting. However too much solvent's presence leaves the stain marks in the lining as well as upper.

The toe-puff must immediately be applied to the upper. The bonding takes place only when the toe-puff has sufficient amount of solvent in it.

- **Thermoplastic Materials:**

Adhesive coating on heat – activated puff (for heated press application) are based on P.V.A (poly vinyl acetate), E.V.A.(ethylene vinyl acetate),polyacrylate, polyurethane. Resin and plasticizer are added to impart the required adhesive properties. More recently, hot melt adhesive have been used. The adhesive is heated to 120-140 C and is applied as single coating.



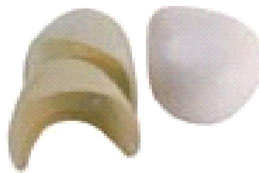
The following recommended uses of various types and thickness of puff are given as guidelines rather than as hard and fast rules.

	Solvent activated fabric-based puffs		**Thermoplastic**
	Cellulose – Nitrate impregnated	**Polystyrene impregnated**	**Polystyrene impregnated**
Women's shoes	0.7-0.9 mm	0.5-0.8 mm	0.4-0.7 mm
Women's heavy shoes and boots and children's and men's light shoes.	0.9-1.2 mm	0.8-1.0 mm	0.7-1.0 mm
Men's and Boy's shoes	1.2-1.6 mm	1.0-1.2 mm	1.0-1.2 mm
Men's heavy shoes industrial boots and sports shoes	1.6-2.0 mm	1.2-1.6 mm	1.2-1.5 mm

- **Steel Toe- Cap:** These toe caps we use in safety shoe Steel protective toe caps are extremely hard and difficult to damage. They are heavier than aluminum or plastic toe caps, and bend under pressure, anti-rusty.

- **Plastic Toe- Cap**

Superior strength-to-weight ratios:. At the same strength, thermoplastic plastic shoe toe is 50% and 20% lighter than using steel and thermosetting plastic respectively. No rusting, excellent corrosion, chemical and climate resistance.



Self-Check 3	Written Test

Name: _____________________________ Date: ___________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. **(Total points: 14)**

1. What are the properties of leather? (2 points)
2. What is the line of tightness in leather? (2 points)
3. Define the properties of soling materials. (2 points)
4. Define the properties of adhesive. (2 points)
5. How many types of testing we do in soling materials. (2points)
6. Define the properties of toe-puff and counter stiffeners. (2 points)
7. Write down about the steel toe cap. (2 points

Note: **Satisfactory rating - 7 points and above** **Unsatisfactory - below 7 points**
You can ask your teacher for the copy of the correct answers.

Score = ___________

Rating:
Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

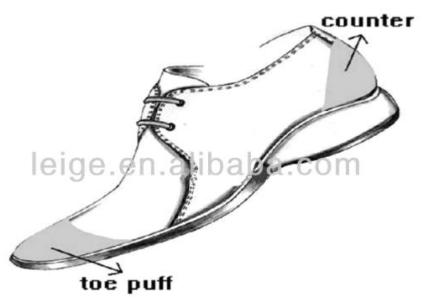
Information Sheet 4 Identifying generic and trade names for materials

For the awareness of the different footwear materials available in the market, it is required to know the Generic and Trade names. Following are the generic/trade names associated with selected footwear materials:

1.3.1 Leather:

Cow:	Cow Softy, Cow Burnish, Cow Smooth C.G., Cow DD Lining
Sheep:	Sheep Nappa, Sheep Cabretta
Goat:	Goat Glazed, Goat Suede

1.3.2 Toe Puff and Counter Stiffener:



Texon, TP Sheet etc.

1.3.3 Textile:

Drill Cloth, Sugar coated lining, Mesh, Tricot, Skinfit etc.

1.3.4 Adhesive:

PU, Latex, Rubber Solution, Bostik, Fevicol, Dendrite etc.

1.3.5 Soles:

TPR, PU, EVA, PVC, VT etc.

Self-Check 4	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. **(Total points: 8)**

1. What are the generic or trade names in leather category? (2 points)
2. What are the generic or trade names in Adhesive category? (2 points)
3. What are the generic or trade names in Textile category? (2 points)
4. What are the generic or trade names in Sole category? (2 points)

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Score = ___________

Rating: ____________

LG #20	LO #7. Identify Leather Manufacturing Processes

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying types of leather
- Identifying basic structure of the skin/hide
- Identifying tanning types and stage process
- Identifying basic crusting operations
- Identifying basic difference between corrected grain and full grain leather
- Describing types of finished leather
- Explaining and demonstrating method of storing leather
- Demonstrating the leather bundling

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify types of leather
- Identify basic structure of the skin/hide
- Identify tanning types and stage process
- Identify basic crusting operations
- Identify basic difference between corrected grain and full grain leather
- Describe types of finished leather
- Explain and demonstrating method of storing leather
- Demonstrate the leather bundling

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Read the information written in the "Information Sheets 1".
- Accomplish the "Self-check 1" in page 12. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #2.
- Read the information written in the "Information Sheet 2".
- Accomplish the "Self-check 2" in page 16. Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 3". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #5.

- Read the information written in the "Information Sheet 3".
- Accomplish the "Self-check 3" in page 20. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 4". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #8.
- Read the information written in the "Information Sheet 4".
- Accomplish the "Self-check 4" in page 24. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #11.

1.

Information Sheet 1	Identifying types of leather

Introduction

Leather is derived from raw hide and skin, which is a byproduct of meat industry. The outer covering of large animals is called hide whereas the outer covering of small animals is called skin. Raw hide/skin (H/S) is highly susceptible to bacterial attack. To make this highly putrescible material usable they are converted into a permanently preserved form. This permanently preserved form of raw hide/side is called leather.
Raw hide/skin is first converted to wet blue, which is in turn converted to crust and finally converted into leather by finishing.

This can be explained by the following diagram.

Raw hide/skin – –> wet blue – –>crust – –> leather

For making footwear, leather is being replaced nowadays by varieties of synthetic materials available in the market due to the cost factor. But leather is still the most suitable material for making footwear and is superior to synthetic leather or any other leather substitutes.
Leather is fibrous in natural and is still the most suitable material to be used as upper making because of its physical properties, elasticity, strength, plasticity, flexibility, ease of working, availability in varieties of color and finish, thermal conductivity etc.

The leather is fibrous in nature and due to this it can perspire giving the feet extra comfort. Also, the leather has got poor thermal conductivity, keeping the wearer cool in summer heat and warm when it is cold. The elasticity & plasticity of leather allows it to adjust to individual foot shape. The tensile strength, bursting strength, tear strength, flexing endurance, shrinkage temperature etc. are also observed to be considerably high when compared to synthetic materials.
Additionally, the leather is repairable & eco-friendly justifying its suitability as the best material. Now the structure of hides & skins and the tanning methods involved determine the actual properties of the given leather.

- **Upper leather**

Different types of leathers are used for upper making purpose in foot wear industry today. Some of these are listed and described as follows.

- **Full grain leather**

Full grain leather is often denoted by F/G. This type of leather has original grain pattern. Since, covering or hiding of grain is not done by finishing or plating the raw hide /skin from which this leather is made, it is almost defect free. Hence, the full grain leather is costly leather.
This type of leather has a natural look. This is mostly finished with aniline or semi-aniline. Sometimes, we have F/G leather in pigmented finish and also called F/G pigmented leather. Full grain refers to leather which has not been sanded or buffed.
Sanding or buffing removes surface imperfections from the leather, except in the case of nubuck where the buffing is very light.

Fig 1: full grain leather

- **Corrected grain leather**

A large proportion of the hide or skin coming to the tannery are full of defects and they are either unusable or it is very costly for shoe manufacturers to use them. The tanner therefore, endeavors to improve the quality by eliminating or rendering these defects by a procedure called “Correcting the grain side”.

If the raw hide/side is defective from the grain side, in tannery, the leather is buffed (rubbing with fine emery paper) from the grain side and then finished, plated at high temperature & pressure to give it a good appearance and again finished with heavy coats of pigmented finish. Since, correction of grain pattern takes place in the whole process, to hide the defects and increase the cutting value, this leather is called corrected grain leather often denoted by C/G.

Based on different design and different plates, different names is gives to C/G leather e.g. smooth C/G is a plain plated leather, hair cell printed, booty print etc.

Fig 2: corrected grain leather

- **Resin finished leather**

This kind of finish is normally given on a leather whose grain side needs covering or correction to hide the defects or imperfections. A heavy coat of pigment finish, which gives a very good covering effect, is applied on leather.

Finish for corrected grain leather, prime constituent is acrylic or meth acrylic binder, good covering power due to high content of pigments (coloring material), better water resistance, cannot withstand high temperature.

- **Suede leather**

If the grain side of leather is having more deep defects it is made velvety by buffing the flesh side. This leather is called suede. Suede leather is basically buffed leather with a fine velvety nap on the flesh surface. Dye finish is carried out in this case without binder and then proper fixation of the dye is done.

Fig 3: suede leather

- **Split suede**

If the leather is made velvety from both sides, it is called split suede. Course fibres of similar look are visible from both the sides. This leather can be utilized from both the sides.

If the grain side is totally defective then the fresh side is made usable by giving it a velvety appearance. This leather is called **reverse side suede.**

Fig 4: split suede leather

- **Nubuck leather**

In nubuck leather, the grain side of the leather is made velvety by snuffing. The nap in nubuck leather is very fine because of the tight fiber structure in the grain layer. The dye finish is done on Nubuck leather.

This leather has got a very good writing effect. Writing effect is the effect caused due to raised naps on the surface. When we apply our finger on the surface we get finger marks on this leather. This effect is called writing effect.

Note: Buff nubuck has low writing effect.

Fig 5: nubuck leather

- **Burnish leather**

This finish is given by a special kind of wax called burnishing wax which gives shine or burning gloss on high abrasive action (by rubbing on the surface). This finish is normally given on full grain leather.

Good burnishing effect can be observed using the specific tool as in this case a type of burnishing wax is used during finishing giving dry & shiny surface effect.

When you burnish something, you are making the object shiny using friction and pressure. Leather is usually burnished at the edges, such as on a belt, using a metal tool, like a spinning disk. Burnishing is different than polishing as no polish is used in the process. Leather must be fairly moist when burnishing, but not wet.


Fig 6: burnished leather

- **Glazed leather**

It is a type of leather in which a type of protein finish is done and the glazing effect is obtained by glazing machine. Glazed leather is leather treated with a pigment containing not only gloss, but also protection.

Compactness of grain is required to sustain the high temperature & pressure of the machine. Glazed finish is again a natural finish given normally on goat/kid leather. This has a very brilliant & natural gloss.


Fig 7: glazed leather

- **Oily leather**

This leather is oily in nature. It is carried out on full grain leather (partially snuffed). The pull-up oil (free oil) is when sprayed with the season and finally the oil is sealed inside by top coat permitting the oil to move freely inside, responsible for color change when pulling the leather. On pulling this leather or folding this leather, the oil deposited in between the layers is removed and give the folded pulled area a light color. Hence, this finish also gives a two-tone effect to leather. This effect is normally given on full grain leather. Cow leather having a pull up effect is called cow oil pull up. Sometimes, we have oil pull up effect even on milled leather. This leather is called milled oil pull up.

Fig 8: oil pull up leather

- **Patent leather**

Patent finish is basically a P.U. finish in which a special coating is carried out. The finish film thickness is restricted to be less than 0.15 mm. The mirror like appearance is the unique feature of this finish.

Patent PU Coated or PU Film Coated**:** A patent or PU coated leather is split leather with a thick film of PU laminated on it. This leather does not have breakability like leather because of thick PU film.

PU film coated leather is either a split or sometimes full grain leather with a very thin film of PU laminated on it. This leather breathes.

Fig 9: patent leather

- **Crimpled leather**

Distressed leather is any type of leather that has been treated to age the appearance of the leather while not weakening the overall integrity of the product. There are a number of different methods used to distress leather clothing and upholstery. Often, the goal is to give newly produced products a weathered and broken in quality that is sometime more appealing to consumers.

The use of distressed leather is common with many different types of items. Accessories like gloves, belts, wallets and hand bags are sometimes aged using one or more distressing methods. A jacket or coat, along with other clothing such leather pants and vests, are often aged to make the leather more supple without causing the material to weaken. Even leather furniture may be distressed, as the look and feel of the aged leather on a couch, sofa, or chair is often considered inviting.

While treating leather products is often conducted at home, there are manufacturers who offer new clothing and other products with distressed leather. While techniques vary, the leather is usually treated with a thin coating of some type of alcohol based agent, and then subjected to a series of steps aimed at creating wrinkles and creases in the grain. This pre-distressed leather may also undergo treatments that effectively scrape the material to lighten the color in random areas.

Fig 10: crimpled leather

- **Dry milled leather**

Very high quality Natural Dry Milled (NDM) leather refers to the high end vegetable tanning process of bovine (cow) leather. NDM is a softer leather finish which contains the natural texture of a top grain cowhide. Inside leather is durable cowhide leather.

Fig 11: dry milled leather

- **Velvety**

The leather is given a velvety look either on the grain side or flesh side by buffing (rubbing by course emery paper) or snuffing (by fine emery paper). In this process small fibres called naps are raised on the surface which gives a velvety look. Nubuck, suede, split suede and reverse side suede comes under this category.

- **Lining leather**

Lining leather is the leather that is used to constitute the inside of the footwear i.e. the materials against the foot. Lining can be prepared from the following different types of leather.

- **Drum dyed leather**

Drum dyed leather is obtained when leather is immersed in a drum with dyes and tumbled to insure complete color absorption.

- **Pigmented leather**

Pigmented (protected) leather is the most durable but is less natural in appearance, having a polymer coating. Pigmented leather is leather whose surface has a finish containing pigment particles that render the finish completely opaque.

Pigmented Leather is used in the majority of furniture upholstery and almost all car upholstery. The durability is provided by a polymer surface coating which contains pigments.

The surface coating allows the manufacturer more control over the properties of the leather, e.g. resistance to scuffing or fading. The thickness of the surface coating can vary.

Full grain pigmented leather: The grain surface is left intact before applying the surface coating.

Corrected grain pigmented leather: The grain surface is abraded to remove imperfections before the surface coating is applied. A decorative grain pattern is then embossed into the surface it is indistinguishable from full grain pigmented leather to the naked eye.

Fig 13: Pigmented leather

- **Pigmented split**

Pigmented leather is any top grain leather to which a clear topcoat and pigments have been applied. The pigments are what usually give the shiny even top color to the leather. The leather may or may not be aniline dyed. Sometimes the pigments (color) are applied to a base crust of a different color and in this case the leather in not dyed all the way through. If the pigments are applied to a hide that has been aniline dyed and matched for color then this leather is called protected aniline leather. Leather is usually pigmented to give it durability and hide its natural blemishes. Pigmented leathers are easy to maintain and have maximum resistance to wear, soiling, and fading from light. Pigmented split leather is the split pigmented part of pigmented leather.

- **Split**

Split leather is leather created from the fibrous part of the hide left once the top-grain of the rawhide has been separated from the hide. During the splitting operation, the top grain and drop split are separated. The drop split can be further split (thickness allowing) into a middle split and a flesh split. In very thick hides, the middle split can be separated into multiple layers until the thickness prevents further splitting. Split leather then has an artificial layer applied to the surface of the split and is embossed with a leather grain. Splits are also used to create suede. The strongest suede are usually made from grain splits (that have the grain completely removed) or from the flesh split that has been shaved to the correct thickness. Suede is "fuzzy" on both sides. Manufacturers use a variety of techniques to make suede from full-grain. Reversed suede is grained leather that has been designed into the leather article with the grain facing away from the visible surface. It is not considered to be a true form of suede.

- **Sole & insole leather (vegetable tanned)**

Sole and Insole leather: Leather was always the main soling material. The leather which is used as soling material is vegetable tanned buff leather and varies thickness from 4mm - 7mm.Sole leather should be Solid, bold, flexible; it should not wear out easily; it must not increase in area as a result of shoe wearer's body pressure and at the same time it should not crack when subjected to a certain degree of bending on a specified metallic ball or rod.

The real secrecy of vegetable tanning of heavy leathers like the sole lies mainly with their degree of tonnages, which can be defined as the quantity of vegetable tannins fixed by 100gms of the hide substance. For high value of D.T. (Degree of tannage) a large quantity of tannins should enter into pelt and at the same time chemically react with collagen, so that the tannins cannot be extracted out with water.

The degree of tannage of sole leather is highest and lies between 90 & 95, even though this D.T. for leather can be raised up to 120 or more. When D.T. exceeds 100 the fiber structure of leather gets disoriented or destroyed and the leather becomes hard like piece of horn which cannot be made flexible with the best lubrication.

Self-Check 1	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below.

- **Fill in the blanks: (5 marks)**

1. Raw hide/skin – –> --------------- – –>crust – –> leather
2. Pigmented (protected) leather is the most durable but is less ------------- in appearance.
3. The leather is given a velvety look either on the grain side or flesh side by buffing (rubbing by course emery paper) or --------------- (by fine emery paper).
4. Patent finish is basically a ---------------- in which a special coating is carried out.
5. Full grain leather is often denoted by ---------------------.

- **Match the words: (5 marks)**

• Glazed leather	• Leather is immersed in a drum with dyes and tumbled to insure complete color absorption.
• Drum dyed leather	• Basically a P.U. finish in which a special coating is carried out.
• Patent leather	• A type of protein finish is done and the glazing effect is obtained by glazing machine.
• Full grain leather	• By product of meat industry
• Leather	• This type of leather has original grain pattern.

- **One word answer: (5 marks)**

1. In the leather making process after wet blue what is formed?
2. What is the meaning of F/G.?
3. What is the meaning of C/G.?
4. In what leather the grain side of the leather is made velvety by snuffing.
5. What is the full form of NDM?

***Note:* Satisfactory rating – 100%** You can ask you teacher for the copy of the correct answers.

Information Sheet 2 Identifying basic structure of the skin/hide

RAW HIDE & SKIN STRUCTURE:

Raw hides & skins of domestic animals are commonly used for making leather. They consist of cattle hides (cow, ox, and bull), buffalo hides, calf skins, goat skins and sheep skins. Hides and skins differ in their structure depending upon the breed and origin of the animal, its mode of life, its food, its environmental conditions, age, sex etc. These factors also influence the leather manufacturing process.

Furthermore, there are differences in quality between different parts of the same hide or skin. In case of cattle hide the fibers are heavier in the back (butt) areas than in the belly and the hair is longer.

From anatomical structure point of view, in case of calf skins there is firmness of grain, smaller collagen fiber-bundles, smaller and closer hair follicles found as compared to cattle hide. As a result, calf skins have a very fine structure and therefore useful for finest of leather. In case of buffalo hides the hair pores are less in number and the pore diameter vary widely. Goat skins as compared to sheep skins have very tight, firm fiber structure but have fewer fats (grain is also very compact) and so are used in the manufacture of shoe upper leather for premium market segment. The wool sheep are more porous whereas the hair sheep is tighter.

The pig skin cross section shows the hair follicles going completely through & through the skin, the grain surface is rough having grouping of follicles. The horse hides have a structure resembling hair sheep or goat. It has also got a strong & tight fiber structure.

The alligator (reptiles) has the characteristic woven network of hide fibers with no hair follicles or fat glands.

Raw material Commercial use

Cow hides sole, upper, furniture, clothing, bags, splits Buffalo hides sole, upper, furniture, clothing, bags, splits Calf skins upper, clothing, lining, bags Goat & Sheep skins upper, clothing, lining Pigskin upper, clothing, lining Reptiles upper, bags, applications etc.

STRUCTURE OF HIDES/SKINS:

A.) ANATOMICAL STRUCTURE

B.) CHEMICAL STRUCTURE

A.) ANATOMICAL STRUCTURE

1. Epidermis

2. Dermis or true skin

3. Hypodermis or flesh layer

1 .Epidermis :

This layer forms the upper boundary of the skin. It constitutes only 1% of the total thickness of the h/s and serves to protect the layer beneath known as corium. This layer is made up of hard wearing layer of keratinous cells. The dead cell of keratin can be identified in the form of dandruff. The epidermis is removed from H/S during pre-tanning operations (liming & unhairing).

2. Dermis:

This layer consists of two layers: a) Grain layer and

B) Corium

A) Grain layer: Grain layer is also known as corium minor. It is the top of corium constituting about one fifth of the total thickness in case of cattle hide. This layer has a characteristic grain pattern due to the presence of hair follicles (responsible for the perspiration) in this layer. The grain pattern thus depends upon the density and structure of the hair follicles.

B) Corium:

Corium or reticular layer is the main part constituting leather and appearing like net like fibers of connective tissues. The entire corium is an inter-woven structure consisting of several fibers grasped together. Again each fiber consists of several fibrils bundled together. The unique properties of leather are largely dependent upon the interwoven fiber structure which is more or less preserved as it was in the original skin. The fibrous elements of skin float in or surrounded by a soft mucous substance caleed “Cementing substance” or “Interfibrillary tissue”. By the partial or complete removal of the cementing substance and by the permeation of tannins into the fibers and even into fibrils, the fibers are prevented from being cemented together when the hides or skin are dried. They are thus free to move over each other and the leather becomes flexible & pliable.

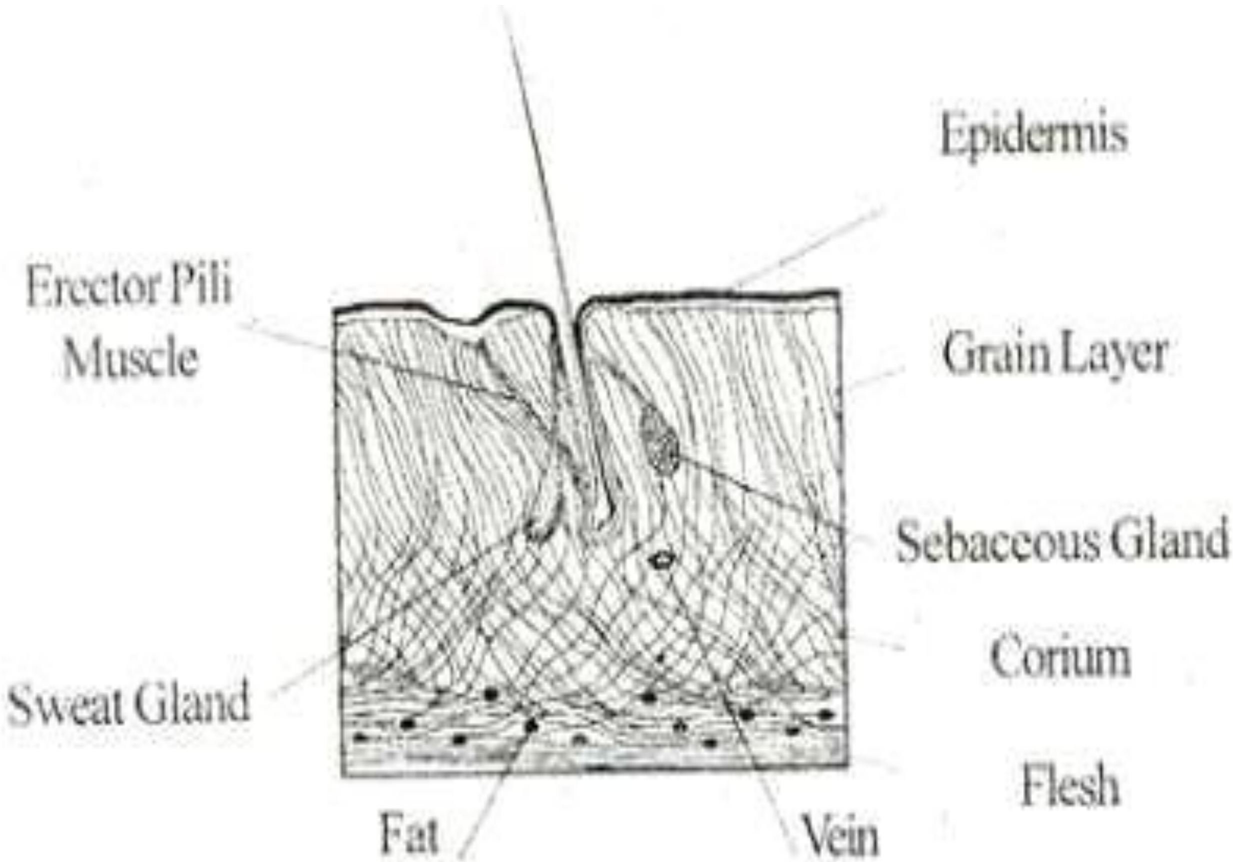
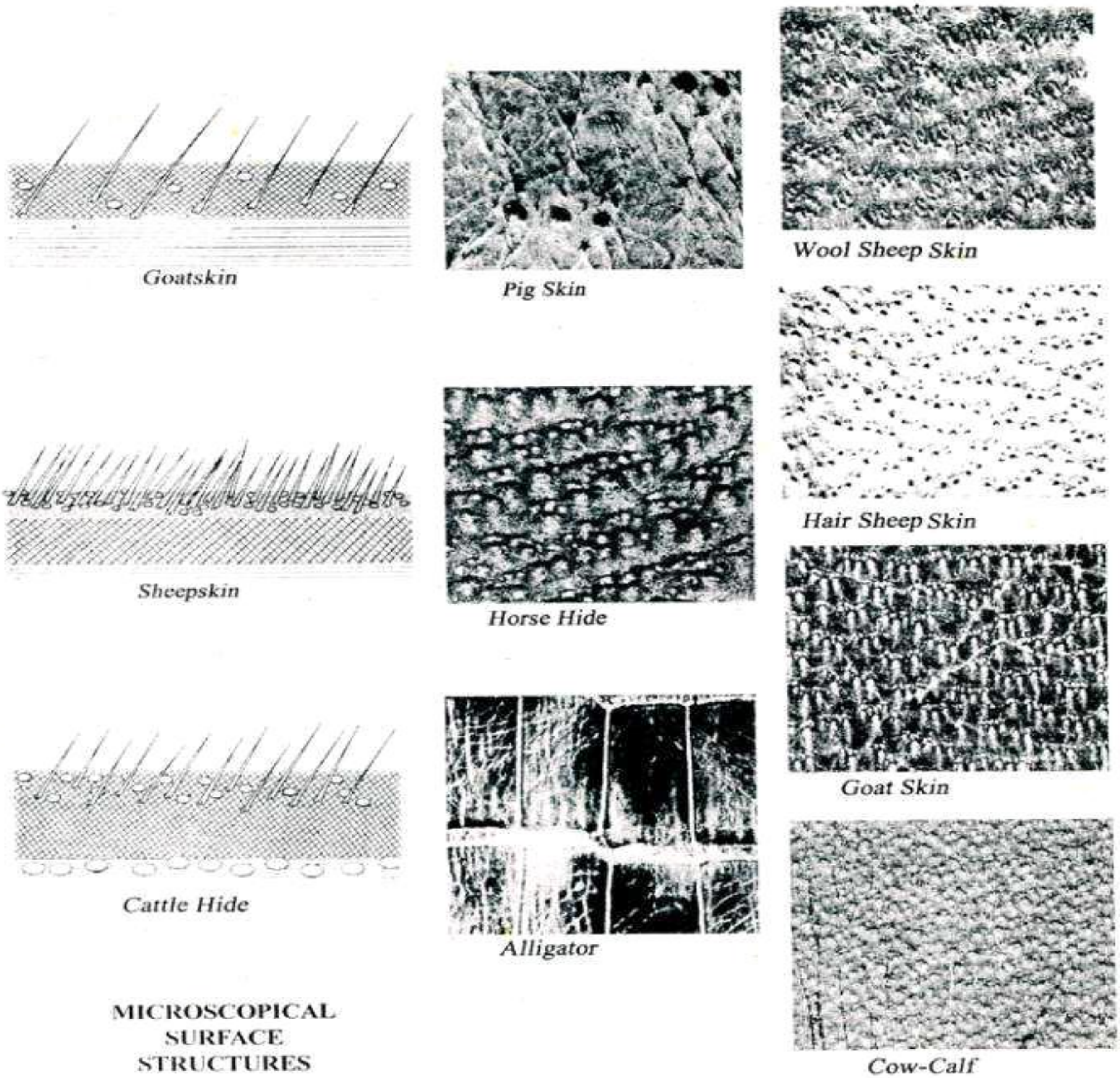


Figure 1 Cross section of cattle hide showing major parts of the skin



MICROSCOPICAL SURFACE STRUCTURES

STRUCTURE OF HIDES & SKINS

3. Hypodermis or Flesh Layer:

This layer is found below Dermis adjacent to the flesh of the animal therefore known as flesh layer. It consists chiefly of fat cells, with a few scattered fibres. There is also some muscular tissue. All these structures are useless for leather manufacture and must be removed during Pre-Tanning (Soaking and Liming) operations.

B.) CHEMICAL STRUCTURE OF HIDES/SKINS:

Water Protein Fats Mineral & Pigments

Structural Proteins Non Structural

Proteins

Collagen Keratin Elastin Reticulin Albumens
Mucins

Globulins
Mucoids

The chemical constituents of hides & skins can be divided into following groups:

- Proteins 19.2 - 32.75%
- Water 60 - 70%
- Fats 1.5 - 10.5%
- Minerals, Pigments etc. 0.36 - 1.5%

The relative proportions of these materials vary from skin to skin depending upon the species , age, breed, feeding and other habits of the animals.

1.) Proteins:

Proteins are structural units of a living thing containing carbon, hydrogen, nitrogen, oxygen, sulphur etc.

a) Structural or fibrous proteins: There are four types of structural proteins found in hides & skins namely- Keratin, Collagen, Elastin & Reticulin.

b) Non Structural or non fibrous proteins : Three types of non fibrous proteins known as Albumins, Globulins & various protein Mucins are also the constituents of hides & skins removed during Pre- Tanning operations. In leather manufacture, Collagen is of interest to the tanner. Collagen, a fibrous protein is composed of rope like bundle of smaller fibrils (made of molecules consisting very fine & long thread like structure). Collagen constitutes 90% of the total hide or skin protein. Proteins other than Collagen are removed during Pre- tanning operations.

Protein synthesis: Protein synthesis can be understood by chain:

Amino acids simpler peptides Polypeptides Peptone Proteose Protein

Amino acids: Amino acids are derivatives of the carboxylic acids (say Acetic acid) in which the hydrogen atom in the carbon chain has been replaced by an amino (-NH2) group.

CH_3-COOH $NH_2.CH_2.COOH$

Amino acids have both acidic & basic properties. The result is that, in aqueous solution, Glycine is neutral to litmus but forms salts with acids as well as bases.

Amino acids have properties like high melting point, low solubility in organic solvents and high solubility

Zwitter ion: In aqueous solution the amino acids lose a proton and the amino group accepts that proton. Hence the resultant molecule exists largely as an internal salt known as a Dipolar ion or a Zwitter ion.

Simpler peptide: When two amino acids form amide-linkage together eliminating water, it is known as Peptide-linkage.

Polypeptide: Polypeptides are the chain of peptides constituting protein Molecule**.**

Structure of proteins: There are Primary, Secondary and Tertiary levels of the protein structures. The Primary structure gives a complete description of covalent linkage in a protein molecule. The Secondary structure is geometrical configuration of polypeptide chains (Spatial relationships of near neighbors).

The Tertiary structure refers to as the arrangement of several polypeptide chains (Spiral, Stretched or both) in one molecule. It also determines the shape & size of protein molecule. The bonds which are of importance could be listed as: Electrostatic, Covalent, Hydrogen, Sulphide etc.

2.) Water: Two forms of water present in H/S:

1. Free water

2. Bound water

The free water can be removed easily by squeezing or mechanical pressure.

The bound water can be partly removed by chemical treatment and partly by constant drying.

3.) Fats: The fats found in hides and skins are of two types:

1. Glycerides or fatty acids

2. Non Glycerides

The Glycerides of fatty acids found in corium and flesh layers, whereas the non Glycerides are found in the fat glands of the grain layer. The fat content in hides and skins may vary widely and the maximum is found in sheep skins. Both these fats are removed during Pre-Tanning operations (Liming, Bating and Degreasing).

4.) Minerals, Pigments etc. : Raw hides and skins contain mineral salts in small quantity in the form of chlorides, sulphates, carbonates, phosphates of sodium, potassium, calcium, and magnesium. Hides and skins also contain small amount of carbohydrates, pigments (coloring matter), enzymes etc. All these minerals are removed before Tanning operation.

Self-Check -2	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid

Some explanations /answers: **(Total marks 22)**

- Match group A with group B (5 points)

Group A	group B
1. Fats	a) Sulphates & carbonates
2. Water	b) Keratin & collagen
3. Minerals, Pigments	c) Bound water
4. Structural Proteins	d) 19.2-32.75%
5. Proteins	e) Glycerides or fatty acids

- Choose the correct answers(2 points)

1. Water can be of:
2. Free water b) Bound water c) Both d) None
3. Fats can be of : (1 points)
4. Glycerides b) Non-Glycerides c) Both d) None

- Fill the right value in blank space (5 points)

The chemical constituents of hides & skins can be divided into following groups:

1. Proteins -----------------%
2. Water --------------------%
3. Fats ----------------------%
4. Minerals, Pigments etc. ------------------%

Information Sheet 3 Identifying tanning types and stage process

Basic tanning requirements

Chrome tanning chemicals

Earlier tanning agents were leaves, roots, barks and fruits containing tannins (chemical agents capable of converting raw H/S into leather).Later Alum salts (sulphates) and afterwards other salts were used for tanning.

In the middle of nineteenth century Chromium salt was discovered as suitable agent for tanning. Chrome tanned leather is ideal for footwear & most of the upper of the shoes worn now are made either of fully chrome tanned leather or combination tanned leather.

Vegetable tanning chemicals

The principal materials used for vegetable tanning are Wattle, Babool, Myrobalan, Avaram (Turwar), Gambier, Cutch, Quebracho, Chest-nut, Oak, Valonia, Sumac etc. Infusion of tanning materials obtained from different sourcesgreatly differs in color, tanning properties and the texture of leather they produce. This is due to the presence of soluble Non-tans in various degrees.

Practical tanners are of the opinion that no single vegetable tanning material is capable of imparting all the qualities in the finished leather as per demand. A blend of several tanning agents is therefore used by the tanners to get the specific properties viz. solidity, flexibility, fullness & color. Proper blending also influences the rate of penetration of tannins.

Classification of tanning materials:

Vegetable tannins are divided chemically into two groups namely: i) Pyrogallol (Hydrolysable, Acid producing)
ii) Catechol (Pyro Catechol, Condensed) When the tannins are dry distilled at 180*-200*C with the air excluded, the Pyrogallol tanning materials yield Catechol. Other differences can be displayed by the following comparison:

S.No.	Particulars	Pyrogallol	Catechol
1.	Iron-Alum Treatment	Blue Colouration	Greenish Black
2.	Bromine Water Treatment	No Ppt.	Ppt.
3.	Boil with HCHO & Hcl	Incomplete Ppt.	Complete Ppt.

4.	Color of Liquors	Yellowish Tan	/Tan Reddish
5.	Color of leather	Creamy Yellow/Tan	Red Brown
6.	Action of light	Slight Darkening	More
7.	Average Weight	Much lower	much higher
8.	Tan-Liquors content	Higher natural acid content	smaller
9.	Penetration	Relatively Slow	relatively fast

The tanning material available can be classified chemically as:

Catechol Tannins	**Mixed Tannins**	**Pyrogallol Tannins:**
	(Catechol tannins predominate)	
Cutch	Wattle	Oak Wood
(Acasia Catechu)	Babool	Valonia
Quebracho		Sumac
Cutch		
(Mangrove)		
Goran		
Gambier		

Non-Tan Materials:

The vegetable tanning materials contain not only various kinds of tanning materials (Tans) but also the Non-tans. These non tans consist of Sugary matter, Gallic acid, soluble mineral salts & other acids (usually organic). The presence of non-tans in reasonable quantity gives soft leather with full handle. Non-tans, however, does not have the capacity to tan protein.

The higher Tan/Non-tan ratio gives Harsh, Astringent liquors (e.g. Quebracho). The rate of diffusion of Non-tans into pelt is more than the Tans. The presence of Non-tans also enhances the water absorption capacity of leather. Among the Non-tans, the sugary matter ferment to form organic acids (Acetic, Lactic and Prop ionic acids etc.) which are particularly desirable in the early stages of tanning if it is desired to produce fullness & plumpness in the finished leather.

Purpose of tanning

Leather Technology deals with the technical aspects of making leather from raw hides and skins. Basically it is a conversion process involving a number of operations starts right from the death of animal. The operations (methodology, sequencing, controlling parameters etc.) vary according to the type of leather to be produced. These operations solely depend upon the tanning method involved. Compare the soft feel and stretch of Gloving leather with the solid firmness of Sole leather. These qualities are obtained either by the choice of skin or by variation of the sequence of tanning operations.

Tanning is the process to convert putrescible hides and skins into non-putrescible material known as leather.

Earlier tanning agents were leaves, roots, barks and fruits containing tannins (chemical agents capable of converting raw H/S into leather).Later Alum salts (sulphates) and afterwards other salts were used for tanning. In the middle of nineteenth century Chromium salt was discovered as suitable agent for tanning. Chrome tanned leather is ideal for footwear & most of the upper of the shoes worn now are made either of fully chrome tanned leather or combination tanned leather.

Combination tanning is carried out either with a combination of chrome and vegetable, synthetic or other tanning agents.

Self-Check -3	**Written Test**

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid

Some explanations /answers: **(Total marks 18)**

1. Fill the following columns (10 points)

S.No.	**Particulars**	**Pyrogallol**	**Catechol**
1.	Color of Liquors	------------------	----------------
2.	Color of leather	------------------	----------------
3.	Action of light	-------------------	----------------
4.	Average Weight	------------------	-----------------
5.	Penetration	-------------------	-----------------

2. Fill the right value in blank space (8 points)

- Earlier tanning agents were --------------------------------- containing tannins.
- Soaking to Pickling/Chrome tanning should be planned in ------------------------ and no holidays in between.
- The principal materials used for vegetable tanning are ------------------------.
- The raw material stock should cover minimum ------------------------ requirement.
- Combination tanning is carried out either with a combination of ------------------------ ---------------------------------or other tanning agents.

- Vegetable tannins are divided chemically into two groups namely -----------, ---------------
- In the middle of nineteenth century --------------------------- was discovered as suitable agent for tanning.
- ----------------------- leather is ideal for footwear & most of the upper of the shoes.

3.2 Different stages of tanning

- **DIFFERENT STAGES OF MAKING CHROME -TANNED UPPER LEATHER:**

1. Curing or Preservation, Raw-Sorting
2. Soaking, Pre-Fleshing
3. Liming (Unhairing), Fleshing, Green-Splitting
4. Deliming
5. Bating
6. Drenching, Scudding
7. Degreasing (For Buff, Sheep etc.)
8. Pickling
9. Depickling (For Veg. Tanning)
10. Chrome Tanning, Ageing, Wet-Blue Sorting

POST TANNING OR **PRE-FINISH OPERATIONS**:

After the completion of tanning, the leathers have to pass through many operations to prepare them finally for finishing.

11. Sammying
12. Splitting
13. Shaving

11. Washing
12. Neutralization
13. Dyeing / Fat liquoring / Retanning, Piling, Setting, Drying, Conditioning, Staking, Toggling, Buffing, Snuffing, Crust-Sorting, Dry Drum (If Required), Impregnation (If Required)
14. Setting
15. Drying
16. Conditioning
17. Staking
18. Toggling
19. Buffing
20. Snuffing
21. Crust sorting
22. Finishing
23. Staking (If Required)
24. Ironing
25. Area- measurement,
26. Final Inspection
27. Packing

B) SEQUENCE OF OPERATION FOR MAKING VEGETABLE TANNED SOLE LEATHER:

1. Curing or Preservation, Raw-Sorting
2. Soaking
3. Liming (Unhairing), Fleshing
4. Deliming
5. Tanning

6. Bleaching
7. Filling
8. Oiling & Stuffing

Self-Check -3.2	**Written Test**

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid

Some explanations /answers: **(Total marks 7)**

Short answer questions:

- Write down the different stages of making wet blue.(5 points)
- Write down the different stages of making vegetable tanned upper leather. (2 points)

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 4 Identifying basic crusting operations

After the completion of tanning, the leathers have to pass through many operations to prepare them finally for finishing. The leather in this stage is known as **crust.**

1. SAMMYING
2. SPLITTING
3. SHAVING
4. WASHING
5. NEAUTRALISATION
6. DYEING / RETANNING / FATLIQUORING, FIXATION
7. SETTING
8. DRYING
9. CONDITIONING
10. STAKING
11. TOGGLING
12. BUFFING
13. SNUFFING
14. CRUST SORTING

1. **SAMMYING:**

In this operation the excess water content of the leather is reduced so as to bring it to a suitable condition for subsequent Splitting & Shaving operations. It is carried out by mechanical squeezing using Sammying machine.

2. **SPLITTING:**

After proper sammying the thick /heavy leathers could be splitted into two layers The Grain split & Flesh split using Band knife splitting machine. Thus it is possible to utilize the flesh split by processing it further for conversion into a valuable by-product to reduce the manufacturing cost. Excessive splitting could lower the tensile strength of the grain split. Splitting is carried out at 0.2 mm above the thickness of the shaved leather.

3. **SHAVING:**

The objective of shaving is to make the thickness uniform all over the hide/skin area. The appearance and the value of the finished leather depend upon efficient shaving which require high skill.

Two types of shaving machines are available in the market: 1) Single width (older) and 2) Double width. The thickness of the shaved leather should be kept about 0.2 mm above the required thickness of the final leather. The allowance also depends upon the type & method of Retanning.

After shaving the shaved weight is taken and for all further post- tanning operations the percentage of chemicals will be based on this weight.

4. **WASHING:**

Leather is properly washed after shaving so as to clean the H/S for effective dyeing and other post tanning operations. The washing is carried out in drum with soft water for approximately 30 minutes. The bath is then exhausted and then Neutralization is carried out in new bath.

5. NEUTRALISATION:

The process of neutralization signifies the removal of neutral salts, uncombined chromium salts & strong acids from the chrome tanned leather. The main objective is to reduce the positive charges to a level (p H) suitable for dyeing, fat liquoring etc. This operation is of great importance and must be carefully controlled to avoid difficulties during subsequent operations affecting the physical characteristics of the final leather.

I) Objective:

1. Removal of Acids and Salts
2. Bringing pH to neutral ranges.
3. Preparing chrome tanned leather for effective Dyeing, Retanning & Fat liquoring.

II) Control: p H - 4.5-5.5

Float Temp. - 25-30*C

III) Processing Equipments: Drum.

IV) Chemicals used:

Neutralizing agents should be mild so as to avoid drastic change in p H on the surface of the leather, causing rough leather surface and poor grain break of the finished leather. The agents are:

1. Sodium Bicarbonate
2. Sodium Sulphite
3. Ammonium Bicarbonate
4. Sodium Format
5. Calcium format
6. Neutralising Syntans
7. Borax etc.

The neutralizing Syntans can be very effective for leveling effect and also for the extra filling effect.

V) Process & Duration: The Process and the duration of neutralization depend upon the acidity level of the incoming wet blue.

Normally the process is carried out with water (100%) and neutralizing agents (1.5-2.0%) for 30-40 minutes in total adding the agents in installments of 10 minutes. The indicator is used to check the p H of the cross section of leather. The optimum p H level of the central layer should be less (4.5-5.0) than the surface p H (5.5) for better penetration of dyes, fat liquors etc. subsequently.

6. DYEING / RETANNING / FATLIQUORING:

Dyeing, Retanning and fat liquoring are three distinct and important operations which are normally carried out in the same bath nowadays for the better and controlled results & in shorter duration.

A) Dyeing: The Objective of this process is to give color and appearance to the leather by which the value can be improved. The dyeing is carried out after neutralization and is a continuous process.

I) Processing Equipment: Drum

II) Controls: pH: 5.5- 6.0

Float Temp. : 60 *C

III) Dyeing Agents: The selection of the dyeing agents depend upon various factors eg. I) the fiber-structure (The Origin of animal)

ii) End use of leather iii) Types of tannage /Re tannage / fat liquoring

The Dyes can be broadly classified as:

A) Anionic

B) Cationic

C) Reactive

a) Anionic Dyes: These dyestuffs can be further classified into three sub-groups as:

I) Acid dyes

ii) Direct dyes

iii) Metal-complex dyes

I) Acid dyes: The acid dyes are the compounds possessing negative charges having good affinity towards Chrome tanned Leather.

Ii) Direct dyes: These are also having negative charges but bigger particle size compared to the acid dyes. Hence these dyes are having less penetrating power and good covering power. These dyes are also fast to light.

Iii) Metal-complex dyes: These dyes possess metal radical coordinately bonded with the complex. The metals are Cr, Co, Cu, Fe etc. There are 1:1 / 2:1 Metal complex dyes available in the market in which the dye : metal ratio determines the properties of the dyes. These dyes give shade levelness and very good fastness characteristics to leather.

Iii) Metal-complex dyes: These dyes possess metal radical coordinately bonded with the complex. The metals are Cr, Co, Cu, and Fe etc. There are 1:1 / 2:1 Metal complex dyes available in the market in which the dye: metal ratio determines the properties of the dyes. These dyes give shade levelness and very good fastness characteristics to leather.

c) Reactive dyes: These dyes are having good covalence characteristics with substrate in question. It gives good wash fastness, very good leveling and exhaustion characteristics.

d) Dyeing Auxiliaries: Neutral syntans capable to reduce the cationic charges of chrome leather for dyeing with anionic dyes are the dyeing auxiliaries. The dyeing auxiliaries assist in:

a) Better penetration of dyes

b) Good leveling effect.

IV) Dyeing Method:

The method of dyeing depends upon the quality of final product required. There are basically three methods for leather dyeing:

A) Drum Dyeing

b) Brush Dyeing

c) Spray dyeing

a) Drum dyeing:

For through & through dyeing the drum dyeing method is carried out during other post tanning operations.

Float - 100 % (Temp. 60-65*C)

For black color - 1.0 %

Direct dye for Other Color - 0.75-1.0 %

Acid dye Run for 60 minutes, check penetration, if through, Fix with Formic Acid - 1.0 % (Diluted with 10% Water) Add in 2 installments, Total running 15-20 minutes. In case of black color, top dyeing is preferred with basic dyes (1.5%) to give richness of color on the surface. The total dyeing process can take 90-120 minutes. For better exhaustion of dyes the process can be carried out along with Fat liquoring / Retanning.

(R.P.M. of Drum: 15-20)

b) Brush Dyeing:

Application of dye by means of brush is carried out in this method. This method is used during the Finishing operation so as to give leveling of color and making a suitable base for the season application. The dye-solution (solvent based) is used for this purpose.

c) Spray Dyeing:

Spray dyeing method is used for dyeing the leathers meant for aniline look. This method may cause color bleeding if not finished or fixed properly. Generally basic dyes are used for this purpose.

The other means of dyeing can be: 1.By Curtain Coater

2. By Roller Coater

3. By Screen Printing etc.

V) Factors affecting dyeing:

The dyeing process is very critical regarding the final quality related to uniformity of shade as well as the dye penetration. There are various factors influencing the final quality of leather:

- Pre-tanning & Tanning operations
- Retanning & Fat liquoring
- The type of Dye & its quantity
- Dyeing auxiliaries
- Duration of process
- Dye-fixation to prevent bleeding

VI) Precautions for effective Dyeing:

For better quality of dyeing, some precautionary measures must be taken:

I) Wet-blue Selection

ii) Proper washing before neutralization

iii) Neutralization

iv) Proper fixation of dyes

v) Proper cleaning of drum especially for light colors.

vi) Proper piling after drumming (Covered well in case of light colors).

VII) Color Concept:

The concept of colors is a very important aspect required for effective color matching. This concept involves the basic understanding of the constituents of white color, classification of primary, secondary, tertiary colors (Color Triangle concept) and the shade generation.

Constituents of white light: The white light is composed of seven basic colors of rainbow Violet, Indigo, Blue, Green, Yellow,

Orange & Red. Out of these colors some are classified as primary, secondary colors. The combination can give Tertiary etc colors. The color-triangle can better explain the formation of a new color using two parent colors. This concept of color-triangle helps a lot in shade matching practices.

Color-Triangle Primary colors: Blue, Yellow & Red are known as primary colors.

Secondary colors: Green, Orange & Purple are the secondary colors.

Tertiary colors: The Russet, Citron & Olive are called as tertiary colors.

Vision: The color of a particular body is the color which is reflected by that body and rest are absorbed by the body. In case of white body all colors are reflected and the black body absorbs all colors. The primary and secondary colors are bright but the tertiary colors and so on are dull in nature.

B) Fat-liquoring :

Fat liquoring is the process by which the oils & fats are incorporated into leather to make the leather soft, stretchy and waterproof. In this process, some amount of selected oils (2-6% on the dry leather weight) is provided to the leather in place of the natural fats removed during pre-tanning operations. The purpose is to provide lubrication for fibres, so that they can slip over each other more easily when the leather is flexed and also to avoid crankiness when the leather is dry. Fat liquoring greatly affects the physical properties of leather such as:

- Break peppiness

- Tensile Strength
- Comfort characteristics etc.

I) Factors affecting fat liquoring:

Fat liquoring process is influenced by a number of factors such as:

i) Selection of oils/fat liquors

ii) Tanning / Retanning operations

- Drying system (Rapid drying cause’s patches on the surface).
- Float concentration
- Temperature of float
- Running time
- pH of the substrate as well as the liquor

II): Types of Fat liquors:

Fat liquor is a solution consists of an emulsifier and a water insoluble oil or fatty matter (fatty acids etc.). Useful oil should be of:

a) High molecular weight

b) Non Volatile

c) Fairly linear structure

d) Reasonably viscous fluid or paste.

The types of Oils/Fats commonly used for making fat liquors are:

- Vegetable Oils : Castor Oil, Olive Oil, Coconut Oil
- Marine Oils : Cod-Liver Oil / Fish Oil

- Animal Oil : Neat's Foot Oil, Lanoline
- Mineral Oil : Petroleum products act as solvent
- Synthetic Oil

The emulsifiers are means of dispersing the oils finely in water to enable it to penetrate into leather at 60- 65*C float temperature, eg. Soap, Sulphated oils, Polyamines etc.

The classification of fat liquors used for leather manufacturing can be carried out on the basis of:

- **Ionic charge :**
  - Anionic B) Cationic C) Non-ionic

Anionic fat liquors possess negative charged particles and they are having good penetration into chrome leather.

Cationic fat liquors are having positively charged particles and used for surface-oiling effect in case of chrome leathers. For vegetable leathers these fat liquors show good penetration.

The Non-ionic fat liquors do not combine with the leather cross-links and serve as free oil inside the leather.

- **Chemical Properties :**

A) Sulphonated fat liquor: This fat liquor is obtained by the treatment of vegetable/mineral/animal oils with sulphuric acid in controlled conditions. The sulphur-oxygen-carbon linkage forms in this case. 1.0-1.5% combined sulphate is better for penetration of fat liquor inside the leather. Sulphonated or sulphated fat liquors contain other constituents as neutral oils, emulsifying agents, & filling agents.

B) Sulphited fat liquor: Treatment of fish oil or cod oil (oxidized) with sodium bisulphate gives this type of fat liquor. Very soft leathers can be produced using this fat liquor. It is best suited for garment and gloving leathers.

C) Synthetic fat liquor : The Sulpho-chlorinated fat liquors are the category of the synthetic fat liquors. These do not contain free fatty acids (hence chances of mould growth are minimum). Partial replacement of sulphonated fat liquors & oils gives improved lubrication effect inside the leather.

D) Solvent fat liquors: Oils in high boiling solvents come under this category. This fat liquors can provide softness with minor staking in case of upper leather manufacturing. This type is recommended for the leather used for vulcanized shoes.

III) Fat liquoring process:

Fat liquoring is carried out with an emulsion in water at 60-65*C. The Float-Temperature is required to be maintained throughout the process so as to avoid the surface

Anionic Fat liquor - 3.0-5.0% (in 3-4 installments) (in combination)

Run for approx. 45-60 minutes for every installment of adding fat liquor. Fixation is carried out with Formic acid (0.751.0%), added in 2-3 installments. When cross-sectional p H is found to be 3.0-3.5 cationic fat liquor (0.5-1.0%) can be added (run for another 15-20 minutes) in case of making soft leathers. The total fat liquoring process can be completed in 5-6 hours.

***Fatty Spues:**

The Spue formation on leather may occur when the leathers contain high amount of free fatty acids (Palmitic or Stearic acids), they are more liable to occur on chrome tanned leather than vegetable tanned leathers. At higher temperature of Plating or Glazing operation, the free fatty acids are liable to migrate to the surface of the leather and they solidify on cooling.

The other reasons may be the hydrolysis of these fatty acids by moulds. It is recommended to use 0.2- 0.3% fungicides during the post tanning operations. The addition of mineral oils/Chlorinated paraffin’s also helps in this case.

B) Retanning:

The main objectives of this important post tanning operation are:

1) To improve the quality by filling up the looser & softer parts.

2) To give tightness of grain (esp. in shanks & belly areas).

3) To enhance the strength properties.

I) Retanning Agents:

1) Vegetable tannins eg. Quebracho, Wattle ext., G.S.Powder etc.

2) Synthetic tanning agents (Syntans) eg. Resin syntan, Chome syntan etc.

3) Other tanning agents eg. Alum, Aldehyde etc.

These retanning agents are used in combination as per the final properties of leather required. Also the type of retannage determines the percentage of different tanning agents used in combination.

II) Control:

pH - 5.0-6.0

Float Temp. - 55-60* C (If used with fat liquors)
- 25-30* C (If only retanning is done)

The retanning process is generally preferred to be carried out with low float (For better penetration and uniform distribution of retanning agents and also the risk of D/G* is minimized). Sometimes the re- chroming of the wet-blues is also required before actual retanning, in case the chrome content of the wet-blue stock is found to be less than 8%. But, this Rechroming is essential for the Semi-chrome leather manufacturing. The total retannage for upper leather should be 10-15%, depending upon the type of final leather and also upon the quality of W/B, E/I as an input material. Retanning process is generally carried out for 3-4 hours but if the percentage of retannage is required more, as per specific quality requirements (Thicker leather, shrunken grain leather etc.), the duration can be more accordingly. The fixation of retanning agents is carried out using the same formic acid (0.5-1.0%) added in installments.

IV) Types of Syntans:

There are variety types of synthetic tanning agents available in the market according to the requirements of the tannery people and also research & development activities are going on to get better results at lesser cost . Broadly the syntans are classified into:

1. Replacement Syntans: Replaces veg. Tannins, Bigger Particle-size, good filling effect

2. Exchange Syntans: Neutralizes the positive charges of chrome for better penetration of vegetable tannins inside

3. Resin Syntans: They have also got very good tightening effect

4. Other Combination Syntans: Combination of various mineral tanning agents after the drumming operations are over, unloading of drum is carried out and the stock is piled grain to grain and left overnight for ageing. Next day on wards, some mechanical operations are carried out:

1. Sammying
2. Setting
3. Drying
4. Conditioning
5. Staking
6. Toggling
7. Trimming
8. Buffing / Snuffing

1. SAMMYING:

In this operation the excess water content of the leather is reduced so as to bring it to a suitable condition for subsequent Setting operation. It is carried out by mechanical squeezing using Sammying machine.

2. SETTING:

The objective of Setting out is to make the leather flat (removal of wrinkles & fold marks) and to smoothen the grain. This operation is carried out using Setting M/c, having helical cylindrical blunt knives with other pressure rollers. The Pressure adjustment can be done for light & heavy leathers.

3. DRYING:

After Setting, the leather is dried for subsequent mechanical processes. The moisture content should be 15-20% after drying. The methods of drying could be:

1. Normal air drying:

A. Ordinary drying: The stock is hanged to dry in normal environmental condition.

B.Nailed drying: The leather are nailed on a flat surface in stretched condition & dried under natural air. The dried stock will be flatter.

Direct Sunlight is not recommended for this purpose.

2. Forced Drying:

A. Hot Air-Blow: For this, the stock is hooked in stretched condition with the wire-frame & the stock can be dried inside the drying chamber with the arrangement of blowing hot air.

B.Vacuum Drying: This is the latest method of drying leather & the drying time is also very less. The stock is spread in between hot metal plates and the moisture is removed under vacuum. It is required to hang the leather in normal condition for some time after removal from the Vacuum dryer.

4. CONDITIONING:

Condition is the process of dampening back of the dried lot for quality staking subsequently. This process is carried out by applying the damp saw-dust on the flesh side of the stock or by light-spray of water. The stock should be kept under such condition overnight. The moisture content after proper conditioning should be 25-30%.

5. STAKING:

The objective of Staking is to provide proper softness to the leather by separating the opening the fiber- structure mechanically. There are two types of Staking machines used for the purpose:

A.Molissa type: This machine gives the mild effect by pin-vibration method. Suitable for Upper leather.

B.Slocomb type: This type of machine can give additional softness (as desired) and suitable for garment/gloving leathers. The mechanism is based on two combs acting together.

6. TOGGLE-DRYING:

By this method the leather is dried finally and the area yield is also observed to be approx. 10%. Nowadays the machine toggling came in practice which reduced the drying time and also the stretch of leather can be done automatically during the process.

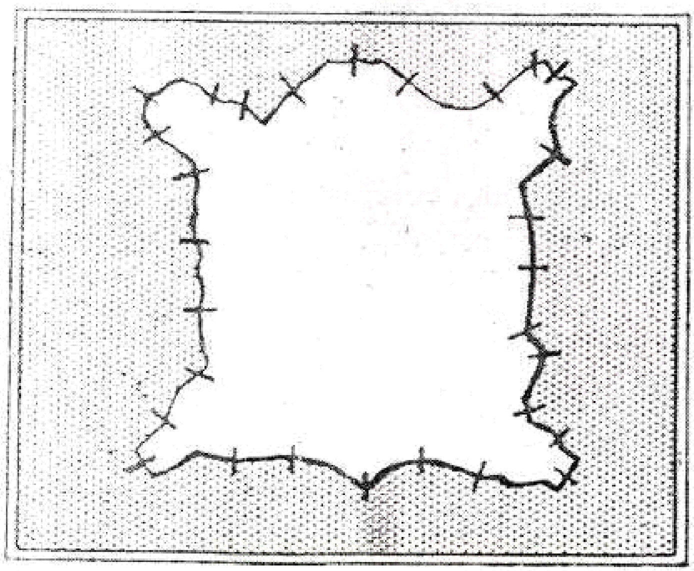


Fig. Togglestraining

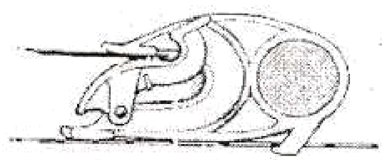


Fig. Teggle

7. EDGE-TRIMMING:

The Stock should be trimmed well round about the area for efficient Buffing and Snuffing subsequently and also it prevents the damage of leather. This objective of this process is to give proper shape to the leather also.

8. BUFFING / SNUFFING:

The process of removal of a very thin layer from the grain surface is known as Snuffing, whereas if the same process is carried out on the flesh surface of leather, it is called as Buffing. The removal of the layer is carried out by means of rubbing with emery paper roller (using pressure) provided with the Buffing / Snuffing machine. Normally, 80-120 Grit paper is suggested for Buffing whereas. 600-800 Grit Emery paper can be used for Snuffing operation.

Dust removal is also very essential operation before the leather is sent for finishing. After cleaning Grain/Flesh surfaces the stock (Now known as “Crust”) should be sorted out as per Grade, Type of finish etc

Self-Check -4	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid

Some explanations /answers: **(Total marks 17)**

1. Match the correct answer. (10 points)

1. SAMMYING 1. The stock is hanged to dry in normal environmental condition

2. SPLITTING 2. Dampening back of the dried lot for quality staking subsequently

3. SHAVING 3. To make the leather flat (removal of wrinkles & fold marks)

4. WASHING 4. To clean the H/S for effective dyeing and other post tanning operations

5. NEAUTRALISATION 5. To make the thickness uniform all over the hide/skin area

6. FATLIQUORING 6. The thick /heavy leathers could be splitted into two layers

7. SETTING 7. The removal of neutral salts, uncombined chromium salts & strong acids from the chrome tanned leather

8. DRYING 8. Provide proper softness to the leather

9. CONDITIONING	9. The oils & fats are incorporated into leather to make the leather soft, stretchy and waterproof
10. STAKING	10. Water content of the leather is reduced

2. Fill in the blank (7 points)

1. The process of removal of a very thin layer from the grain surface is known as ---------(1 points)
2. Normally, -------------- Grit paper is suggested for Buffing whereas. (1points)
3. ------------------ Grit Emery paper can be used for Snuffing operation.
4. Nowadays the machine ----------------- came in practice which reduced the drying time and also the stretch of leather can be done automatically during the process.
5. ----------- machine gives the mild effect by pin-vibration method.
6. The objective of ----------------- is to provide proper softness to the leather by separating the opening the fiber- structure mechanically.
7. ---------------is the latest method of drying leather & the drying time is also very less.

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 5 **Identifying difference between corrected grain and full grain leather**

FULL GRAIN LEATHER

Full grain leather is often denoted by F/G. This type of leather has original grain pattern. Since, covering or hiding of grain is not done by finishing or plating the raw hide /skin from which this leather is made, it is almost defect free. Hence, the full grain leather is costly leather.

This type of leather has a natural look. This is mostly finished with aniline or semi-aniline. Sometimes, we have F/G leather in pigmented finish and also called F/G pigmented leather. Full grain refers to leather which has not been sanded or buffed.

Sanding or buffing removes surface imperfections from the leather, except in the case of nubuck where the buffing is very light.

Only the best hides are selected for this type of leather as any imperfections in the hide will show in the finished leather.

Full grain leather is given an aniline or semi-aniline finish in a manner similar to that for calf leathers. The resulting leather has “natural” leather; look that is much sought after. The current fashion for natural leathers has, in fact, overtaken the supply of suitable hides.

Full-grain leather is considered among the best quality leather you can buy. It can be made from a variety of different animal hides, but most usually is made from cow skin. Leather can undergo complex treatment processes in order to create numerous products. Many of these treatments may result in weaker leather that will not wear as well. This is especially true when the leather is treated with chemicals. Full grain leather is desirable because of its minimal treatments and its durability.

With full-grain leather, the hides of the animal used are not treated significantly. Instead they have the hair of the animal removed but they are not sanded. This can result in some minor flaws in the leather, but as used in fabric, it also results in the most breathable leather you can wear. Like a great pair of jeans, full-grain leather clothing actually gets more comfortable the more you wear it, becoming softer and some say even more attractive as it gets older.

Though full-grain leather is not sanded, it can still be dyed, called an *aniline* finish. Non-dyed full-grain leather is harder to find. In fact if you don’t buy full-grain leather with an aniline finish, you will usually find it with a semi-aniline finish. This is a clear finish placed on the leather that will allow imperfections in the leather to show. Actually many

desire the semi-aniline finish in full-grain leather because it gives a more natural look to the leather.
Unlike other types of leather, full-grain leather uses the whole hide rather than layers of the hide. In contrast, top-grain leather, another very desirable product uses the top layers of the animal hide. Using the whole hide makes full-grain leather much thicker, and great for products that require a certain amount of durability.

Generally, it is the grain split of a hide from which nothing has been removed except the hair and associated epidermis.

The surface of full grain looks like this under the microscope:

Aniline leather
It is a type of leather dyed exclusively with soluble dyes without covering the surface with topcoat paint or insoluble pigments. The resulting product retains the hide's natural surface with the 'grain', i.e. visible pores, scars etc. of the complete original animal's skin structure.

Originally, the dyes used for this process were synthesized from aniline through chemical reactions. These dyes used to be called 'aniline dyes' or 'tar dyes'. In modern times, the dyes used are subject to laws and regulations in many countries, and the use of certain compounds is prohibited as there are reasons to assume health risks. Typically, leather is dyed both for aesthetic reasons and to conceal blemishes. The dye colors leather without producing the uniform surface of pigmented leather. Any visible variations on the surface which is not dyed leather such as natural blemishes will remain visible.

There are different kinds of aniline leather, but the same kinds of dyes are used in the process. The dyes used are clear and transparent chemicals that allow the grain structure of the leather to be seen. These dyes show the natural texture, but do not protect the leather from damage.

Aniline leather may be referred to as full aniline or full savage leather to differentiate between this dye treatment and variants. Semi-aniline leather is produced through a very similar process to full-aniline, but has a thin protective top coat added to protect it from wear and staining. Pull up aniline leather has additional oil or wax applied to the leather to give it a distressed look.

Semi-aniline leather

Looking at semi-aniline leather through a magnifying glass will look quite similar to aniline. The hair follicle holes are slightly visible (as indentations) but you will notice a thin pigmented coating covering them. Some semi-aniline has thicker coatings than others and so the holes may not always be identifiable.

The Absorption Test

Drip a small amount of leather cleaner or water on to the semi-aniline leather. It will sit on the surface so dab it with a piece of cloth to absorb the liquid. You will notice that the leather will absorb a very small amount of this liquid, this shows by a slightly darker patch. It can take between 3 – 4 minutes for semi-aniline to absorb a drop of cleaner.

The Touch Test

Semi-aniline feels quite natural and soft to the touch. The finish is often smooth and you can feel the lacquered surface, which makes the leather semi slippery compared to an aniline.

The Visual Test

The color of semi-aniline will look quite uniform, not as varied as aniline and not as uniform as pigmented. The grain pattern will be natural looking as only a thin pigmented coating is applied. You may be able to see natural markings, but you will have to look closely to spot them. Semi-aniline is often two toned but this two tone effect can sometimes be very slight and so hard to spot.

If you do not maintain the leather using the leather protection cream, the top coat of color can wear off in high use areas. To make the leather last longer, apply the protection cream once every three months to reduce friction and so, stop the color wearing away as quickly.

CORRECTED GRAIN LEATHER

A large proportion of the hides coming into the tannery are marked by scar marks, barbed wire scratches and growth marks the shoe manufacturers would find them very costly to use because of the large amount of wastage that would result. The tanner

therefore endeavors to improve the quality by eliminating, or reducing, these defects by a procedure called “correcting the grain”.
This is done by snuffing the grain surface with a very fine abrasive paper, which takes off the shallower surface marks. The sides are finished with pigments bound with resins in water. The method involves padding on a base coat to the corrected grain surface, (A pad is wooden block covered with plush). Applying the finish in this manner ensures good uniform penetration of the resin binder into the surface and good anchorage of the finish. The leather is then plated in a heated press (150^{o}c) under pressure (150 kg/cm^{2}). As the resins are thermoplastic the finish will flow under the influence of heat. This aids the anchorage of the finish and its smoothness. Two coats of the pigments resin mixture dispersed in water are then sprayed on. The leather is again plated to bind the finish coats together. The final operation is the application of a spray coat of nitrocellulose emulsion, to improve the resistance of the finish to soiling and to wet and dry rubbing.

Corrected leather has been significantly processed so that lower quality top-grain hides may be used. CORRECTED, means the application of more chemicals and paint, the stamping of an artificial texture and other processes. This tends to produce leather that is not as soft as less-processed top-grain but has a more uniform look and finish, making the product very durable. Corrected leather allows for a lower price for the final product. It is often best suited for recreational rooms or other places that require exceptional durability.

Protected Leather:
This is simply another way of saying “corrected” leather, except it may not be limited to top-grain. It refers to the fact that enough paint or other finish was applied to make the surface more durable than more natural and less-processed leather.

Top Grain Leather
Top grain leather is leather from the uppermost layer of a hide. It is the highest quality part of the hide.

This leather comes from the outermost upper layer of the cowhide, and is the only leather recommended for all high quality sofa leather. The best top-grain hides reflect that the animal has lived in an environment that resulted in limited scratches, insect bites or other damage. These hides can be minimally processed and used in their most natural form. Generally, less processing allows the hide to be softer and display a more natural character.

PureAnilineLeather
Pure Aniline is top grain leather that is dyed for color without any pigments applied. These hides will exhibit some natural characteristics such as healed scars, scratches, neck and belly wrinkles. Expect color variation from the swatch to the actual leather, due to the fact leather is a natural product and will absorb dye differently within the hide and from hide to hide. This leather will develop a rich patina over time and will fade with prolongedexposuretosunlight.

ProtectedAnilineLeather
Protected aniline leather is top grain leather that is dyed for color and then receives pigment to ensure color consistency. Without pigment protected leather is not color consistent. The pigment also ensures fade resistance and helps the leather wear over time. A clear water based topcoat is applied for additional protection. The natural imperfections of the hide are also less noticeable. Hides average 50-55 square feet. Protected Aniline Leathers are easy to maintain and have maximum resistance to wear, soiling, and fading from light.

Semi-AnilineLeather
Semi-Aniline leather is pure aniline leather that has a small amount of pigment or clear finish thus allowing the natural characteristics of the hide to still show through while offering some of the benefits of color consistency and increased wear ability.

The difference between full grain and top layer leather
Full grain leather is the highest quality of leather that you can get and is made from the entire cowhide. It is thick, making it very strong and durable. It also is costs a lot more than many other types of leather.

Top grain leather is leather that has imperfections on the surface of the hide that are removed by sanding and then refinished. It has also had the "split" layer removed, meaning that the bottom layer of the hide is taken away. Top grain leather is thinner than full grain and is less expensive. It also is suppler.

Which is more durable semi aniline leather or corrected grain leather?
Semi aniline leather is really more of a dying process. Usually a semi aniline leather has a corrected grain, hence the use of semi aniline. What happens on semi aniline leather is that small defects on the leather hide have been buffed or sanded and then get an embossed grain or corrected grain. In order to have color consistency, a semi aniline dye is utilized.

Self-Check 5	**Written Test**

Name: _______________________________ Date: _____________________________

Time started: ________________________ Time finished: _____________________

Instructions**:** Write all your answers in the provided answer sheet on page.

Directions: Answer all the questions listed below. **(Total marks 10)**

- **Fill in the blanks: (5 marks)**
  - Full grain leather has a ---------------- look.
  - Full grain leather has original -------------------------.
  - -------------------is a type of leather dyed exclusively with soluble dyes without covering the surface with topcoat paint or insoluble pigments.
  - Some ---------------------- has thicker coatings than others and so the holes may not always be identifiable.
  - Improving the quality by eliminating, or reducing, defects by a procedure called ---------------------------.
- **One word answers: (5 marks)**
  - What is the full form of F/G.?
  - What is the full form of C/G.?
  - What type of finish is given in full grain leather?
  - In aniline leather what is used for finishing (dye or pigment).
  - What is the name of the procedure when we improve the quality by eliminating the defects?

Score = ___________

Rating: ____________

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers.

Information Sheet 6 Describing types of finished leather

CrookhornDavis offers a wide assortment of genuine leather accessories in a variety of finishes, with each finish carefully chosen to best fit its application. Below is a look at some of the quality finishes we carry.

Aniline Finish

Only the highest quality Full Grain Leather can receive an Aniline Finish. This is because the grain remains exposed, and must have as few blemishes as possible. As only the finest hides can be made into aniline, only around 5% of them are adequate.

The result is a leather that looks and feels much better than other finishes.

Aniline finishing involves using aniline dyes, which are water-soluble pigments. This creates an effect closer to staining, as opposed to the heavy opaque coating left by other finishes. The purpose of this is to reveal more of the natural colorings and patterns of the leather, such as fat lines and wrinkles. This is sometimes followed by a pigment-free polish or glazing. When inspected under a magnifying lens, pores should be clearly visible.

There are many benefits to Aniline Leather. The lack of finish allows the leather to breathe and adjust to body temperature quickly. This makes it great for clothing, shoes, and small accessories. It also ages incredibly well, developing a much sought-after patina that comes with wear.

This type of high-quality leather requires proper care, as it may fade in direct sunlight or be susceptible to staining and soiling. To reduce this, micro pigments may be applied to offer some protection. This is referred to as “protected aniline” or “aniline plus.”

If you’re gentle with your accessories, seeking the look of a beautiful patina, and don’t mind the required maintenance, Aniline Leather can be a great option for you. As one of the softest, most pliable finishes, it is well suited for most applications, but is best for smaller accessories that are easier to maintain, such as belts, shoes, and wallets.

Semi-Aniline Finish

Semi-Aniline leather leaves the grain exposed, but has a thin protective/corrective layer.

Between variations in grain and color, scratches, insect bites, and other wear and tear, it is very common for hides to have at least a few unsightly blemishes. To rectify this, a light coat of finish can be applied with enough opacity to mask variations, without hiding the natural grain of the leather.

Semi-Aniline finishes are applied to full grain leathers, with only a small amount of pigment being used. The pigment provides a degree of durability and stain resistance that can take more wear than true aniline leather.

This finish can result in a slight sheen, but still retains the high-quality look. Unlike aniline leather, it is resistant to sunlight and water damage.

Semi Aniline leather is a good fit for those who want high quality leather without the frequent maintenance. Like Aniline leather, it is suitable for most applications, including larger items like handbags and upholstery. It may not patina, but it is still soft and will hold up nicely to gentle use.

Pigmented Full Grain Leather

While this type of leather finish requires a heavier layer of material to mask details than semi-aniline finishes, it is still made of high-quality Full Grain leather. A resin-based pigment is applied to hide defects, but it still maintains the look and feel of a quality product.

Unlike the aforementioned finishes, this finish does not leave the pores visible, and hides the natural color variations in the leather. Instead, the color and surface are uniform and evenly coated with pigment, giving it great light fastness and stain resistance. It does have reduced breathability, which is at times compensated with perforation.

This is one of the most common high-quality leather finishes. It’s also suitable for most people, needing little maintenance, and being more durable that non-pigmented leathers. It is not as soft as aniline and semi-aniline leathers, but its stiffness and thicker top coat allow it to hold up to rougher use without as much upkeep. Pigmented Full Grain leather is great for most applications, especially those that experience frequent wear. This finish is ideal for “everyday” accessories.

Suede

A process of abrasive action, called buffing, raises the corium fibers to produce an even and short fiber, or “nap” finish. The raised nap is finished by buffing the flesh side, or inner layer, of the hide.

Suede can be made from the flesh side of grain split leather or any side of a flesh split. Suedes are attractive and tough, with springy fibers that rebound quickly to the upright position. This means that there is no “finger mark” or “two-way rubs” that appear.

Suede is highly durable, yet maintains an appealing look and softness to the touch. It’s great for shoes, jackets, and gloves. At CrookhornDavis, you can find it lining handcrafted Italian leather belts, for a luxurious and comfortable feel.

Nubuck

Also referred to as velvet suede, Nubuck has a finer buff than suede and is buffed on the grain surface of leather. This is also referred to as “snuffing.” The collagen fibers of the surface are finer than the corium, which makes for the finer nap. Nap is then brushed or plush wheel padded to produce velvety, lustrous looks and feel. Wax, grease, or oil are sometimes applied. These leathers are referred to as oil nubucks.

Nubucks have the “two-way rub” or “writing effect” that suede does not. Nubuck is made of more expensive, higher quality leather than suede. As a result, it is softer and more durable. While the two have similar applications, nubuck is for those willing to pay for the extra softness and durability that comes with using the grain side of leather.

Pull-Up Leather

Leather which has extra oil added during the manufacturing process and is finished with a spray coating of wax is called Pull-Up leather. This gives the leather a dark, almost greasy, look and feel that imparts a rugged, outdoor look.

Pull-Up leather is similar to nubuck and suede in that it does not have a protective finish coating applied. This type of leather is prone to color changes in areas of high wear and is associated with water resistance and high quality.

The finish is designed to lighten as it is stressed or stretched, resulting in a worn effect. Pull up leather is an excellent option if you love the distressed look of a well-worn leather accessory.

Embossed Leather

When leather is pressed against a hot, raised-patterned metal plate, the surface fiber structure will retain an impression. This is a process of leather that has been used for hundreds of years and opens up many possibilities.

Leathers can be embossed to mimic the look of crocodile, lizard, snake, and many other skins. The softer the leather, the easier it is to emboss, but the less permanent the embossing becomes.

Vegetable-tanned leathers are usually easier to emboss as they retain the impression better than the more elastic chrome-tanned leathers.

The resulting leathers tend to be firm and stiff, with compromised breathability. However, embossed leathers can be an affordable alternative to rarer animal skins that are difficult to work with. They have the added benefit of looking exotic without requiring additional, more complicated care.

Dry Milled Leather

To achieve this finish, leather is loaded into milling drums and rotated. The soft falling action intensifies the natural lines in the leather to give it an attractive pebbling effect. It also makes the leather considerably softer and is one of the techniques used to soften vegetable-tanned leathers. This is a great finish for clothing and upholstery.

Antiqued Grain (Two-Tone Leather)

To achieve a two-tone leather, a top coat is applied unevenly, or partially removed to show a contrasting underlying color coat. The leather may have had hollows or creases embossed before application of two pigmented coats, so that the first coat, usually the darker one, settles into the depressions. This finish creates a classy, aged look, without having to wait for a natural patina.

Patent Leather

Traditionally, patent leather is made when linseed oil-based products are applied to the leather to produce a high gloss finish. Modern patent leather has either a liquid resin coating or a layer of plastic laminated to the surface. This produces a beautiful, shiny surface with a high-end feeling.

Self-Check 6	**Written Test**

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Total marks (5 marks)

1. Write and illustrate the types of finished leather.

Information Sheet 7 Explaining & demonstrating method of storing leather

❖ **Leather sorting**

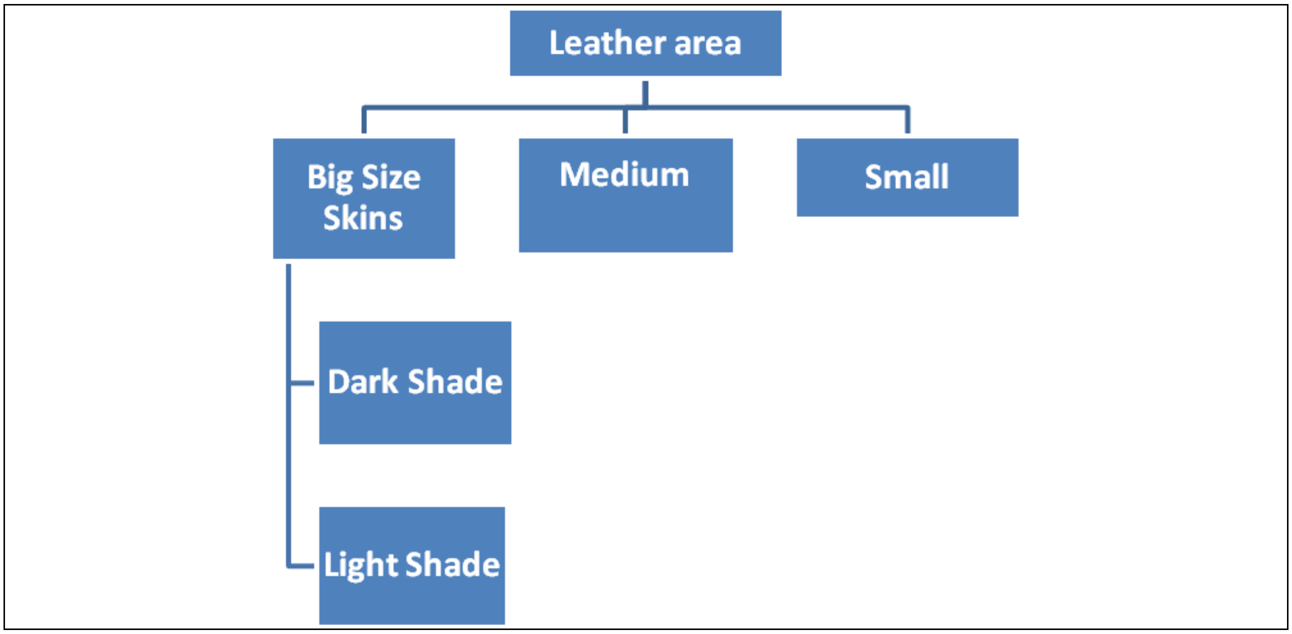
- **Reason for leather sorting:**

Leather is a natural product and is subject to ***variation*** from one skin to another, even though most tanneries try to ensure uniformity within batch. In some batches variation may be slight, in order they may be more noticeable. Even variation of leather not only might happened on the same batch of different leathers, variation of grain, color and shade may also happen on the same(one) leather.

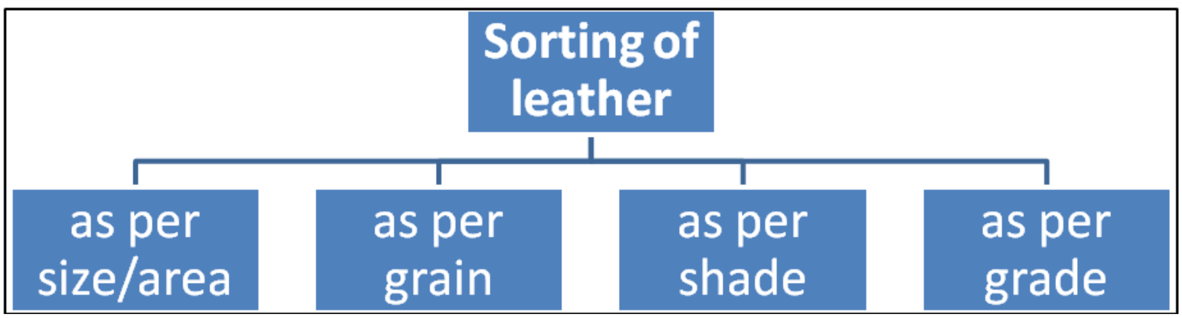
- **Variation in leather may include the following:**

a) **Color:** different skin can show color variation which is a very normal phenomenon with aniline dyed leather.
b) **Substance:** skin of the same area and from the same type of animal can often considerably in substance,(thickness) correct leather sorting will ensure that the various substance can be selected and allocated for different styles.
c) **Amount of stretch:** the direction of stretch does not very but the amount of stretch does zoning the tanning process the leather can be made finer or softer, which influence the amount of stretch but it is impossible to make the amount of stretch totally uniform.
d) **Grain:** the grain of the leather can vary from skin to skin even within single skins; changes in grain structure can also affect color and dyer glass.
e) **Defect and marks:** these one caused by numerous natural and man-made sources and vary widely in degree.

The sorting is done as follows:



❖ **Sorting of Leather Done by a Cutter (If Necessary)**



Once a cutter receives material according to his ticket he may sort skins from standard size, grain and shade. This increases his productivity.

- **Before starting cutting the cutter must check**

  (i) Knives and patterns

  (ii) Work tickets

  (iii) Production samples and production guide

  The perfect state of clicking dies has the important task at clicking out. At the check the clicker concentrate on

  (i) Cutting edge quality

(ii) Dimension (time to time the dies are checked with the master pattern in production)

(iii) Design

(iv) Faults

The material is put on the leather horse according to the following rules

- At first he can put thinner leather and thicker ones are put up.
- Color shades are put from the darkest to the lightest ones step by step (for an easier pairing).
- Whole leather is over loaded at the longitudinal axis by grain up and shifted out slightly.

Self-Check 7	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below.

Fill in the blanks

1. The main reason for leather sorting is in order to minimize leather ______ in the same batch and to maximize _______.(2 points)
2. Sorting of leather is conduct as per the _______, _____?(2 points)
3. Before starting cutting the cutter must check ----------, -----------?(2 points)
4. Leather is a ------------------------- and is subject to ------------- from one skin to another?(2 points)
5. Randomly the ---------------- is inspected and the whole batch may be pass or fall. (1 point)
6. The grain of the leather can vary from ------------------ even within single skins. (1 point)

Choose the correct answer:

7. Which one of the following is the common variation that may happen on the leathers? (1 point)

   a) Color b) grain C) substance D) amount of stretch E) all

8. Leather variation not only might happened on the same batch of different leathers, instead following may also happen on the same (one) leather: (1 point)

   a) size/area b) grain C) grade D) all

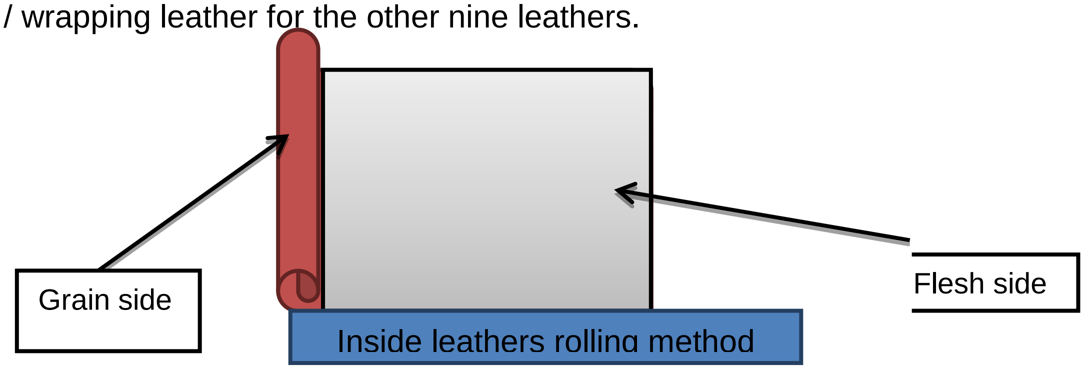
Information Sheet 8 Demonstrating the leather bundling

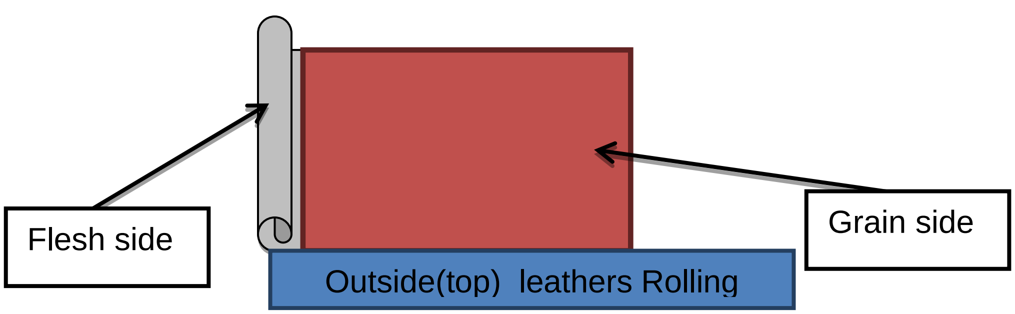
Leather storage:

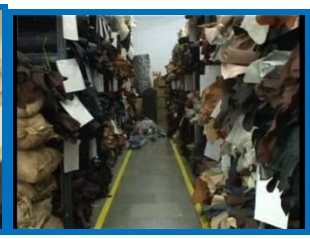
After grading operation is completed, the skin should be stored properly. The leather received in bundles and plastic bags of max of 10 skin of the same grade should be re-bundle for storage attaching each bundle a ticket showing:

- Tannery or supplier name
- Types of leather
- Color
- Thickness
- Quantity
- Grade of leather

Roll/bundle method of leather storage: commonly leathers are stored in the roll/bundle form and 8 to 12 leathers are included in one roll/bundle. Roll method are preferable to utilize the space than stack on method .because once it is rolled/bundled it is possible to keep it on the rack so that more leather can store within the small area/space. But when we tried to store leather using roll/bundle form, we have to be take cure for the leather because grain crack and damaging might happen due to improper rolling, excess bundling of leather together and over lapping of one roll over the others. While bundling, if we use the 10 leather in one bundle, 9 leather roll inside by keeping the grain side of the leather outside and visible and the flesh side inside. The remaining one leather will be on the top of the other nine leathers and rolled in opposite form (flesh side outside and grain side by keep inside.). This leather used as a cover / wrapping leather for the other nine leathers.





Stack on method of leather storage: this kind of leather storage system commonly applicable if the quantity of leather are few or if there is wide and enough space in the store. Stack on or flat method of leather storage is better to keep the leather safely without any kind of damage as compare to roll/bundle method. Usually sheep /goat skin are stored by this method. But if we have the space it also applicable to cow and other big types of leather. Even though there is no standard that have been set before about the number of quantity that have to be stored in stack on/flat form at a time, most footwear factories and even tanneries used to stored 120 – 150 skin/hide once.

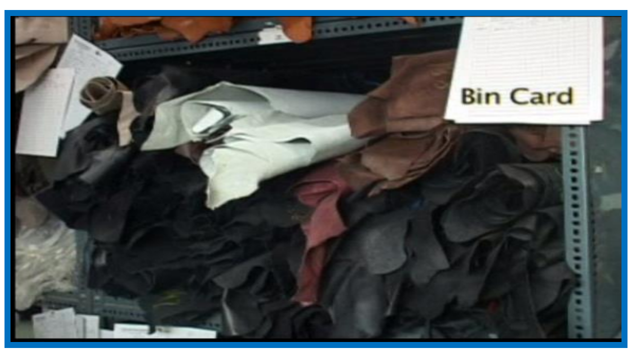
Stack on method: laying one over the other.

Avoid various factors that can affect the performance/usage of leathers and its natural property. Proper storage and handling are also including below:

- **Temperature:** most leather best stored should not be more than 10°c - 20 °c temperature. Very high storage temperature may cause finish blocking and finish cracking caused by the finish adhering itself or taking the imprint of the flesh side of the text skin. Rapid decrease in temperature normally during winter nights may cause space formation. Room with external wall area the most susceptible to such temperature fluctuation and should not be used as leather store. If this is unavoidable some heating in the leather store during the winter months. This reduces the risks of finish cracking, a potential problem when unwrapping bundles of leather which have been stored at low temperature.
- **Humidity:** the ideal atmospheric humidity level is between 50 – 60% RH. Above this there likely to be an increased risks of mould growth whilst below it grain in cracking can be a problem. In addition since the

grain crack resistances of the leathers are relative to its moisture content, prolonged storage in the low humidity environment tends to increase the risk of grain crankiness in lasting.

- **Lighting:** avoid strong light or direct sunlight. Prolonged exposure of leather to strong light, whether natural or artificial often leads to color changes or fading. in extreme cases it may even cause un-brittleness and loss of suppleness. As a general rule the best types of lighting to use in the skin room defuse day light or some form of relatively weak artificial light source.
- **Method of storage**: in order to minimize the risk of cracking all leather should be ideally stored flat or hung over a horse. Unfortunately, flat storage more space than is available therefore, they are stored in rolls. It is good practice to restrict the number of rolls that are stacked one on top of other. Particularly if wire storage racks are available since these can inflict pressure marks on the bottom roll if overloaded. Also there should not be excess overlap of leather and suffocation in the store.
- **Duration of storage:** if leathers are not used immediately, it is not preferable to maintain long time stock.
- **Leather storage:** Different types of leather (in color, in types, in grain and in size) should not be stored together. Similar types of leather are preferable to keep together.
- **Proper labeling:** in order to easily identified each types of leather and to distinguish one types of leather from the others proper labeling is required. The label should include the required dates.



❖ **Problem due to improper storage and handling**

- Grain crack
- Finish crack
- Fungal growth
- Color fades.

- **Leather labeling : include:-**
  - Color
  - Leather grade
  - Leather types
  - Number of leather in the bundle(quantity)
  - Total area in the bundle or shelf(total area/quantity)
- **The following data should be record in the store regarding the leather:**
  - Stock number
  - Delivery date
  - Invoice number
  - Area
  - Number of skin/hide
  - Grade
  - Supplier name
  - Rate
  - Issued quantity
  - Received quantity
  - Balance/stock quantity, etc…

Self-Check 8	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below.

Fill in the blanks:

1. Leather commonly stored in the factory in _________ and/or ______ forms.(2 points)
2. Avoid strong light or direct ------------------- while storing the leather. (1 point)
3. Most leather best stored not be more than ---------------- temperature. (1 point)
4. The ideal atmospheric humidity level is between ------------------. (1 point)

Match the words:

5. Which one of the following is not happen due to improper storage and bundling of leather.(1points)
   A) Grain crack B) finish crack C) brand mark and scratch D) all
6. Leather labeling include:- (1 point)
   A) Color B) Leather grade C) Leather type D) All
7. The following data should be record in the store regarding the leather: (1 point)
   A) Stock number B) Delivery Date C) Invoice number D) all

True and false:

8. Stack on/flat method of leather storage is more preferable to utilize the space. (Say true or false) (1 point).
9. Roll method of leather storage is more preferable to keep lather safely and utilize the space. (Say true or false) (1 point).

LG #21	LO #8. Determine the use of material and accessories in footwear production

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying the different types of shoe styles/designs
- Explaining the different types of constructions
- Identifying accessories used for footwear making
- Identifying uses of materials for footwear production
- Identifying handling and care requirements for materials
- Identifying common problems and faults of materials
- Identifying relevant OHS practices

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify the different types of shoe styles/designs
- Explain the different types of constructions
- Identify accessories used for footwear making
- Identify uses of materials for footwear production
- Identify handling and care requirements for materials
- Identify common problems and faults of materials
- Identify relevant OHS practices

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Read the information written in the "Information Sheets 1".
- Accomplish the "Self-check 1" in page 12. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #2.
- Read the information written in the "Information Sheet 2".
- Accomplish the "Self-check 2" in page 16. Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 3". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #5.

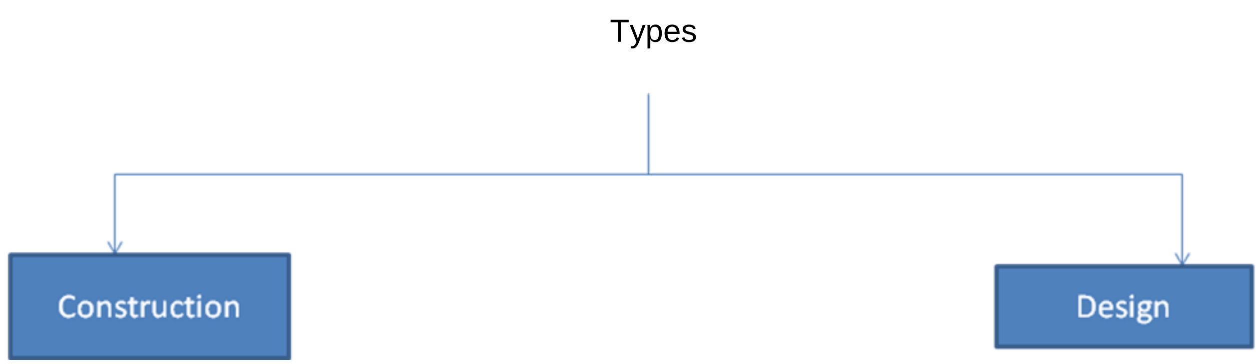
- Read the information written in the "Information Sheet 3".
- Accomplish the "Self-check 3" in page 20. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 4". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #8.
- Read the information written in the "Information Sheet 4".
- Accomplish the "Self-check 4" in page 24. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #11.

2.

Information Sheet 1 Identifying the different types of shoe styles/designs

Basic shoe styles

There are a variety of shoe styles available in the market in different heel heights, shapes, different toe shapes etc. These styles are obtained by endless variation on seven basic designs. The origin of each design can be traced to one or more features introduced to meet some special need or purpose.



Application of the footwear defines the construction. Design is feature of the product; the styles are created from the basic designs. Dynamic product-features are variable.

There are various types of shoe styles. These are:

- Derby Shoe
- Oxford shoe
- Court shoe
- Sandals
- Slippers
- Boot
- Moccasin
- Slip-on

1. Oxford

It is general term indicating a low-cut shoe with lacing attachment over the instep. It is probably the mostly used design today.

It is originating in the University Town of Oxford, England, in the middle of the 16^{th} Century.

The main visual feature of these construction is that the vamp overlays the quarter




2. Derby

The main visual feature of the derby construction is that the quarter overlays the vamp.

3. **Slip-on:** There are no lacings or fastenings. The popular loafers are part of this category, as well as less popular styles, such as elastic-sided shoes.




4. **Sandals**

It is any open shank design employing straps, thongs, ribbons etc. to form the upper and attachment. It is earlier known type of shoe as used to protect the foot from damage to sole.




5. Court shoes

Lowest cut design exposing instep and having no additional means of fastening.

Origin of court shoe: Originally a man’s court shoe; adopted for women at the turn of the 20th century.


6. Monk shoes

Monk shoe is similar to derby shoes but with a cross over section to fasten the quarters with a side buckle.

7. **Slippers: -** For indoor use, commonly worn with pajamas.



8. **Moccasins**:-a soft shoe without a heel and usually made of leather.



9. Ankle Boots

A boot reaching only to the ankle is called ankle boot.

10. Long boots

A boot is a type of footwear and a specific type of shoe. Most boots mainly cover the foot and the ankle and extend up the leg, sometimes as far as the knee or even the hip. Most boots have a heel that is clearly distinguishable from the rest of the sole, even if the two are made of one piece. Traditionally made of leather or rubber, modern boots are made from a variety of materials. Boots are worn both for their functionality – protecting the foot and leg from water, snow, mud or hazards or providing additional ankle support for strenuous activities – and for reasons of style and fashion.

11. Safety boots

A steel-toe boot is a durable boot or shoe that has a protective reinforcement in the toe which protects the foot from falling objects or compression, usually combined with a mid sole plate to protect against punctures from below. They were invented in Germany at the end of World War II








Self-Check 1	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Match the following words: (Total points: 5)

1. Top Line A. The top of the shoe which surrounds the Opening for the foot
2. Feather Edge B. When the patterns are cut, an additional margin Is added to the feather edge which allows the upper to be attached to the rest of the shoe
3. Lasting Allowance C. The lower extremity where the upper meets the sole or insole
4. Derby D. The main visual feature of these construction is that the vamp overlays the quarter
5. Oxford E. The main visual feature of these construction is that the quarter overlays the vamp

Short answer questions: (Total points: 12)

1. Explain the two basic parts of a shoe. (2 points)
2. List and briefly define the parts that constitute the upper and also draw their diagram. (2 points)
3. Describe briefly the following shoe terms. (2 points)
    a. Top line
    b. Feather edge
    c. Lasting allowance
    d. Facing
4. What are appliqués in footwear and explain their uses. (2 points)
5. Describe briefly the bottom parts of a shoe. (2 points)
6. List the basic shoe styles and their main features. (2 points)

Information Sheet 2	Explaining the different types of constructions

Construction

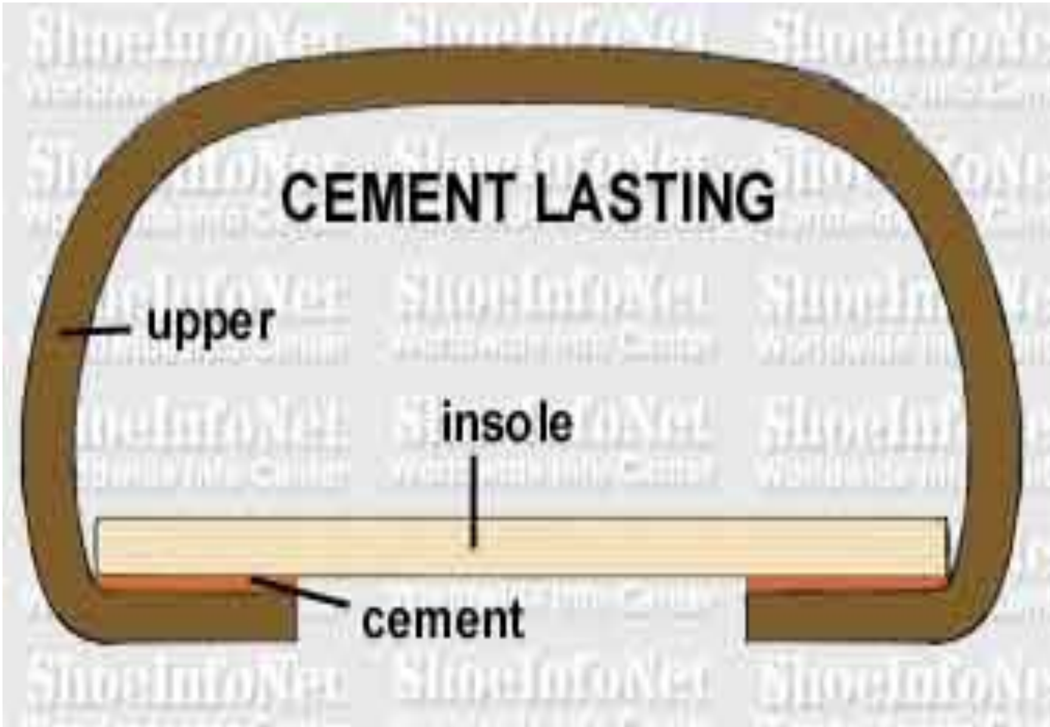
Definition: Construction is a method of assembly of the footwear. This is variable feature and in some product's application, special constructions are applied. In footwear manufacturing the 'construction' is associated with some specific operations in the making department, which is carried out in order to attach out sole, etc. with the upper.

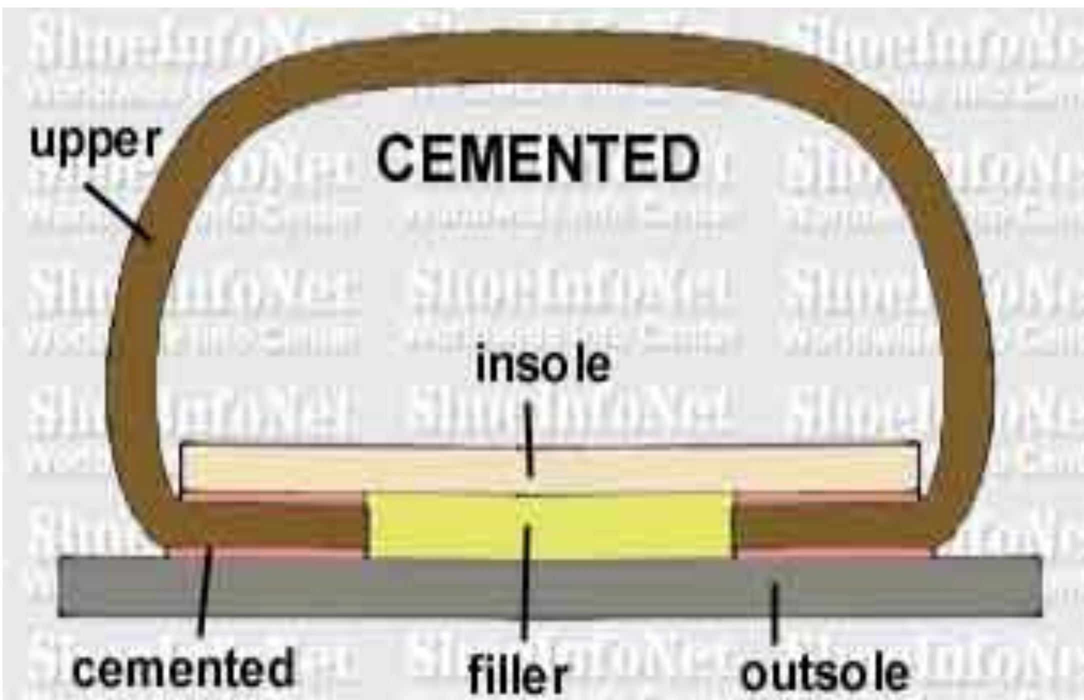
There are different types of footwear construction. These are described as followed.

- Cemented construction
- Good year Welted construction
- Stitch down construction
- Moccasin construction
- California construction
- Direct Injection process (DIP)
- Strobel construction

I. Cement lasting /Stuck-on/flat lasting/construction

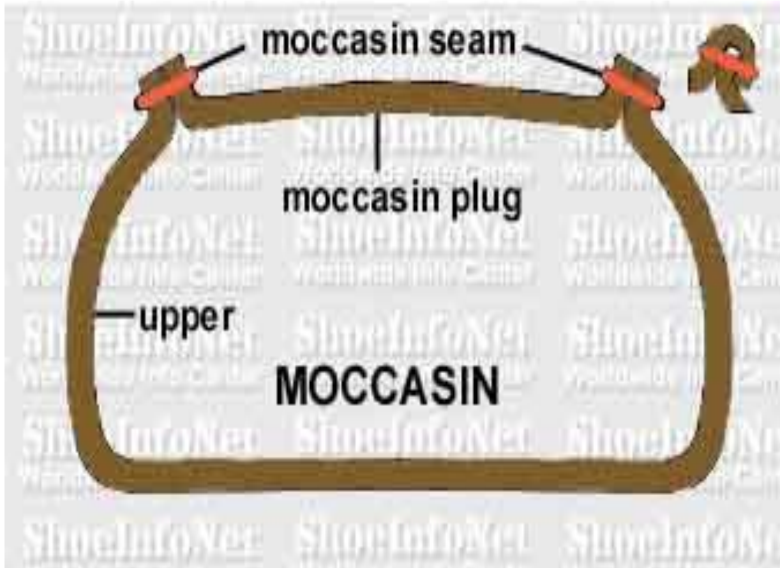
It is a type of construction where Lasted upper is directly attached with the outsole by means of adhesive. Prior to sole attachment, the upper is mounted on the last (Lasting) and the lasting margin is secured with the insole by means of adhesive and/or tacks. Bottom filler is used to fill up the cavity between insole and lasting margin.

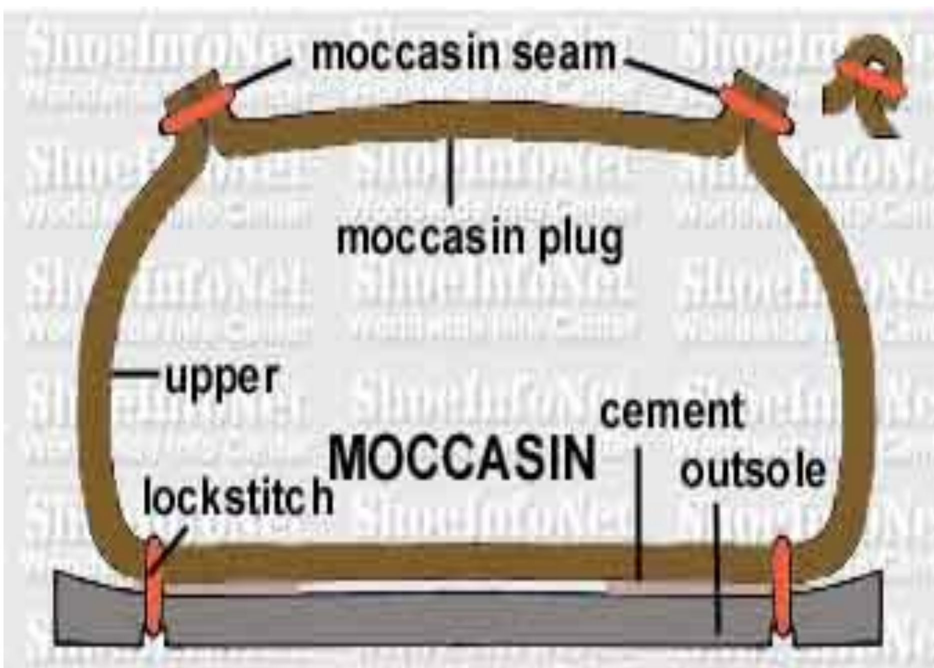

CEMENT LASTING
upper
insole
cement


upper
CEMENTED
insole
cemented
filler
outsole

J. Moccasin construction

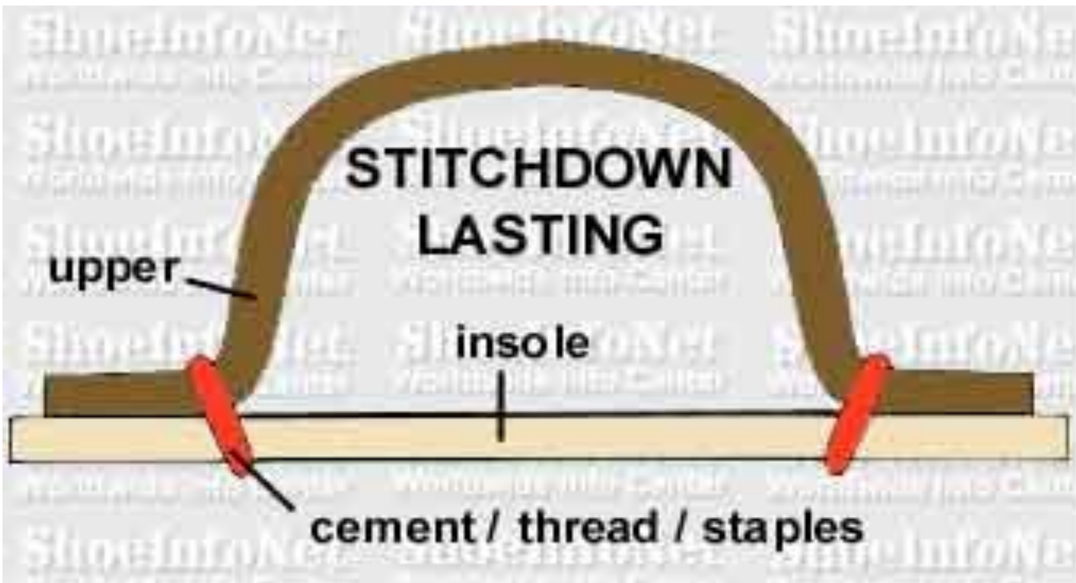
It is a type of force lasting (i.e. the upper is forced over the front of the last with the back being pushed into right position) where the moccasin plug stitched before lasting.





K. Stitch down constructions

Stitched construction is where functional stitching is used during assembly of upper to the bottom components. Amongst the existing manufacturing processes where stitching plays important role in fastening the upper with any of the components mentioned below is known as stitched construction. These components can be midsole, runner, welt and the outsole.



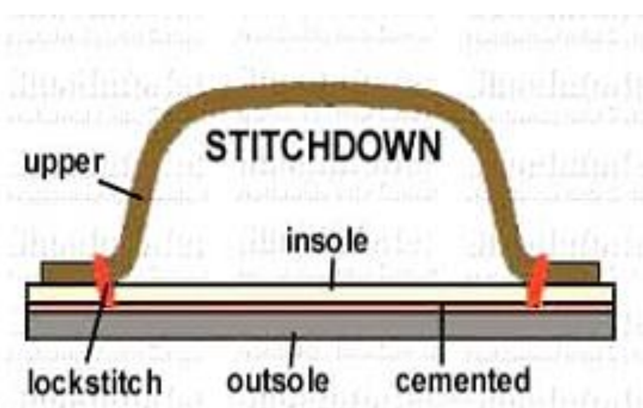


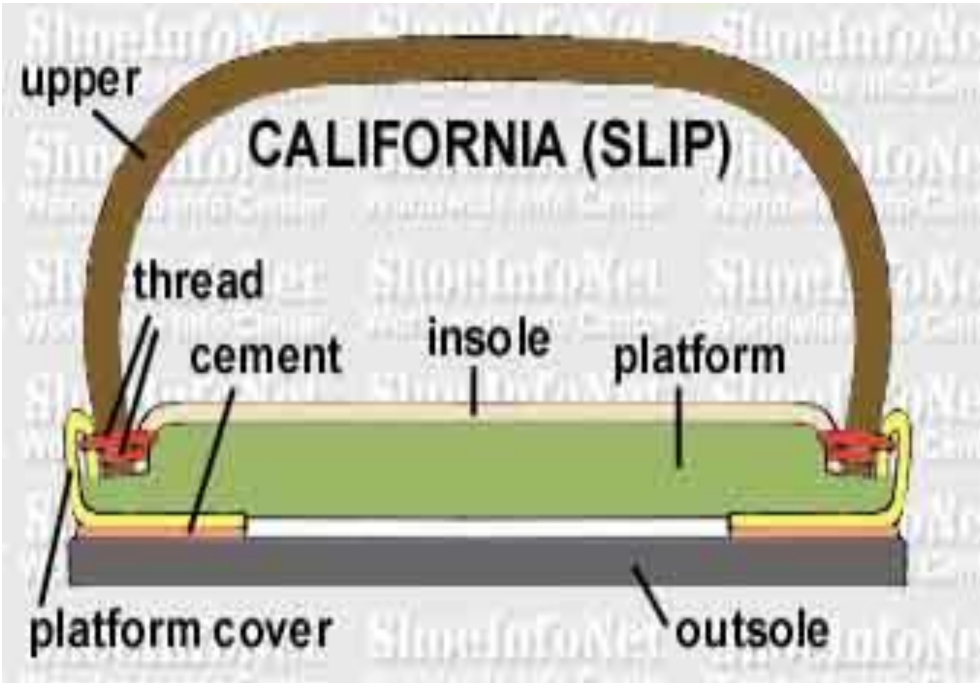
Fig: basic stitch down construction

There are different types of stitch construction. These are:

- **VeldtSchoen:** In this construction the upper is pulled over the last and attached over to the extended part of the insole (runner), and then sole is stuck on. Then the raw edge leaved (the upper materials, runner, insole and sole) is trimmed and coloring is done. A cheaper method used to produce lightweight flexible soles for children's shoes and some casual footwear describes the upper turned out (flanged) at the edge of the last. This is then stitched to the runner.
- **Directly stitched to sole:** in this construction the upper is hand sewn or machine sewn directly through the out sole.

L. California construction

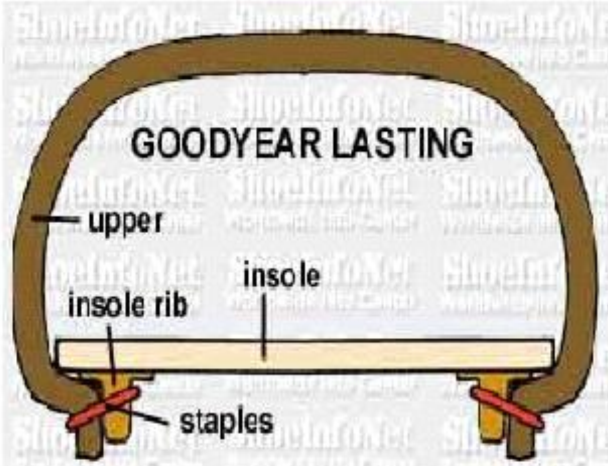
This construction follows a process of cementing, drying, activation and then finally sole press.

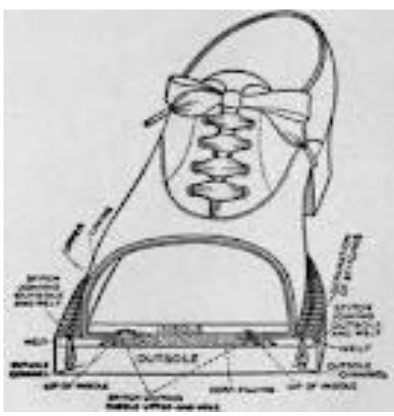


M. Good Year welted construction

It a construction type where the soles are attached to the welt or runner or any other intermediate component which are these already being attached to the lasted upper.

For high quality dress and town shoes the top section (or welt) is chain stitched to the upper and insole rib at the point where it curves under the last. This is supplemented by a lockstitch out seam bonding the welt and outsole. The outsole is then sewn to the welt around the edge. Goodyear Welt creates heavier less flexible footwear.





N. Strobel construction

It is known as force Lasting (Strobel-stitched method or sew in sock). In strobel construction (sewn-in –sock) the upper is forced over the front of the last with the back being pushed into right position. Force lasting has evolved from sport shoes but is increasingly used in other footwear. The Strobel-stitched method (or sew in sock) describes one of many force lasting techniques. The upper is sewn directly to a sock by means of an overlooking machine (Strobel stitcher). The upper is then pulled (force lasted) onto a last or moulding foot. Unit soles with raised walls or moulded soles are attached to completely cover the seam. This technique is sometimes known as the Californian process or slip lasting.

O. Molded Methods

The lasted upper is placed in a mold and the sole formed around it by injecting liquid synthetic soling material (PVC, urethane). Alternatively, the sole may be vulcanized by converting uncured rubber into a stable compound by heat and pressure. When the materials in the molds become cool the sole-upper bonding is complete. These methods combine the upper permanently into the sole and such shoes cannot therefore be repaired easily. Molded methods can be used to make most types of footwear.

The vulcanized sole shoe: Almost all rubber-soled canvas footwear has been made by this process since the turn of the century, however, advances in machine design and rubber technology have made it practical to mould in place and vulcanize a complete rubber outsole and heel unit on an assembled leather upper in one operation.

The injection moulded sole shoe: This relatively new process of simultaneously moulding and attaching sole and heel units. This process is becoming increasingly popular, especially for casual footwear. The method used is fundamentally similar to the vulcanizing process as far as the lasting of the shoe upper is concerned. Canvas shoes to be soled by the injection moulded process; however, may be lasted by a process known as string lasting. The injection moulded process uses vinyl plastic material instead of rubber for the sole and heel.

P. String lasting

It features a special heavy gauge drawstring sewn by over locking sewing machine round the margin of the flat upper.

Self-Check 2	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

True or False: (Total points: 5)

6. **Construction** is a method of assembly of the footwear.
7. Cement lasting is a type of construction where Lasted upper is directly attached with the outsole by means of adhesive.
8. Moccasin is a type of force lasting.
9. Goodyear welted a construction type where the soles are attached to the welt or runner or any other intermediate component which are these already being attached to the lasted upper.
10. In VeldtSchoen construction the upper is pulled over the last and attached over to the extended part of the insole (runner), and then sole is stuck on.

Short answer questions: (Total points: 4)

3. What do you mean by footwear construction? (2 points)
4. What are the different types of footwear construction? Discuss each of them briefly. (2 points)

Note: **Satisfactory rating – 5 points and above** **Unsatisfactory - below 5 points**

Information Sheet 3 Identifying accessories used for footwear making

Bow and Trims

Button and Sequins

D Rings

Eyelets

Buckles

Decorative metal trims

Zippers

Decorative laces

Rivets

Self-Check 3	Written Test

Name: ____________________________ Date: __________________________

Time started: ______________________ Time finished: ___________________

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. Write down the name of the accessories used for shoe making. (2 points)

Information Sheet 4	Identifying the uses of materials for footwear production

Introduction

Footwear are formerly created from one piece of material, later was made by attaching a few accordingly cut pieces combined together with strap and later sewed with needle and thread and other parts like sole as separate components is attached with footwear.

Materials used for construction of footwear are classified as upper materials, lining materials, reinforcement materials, accessories and fittings.

1. Leather

Leather is the most suitable material to be used as **upper, lining** and **socks** making because of its physical properties, elasticity, flexibility, ease of working, availability in varieties of colour and finish, thermal conductivity etc.

2. Textile

It is any woven or knitted materials. Yarns used for weaving and knitting are of natural origin, such as cotton, wool or linen, or a host of synthetic yarns, such as viscose, nylon, orlon and Dacron. Some fabrics are made of a blend of natural and synthetic fibres. All textiles used in shoe production must be backed with another material, usually cotton sheeting or drill, or double-woven in such a way to provide the necessary weight or thickness required of shoe upper and lining.
Generally, textiles are used as **upper, lining, inter-lining, socks** and **re-enforcement** in shoe making industry.

3. Adhesive

An adhesive is a substance capable of holding materials together by surface attachment. Adhesives have many uses in the shoe industry and are an important auxiliary material. In bonding materials together, they are small in volume compared to other joining materials (metal, fibers, wood etc).

The main usages of adhesive in shoe making are for:

a) Lining pasting

Rubber solution is used for lining attaching. While attaching the components from flesh-to-flesh, we can use rubber solution. This is a temporary adhesive, as the bond produced by this is not very strong. This is applied with the help of brush.

Latex, a water base adhesive is used for temporary attachments. This is mostly used for attaching the vamp cloth with the vamp. The best way of applying this adhesive is by means of spraying. This avoids the formation of any kind of knots on the material surface, as it is a rubber base adhesive. In case of bottom components, roller is the most suitable method known for applying this adhesive. This adhesive is also used for folding purpose as well. It is used for establishing temporary bonding for edge folding, upper to lining attachment and socks lining attachment to insole and so on.

b) Foam attaching

A Polychloroprene or Neoprene adhesive and Latex, a water base adhesive can be used for foam attaching.

c) Sole attaching

A Polychloroprene or Neoprene adhesive is used extensively today in footwear industry for sole attaching. All types of shoe sole except PVC, TPR & PU can be attached by polychloroprene adhesives. But different materials require the correct type of adhesives and the right method

A Polyurethane (PU) adhesive is used extensively today in footwear industry for sole attaching. The introduction of new polymer materials for soles and uppers has introduced new problems for the adhesives manufactures. Polychloroprene systems no longer hold the PVC soles to uppers satisfactorily. Bond failure happens on occasion, due to migration of plasticizers into the adhesive films. The solution of this problem is presented in the form of a solvent based polyurethane adhesive, which is unaffected by these chemical compounds. It is used for sole attaching purpose.

d) Inter-lining attaching

Latex adhesive is used for inter-lining attaching purpose in footwear industry.

e) Toe-lasting

It is a synthetic resin having ester linkages in the main chain. Saturated - thermoplastic type mainly used in shoe lasting operations. Hot-melt polyester rod is used for toe lasting operation in shoe industry.

f) Seat & side lasting

Most polyamide resins are used with epoxy adhesives; however those resins similar to nylon, (i.e. based on dimmer acids) are used as the thermoplastic adhesives in shoe and electronic industries. Hot-melt polyamide adhesive is used for seat and side lasting operation in shoe industry.

4. Tacks & nails

Tacks and nails are used in the manufacture of shoes designed to suit numerous lasting and assembling operations. Tacks and nails are used for the following operations.

- Used for seat, side and toe lasting
- A general-purpose tack used for hand lasting sandals and repair works
- Building leather heel and heel attaching
- The inside attachment of wooden heel
- The inside attachment of plastic heels
- The outside attachment of rubber heels
- The outside attachment of leather built heels
-

a) Hand lasting tacks

Hand lasting tacks are used for seat, side and toe lasting in drafting.

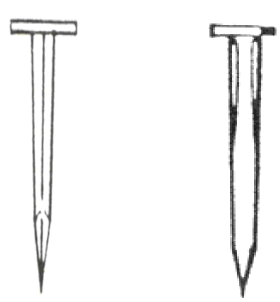
Hand lasting tacks

b) Heel nailing/ buttress nails

Heel nailing/ buttress nails are used for building heel or heel attaching.

c) Machine nails

Machine lasing tacks



d) Ultra-sonic staples

The heels may be attached by an ordinary staple, a specially designed nail or an ultra-sonic staple.

e) Insole staples

Preformed staples are used for insole attaching.

5. Rivets

Rivets are used for locking or fixing parts together in footwear manufacturing. Thus it is used for holding the piece together. Single thickness material can also be riveted for decoration.

6. Shank board

Shank board withstands the tremendous loads which occur in the waist and heel of the shoe. It is again produced in much the same as way as paper.

7. Steel shank or shank

A shank is one of the most vital components in a shoe. It provides essential support for the arch of the shoe. It withstands heavy bending and torsional stresses whilst maintaining accurate alignment of forepart and heel throughout all the stresses of the shoe's life. A shank is probably the most severely stressed component in a shoe. The shankpiece reinforces the waist of the shoe and prevents it from collapsing or distorting in wear.

8. Eye-lets

When a designer selects the eyelets to be used, he must ensure the eyelet dimension is suitable for the material being used no matter which shape of eyelet he chooses, whether it is round, oblong, oval or square. The size of the eyelet is measured as inside diameter or opening of eyelet and depends on the material and choice. Eyelet parts consist of:

- Barrel length,
- Head and
- Opening of eyelet.

Opening is usually measured in millimeters across the internal diameter.

Width of the head depends on the designer choice and material to be eyeleted. Technically, the eyelets having wider head is found most suitable for softer the material

The barrel length is measured in millimeters along the barrel. The length required would be decided by the thickness of material the eyelet will hold onto. Barrel must go through the material and flange over approximately the same width as head.

When eyeleting synthetic, fabrics and canvas a washer is normally used, it is placed over the barrel and locked in place by roll spreader. The washer should fit tightly over the barrel and should be slightly wider than the eyelet head. Now days plastic or other similar material kind of eyelets are in use for delicate and sifter kind of materials.

9. Insole board

Insole board is the material from which shoe insole is constructed. The insole is the foundation of the shoe to which the anchored the upper, heel and outsole. No matter how light a substance fashion may demand, it is the basic components on which the whole shoe is built. Insole board that used to make insole should have a strong bearing on wear, comfort, shape retention, foot health and appearance.

10. Laces

Laces are used to secure shoes, boots and other footwear. Loosening the lacing allows the shoe to open wide enough for the foot to be inserted or removed. Tightening the lacing and tying off the ends secures the foot within the shoe.

11. Toe-puff & Counter stiffeners

The function of the toe puff is basically to provide shape to the forepart of the shoe, and in industrial boots to give protection to the foot of the wearer. It is the mean by which the shape of the last forepart is reproduced in the finished shoe, and thus plays an important part in the appearance and the general performance of the majority of the footwear types. Counter stiffener materials are support to give stiffness, inserted between the lining & upper over the heel area.

12. Finishing materials

a) Finishing Creams

Creams are suitable for gloss enhancement or to give some special appearance (antique effect) on leather look. Creams could be soft, medium or hard. Soft and medium creams are those that require to be polished, and are referred to as the creams to be polished. Hard creams are available as self-shining creams. They don't require cutting or brushing operation. Creams are applied by sponge or synthetic.

b) Repairing waxes

Repairing waxes are gap-filling crayons and do not shrink on flexing.

c) Carnauba wax

Carnauba waxes are used as the final operation to polish and protect the finish that is done in the shoe finishing room. It also enhances the gloss of the shoe.

d) Abrasive wax

Abrasive waxes are used for cutting or smoothening of grain surface, and for filling and special effects, for example brush-off and burnish effect.

e) Water based and Solvent based sprays & Cleaners

The purpose of cleaning is to remove dirt, adhesive over-split and other unwanted marks and contamination, and to condition the finish surface to accept dressings and other treatments. Cleaning agents could be water based or solvent based. These are of three types.

13. Chemicals

a) Toluene

Toluene is used as a solvent and as a starting material for the synthesis of many compounds, including dyes and explosives. Toluene is an important organic solvent, but is also capable of dissolving a number of notable inorganic chemicals such as sulfur.

b) Methyl Ethyl Ketone

Methyl Ethyl Ketone is used in paints and other coatings. It is used for these products because it quickly turns into a vapor. It also dissolves in many substances. Other uses are glues and cleaning agents. Methyl Ethyl Ketone (MEK) is the chemical that is used for PVC sole cleaning or wiping purpose in footwear industry.

c) Ethyl Acetate

Ethyl Acetate is used as a solvent in footwear industry. It is a colorless volatile flammable liquid, $CH_3COOC_2H_5$, used in perfumes, flavorings, lacquers, pharmaceuticals and as a general solvent.

d) TPR primer

TPR primer is used for halogenations of TPR sole in preparation time during lasting operation.

Self-Check 4	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

***Instructions*:** Write all your answers in the provided answer sheet on pages 10-11.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. **(Total points: 16)**

1. Define the uses of leather in footwear manufacturing. (2 points)
2. Mention the type of adhesives used for the following operation.(6 points)
   a) Lining pasting
   b) Foam attaching
   c) Sole attaching
   d) Inter-lining attaching
   e) Toe-lasting
   f) Seat and side lasting
3. Briefly define the uses tacks and nails. (2 points)
4. What is the use of steel shank? (2 points)
5. Define the eye-lets. (2 points)
6. What are the finishing materials used in footwear manufacturing process? List and briefly explain them. (2 points)

Information Sheet 5 Identifying handling and care requirements for materials

1) Leather

After the leather grading operation is completed, the leather should be stored properly. The leather received in bundles and plastic bags of maximum of 10 skins of the same grade should be rebundled for storage attaching each bundle a ticket showing tannery or supplier name, type of leather, colour, thickness, quantity and grade.

A variety of factors can affect the performance of leather during and after storage. These include:

- Temperature
- Humidity
- Lighting
- Method of stacking

Temperature

Most leather best stored at 10-20 degree Celsius temperature. Very high storage temperature may cause finish blocking and finish cracking caused by the finish adhering itself or taking the imprint of the flesh side of the next skin. Rapid decrease in temperature during winter nights may cause space formation. Room with external wall area the most susceptible to such temperature fluctuation and should not be used as leather store. If this is unavoidable it certainly wise to avoid storing skins directly adjacent to the outside wall. In addition, it is advisable to maintain some heating in the leather store during the winter months.

Humidity

The ideal atmospheric humidity level is between 50-60 RH. Above this ideal atmospheric humidity level there likely to be an increased risks of mould growth whilst below it grain cracking can be a problem.

Lighting

Avoid strong light or direct sun light. Prolonged exposure of leather to strong light, whether natural or artificial often leads to colour changes or fading.

Method of stacking

In order to minimize the risk of cracking all leather should be ideally stored flat or hung over a horse. Unfortunately flat storage requires more space than is available therefore, they are stored in rolls. It is good practice to restrict the number of rolls that are stacked one on top of other. Particularly if wire storage racks are available since these can inflict pressure marks on the bottom roll if overloaded.

2) Adhesives

To overcome all the problems in adhesive utilization, it must adopt a minimum use of adhesive or not using policy, so that the final shoe can be made technically sound. This system of upper making will make the shoe more competent in the market. Following points are also to be kept in mind during use of adhesive in upper closing room:

- Latex should not be used on greasy leathers and PVC, as it does not make bond with them.
- Natural rubber solution can be used for folding and attaching lining with the upper.
- Hot melt polyamide adhesive is used in thermo folding machine.
- Pot life and shelf life must be checked before buying the adhesive.

Factors affecting selection of adhesives are described as follows:

1	Safety	Whether flammable/non-inflammable; whether vapors harmful for inhalation, skin protection
2	Application	Hand (brush); machine; roller; spray-gun
3	Drying Time	Quick; Slow
4	Tack Retention Time/Open Time	Time available to make bond after drying
5	Shelf Life	The length of time an unopened package of adhesive can be expected to remain in usable condition under specified conditions of temperature and humidity.
6	Pot Life	Length of time, it can be used after opening of the container
7	Type of Stick	Dry; wet; self adhesive; heat & pressure
8	Compatibility	With materials to be bonded
9	Final Bond Strength	Permanent/Temporary; Flexibility; Resistance to heat/moisture
10	Cost	Low; High
11	Storage	Temperature conditions

3) Finishing Material

Shoe polish-usually a waxy paste or a cream, is a consumer product used to polish, shine, waterproof, and restore the appearance of leather shoe thereby extending the footwear's life.

Various substances have been used as shoe polish for hundreds of years, starting with natural substances such as wax.

Shoe polish is usually flammable, can be toxic, and, if misused, can stain skin. It should be used in a well-ventilated area.

Shoe polish is applied to the shoe using a rag, cloth, or brush. Shoe polish is not a cleaning product, and therefore the footwear should be both clean and dry before application. A strong rubbing action to apply the polish, followed by further buffing with a clean dry cloth or brush, usually provides good results.

Another technique, known as spit-polishing or bull polishing, involves gently rubbing polish into the leather with a cloth and a drop of water or spit. This achieves the mirror-like, high-gloss finish sometimes known as a spit shine.

4) Chemicals

Chemicals are a part of everyone’s life. There are five to seven million different chemicals known in the world. At the first 400 million tones of chemicals are produced worldwide each year including agricultural chemicals, food additives, pharmaceuticals, fuels for power production, chemical consumer products, etc.

The frightening reality is that for the vast majority of the chemicals used and being developed, little or nothing is known about their possible immediate or long-term or uses them at work. Yet workers continue to be required to work with potentially toxic (poisonous or harmful to the worker) substances. In some countries, workers are required to work-with little or no protection- with chemicals that are known to be hazardous to human health. Workers in some developing countries are often required to work with toxic chemicals that have been banned in developed countries because of their hazardous effects.

In most developed countries, workers using those same chemicals dress up almost like spacemen in protective clothing to avoid contamination from the chemicals, and are provided with washing facilities and regular medical checkups.

Though each chemicals is not necessarily hazardous to human health, one must be aware that the inherent source of the hazard can be either the chemical itself, any emission generated during the use or handling of the chemical (e.g. vapors, fumes, effluent) or the containers used for storage and transport of these chemicals.

The impact of such exposure can range from temporary effects such as dizziness, headache, irritation of eyes, skin or lungs, allergic reaction, collapse due to lack of oxygen, poisoning of liver, kidney, nervous system to long term impairments such as ulcer, bronchitis, genetic defects and, in some rare cases, even instantaneous death.

Besides the adverse effects on the human body, chemical can be the sources and the cause of fire, corrosion and damage to structures and electrical installations and may have harmful effect on the surrounding environment when released in an uncontrolled manner.

Chemical can enter the body by:

- Inhalation through the lungs;
- Absorption through the skin;
- Ingestion through the mouth;

The following figure help to explain how chemicals can enter the body and the effects they can have once they are the body. Figure 1 shows the different routes of entr4y by which chemicals can enter the body. Figure 2 shows the different organs and tissues that can be affected by certain toxic industrial chemicals.

Note: exposure to toxic substances in the workplace can also lead to higher accident rates. It is important to learn about the substances you work with, make sure the proper control measures are in place, and to know your rights.

Note: to prevent bringing workplace chemicals home to your family, wash/shower and change your clothes when necessary before you leave work. Leave your dirty clothes at work. If you must wash them at home, wash them separately- never with the family wash!

Tips for control of chemical hazards:

- To find out and effectively manage the inherent hazards of chemicals, the first and most important step is collecting information. Immediate sources of information are labels on chemical containers, chemical danger signs and chemical safety data sheets.
- Do not use new chemicals until you have obtained the above information on the chemicals.
- No chemicals should be brought into the tannery, if these are not properly labeled or marked.
- Avoid chemical exposure of workers whether through inhalation, ingestion or skin contact!
- Eliminate hazardous chemicals and processes.
- Generally good house keeping practices such as regular cleaning of work areas, floors, walls and machines, removal of waste and adherence to safe storage and handling practice reduces the number of potential pollutant in the work place.
- Reduce the number of workers in areas with hazardous chemicals.
- Limit access to areas where hazardous chemicals are like to be present.
- Use personal protective equipment.
- Wherever it is impossible to prevent personal exposure to chemicals and pollutant at levels at which there is no hazard to health, personal protective equipment must be used.
- Ensure good personal hygiene of workers.
- Store chemical safely.
- No smoking and use of open fire in chemical stores.
- Find the right storage space for chemicals.
- Avoid storage of chemicals directly on the floor.
- Transfer of chemicals from chemicals containers.
- Always add acid to water, not water to acid!
- Do not let the waste containers be used for storage of drinking water or food grains!

Self-Check 5	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Instructions**:** Write all your answers in the provided answer sheet on pages 19.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Test I: Short answer questions: (Total points: 8)

7. List out the various factors that affect the performance of leather while storage. (2 points)
8. What is the problem of exposing leather to strong sun light? (2 points)
9. Define factors affecting the selection of adhesives. (2 points)
10. Define the ways that chemicals can enter the body. (2 points)

Information Sheet 6	Identifying common problems and faults of materials

Introduction:

Leather is a natural product, which is derived from the raw hide and skin of the animals. We all know that Hide is the outer covering of animal of large skins e.g. cow, buff etc. whereas, skin is the outer covering of animals of small species e.g. goat, sheep etc. A hide is normally divided into two parts through the backbone for convenience in handling. Each part is called a side.

A large proportion of the hide or skin coming to the tannery are full of defects and they are either unusable or it is very costly for shoe manufacturers to use them. The tanner therefore, endeavors to improve the quality by eliminating or rendering these defects by a procedure called “Correcting the grain side”.

Defective portion is removed partly by snuffing (rubbing with fine emery paper) and then finished and plated at high temperature & pressure to give it a good appearance. This leather whose grain side is corrected by snuffing & plating is called **“Corrected Grain Leather”**. Corrected grain leathers are available in various forms depending on the plate that has been used i.e. smooth corrected grain, hair all printed, printed milled etc.

Defects that can be found in the finished leather can be classified into two basic groups. These are natural and man made defects. Some of the **natural defects** are vein marks, growth marks, tick marks, warble-fly marks and etc. while **man made defects** are brand marks, barbed wire marks, flay cuts, flesh cuts and etc. From these defects, mostly the man- made defects affects the quality and cutting value of the leathers. Some of the common leather defects are listed below:

a) Looseness

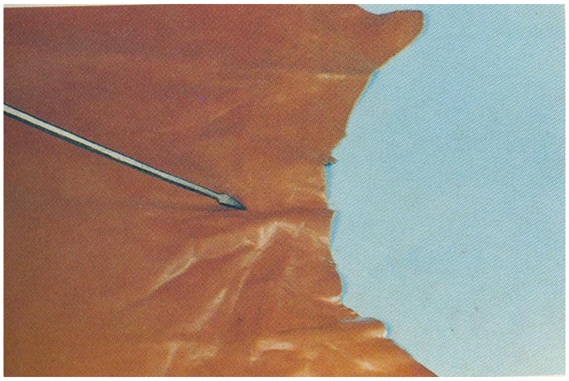


Fig. Loose flanks

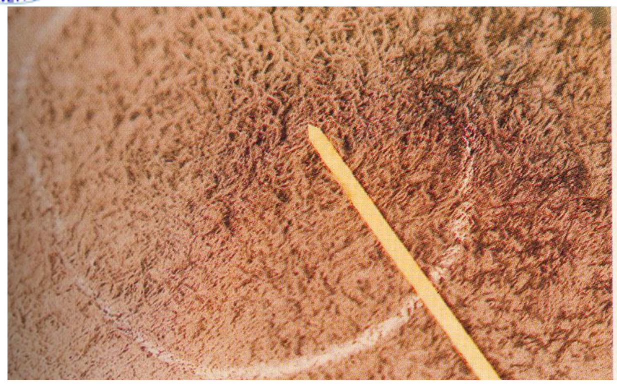
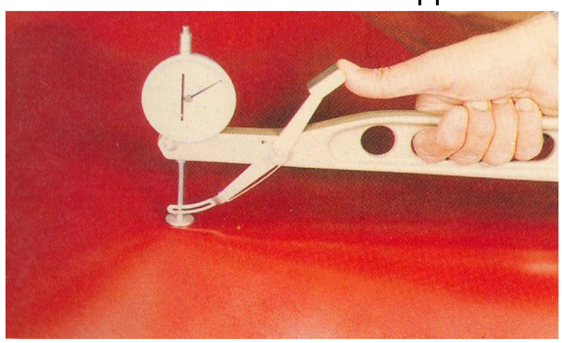


Fig. Loose fibers

b) Poor Thickness

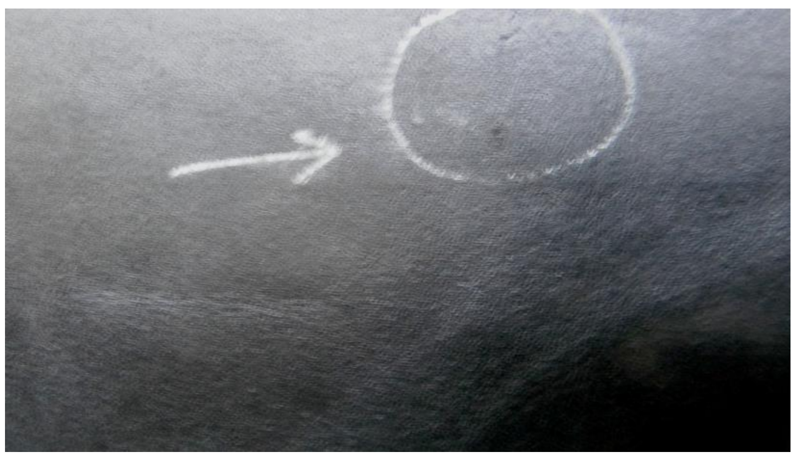
Thickness of the leather is measured to ensure skin supplied of the expected thickness**.**



c) Pipeness

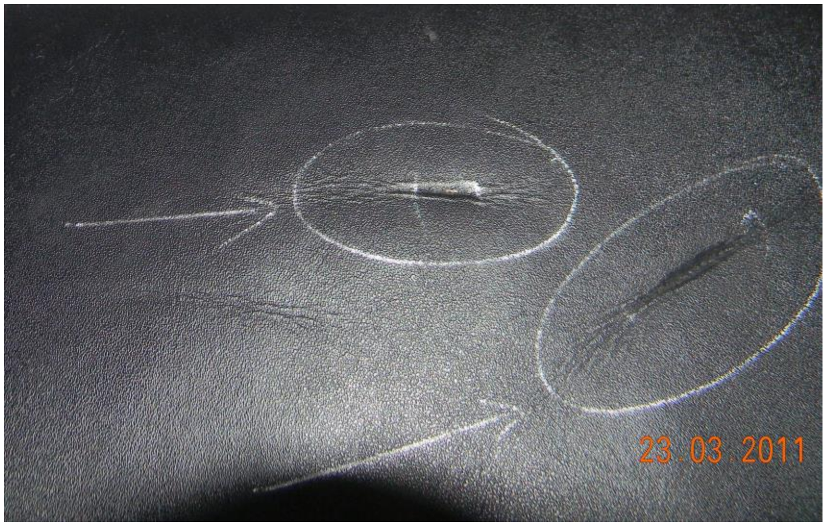
d) Scratch marks

e) Scar marks



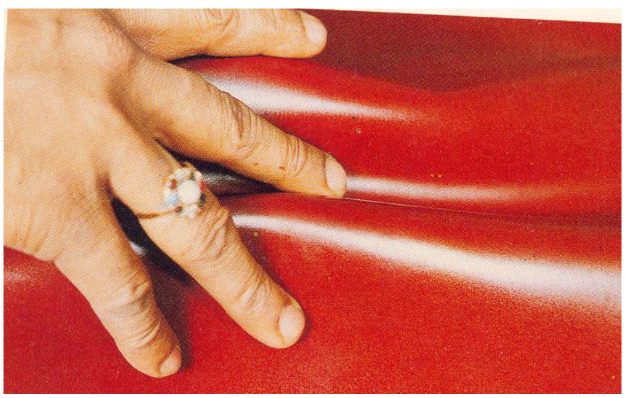
f) Brand marks

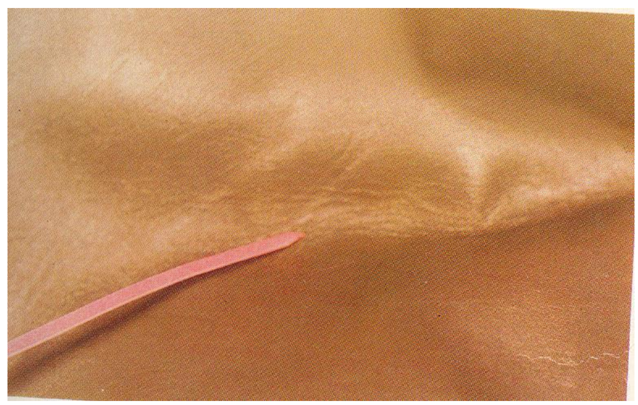
g) Flay cuts



h) Cracking or Grain Cracking

Double fold leather at least 4 places per hide to see whether there is any tendency of pigment and or grain cracking.





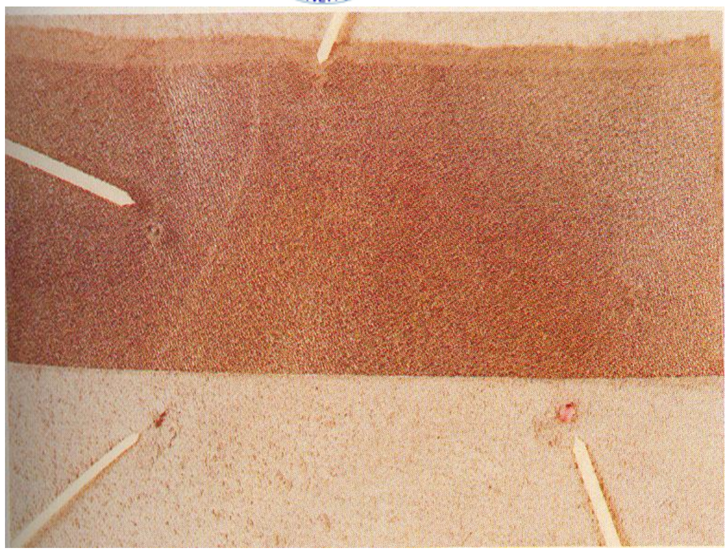
i) Bleeding

It is the diffusion of uncombined materials from the interior of leather to the grain surface where they may contaminate other materials or mar the appearance of the leather. This usually occurs at elevated temperatures and is commonly designated as staining.

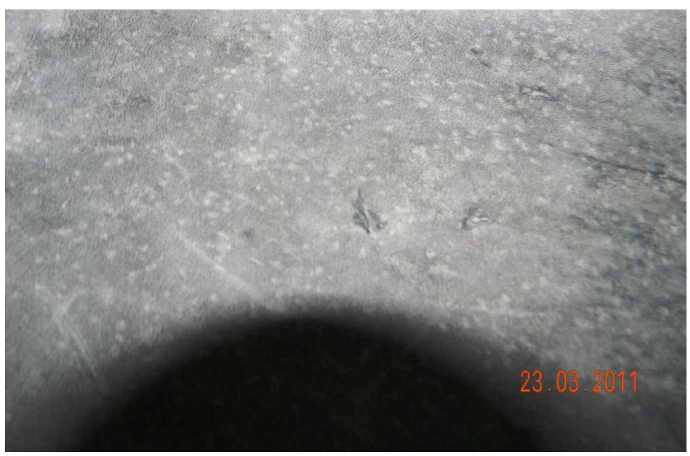
j) Tearing

In the butt region, we make a half inch cut from an edge with a scissor. By holding leather on two sides of cut with thumb and a finger we try to tear it further. If it tears easily the lot is not acceptable. That is, it fails tear strength.

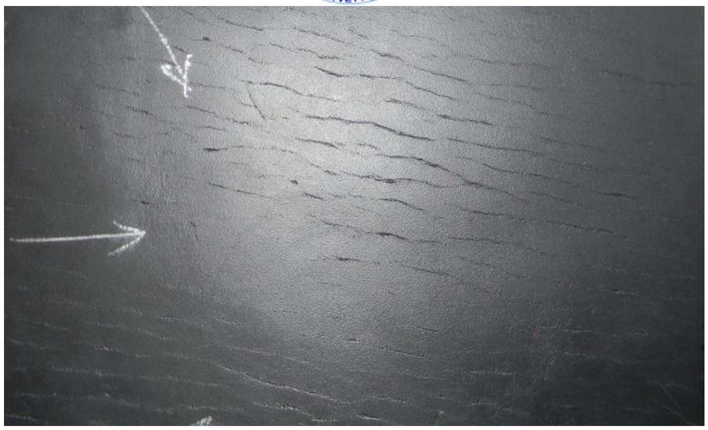
k) Warble hole



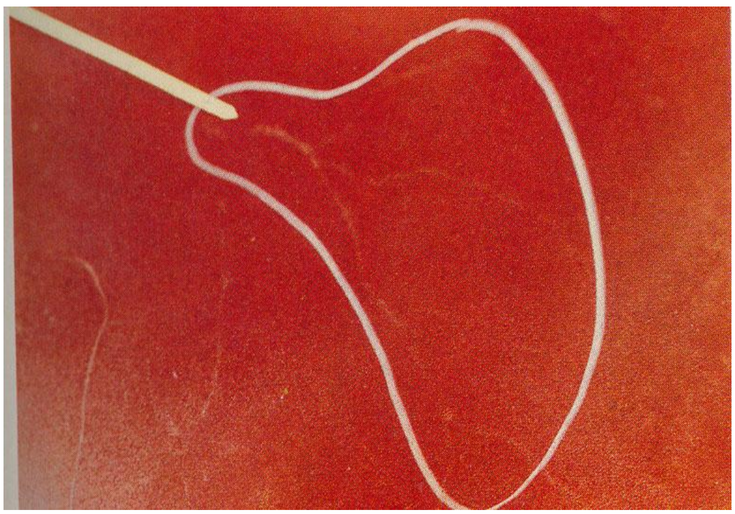
l) Tick mark



m) Growth marks



n) Vein marks



Self-Check 6	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Instructions: Write all your answers in the provided answer sheet on pages 9.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Test I: Short answer questions: (Total points: 10)

7. What is leather defect? (2 points)
8. What are the two groups of defects that are found in finished leather? (2 points)
9. List the different types of leather defects. (2 points)
10. List natural defects of leather? (2 points)
11. List man-made defects of leather? (2 points)

Information Sheet 7 Identifying relevant OHS practices

Introduction

Occupational health and safety (OHS) is a discipline, which aims at:-

- The promotion and maintenance of the highest degree of physical, mental, and social well being of workers in all occupations;
- The prevention among workers of adverse effects on health caused by their working condition;
- The protection of the worker in their employment from risks resulting from factors adverse to health;
- The placing and maintenance of workers in an occupational environment adapted to physical and mental needs.

In other words, occupational health and safety encompasses the social, mental and physical well-being of workers, that is the “whole person”

The definition of occupational health and safety given above encompasses both health and safety in their broadest contexts.

Poor working conditions can affect the environment workers live. This means that worker, their families, other people in the community, and the physical environment around the workplace, can all be at risk from exposure to workplace hazards.

In many countries, chemicals are dumped into the environment, often with serious human and environmental consequences. The laws about chemicals disposal in other countries are strict, to protect both people and the environment.

1. Adhesives

Adhesive is a useful material during shoe making but it may be harmful for factory mankind in case of negligence and safety precautions are not taken care during its use. Therefore we should follow certain safety measures during using the adhesive and checklist has to be made for proper application of such chemical fluids.

For the safety of the operator:

- Wear appropriate footwear and clothing while using it in the workshop.

- Wear a hair band or tie your hair back in case of hair longer than shoulder length.
- Adhesive should not come in the contact of skin, but in case of emergency use hand gloves during manual application of adhesive.
- Avoid wearing loose clothing during machine operation.
- Use proper ventilation/exhaust system near the adhesive application station.

Safety points during machine operation:

- Sit squarely on your chair within reach of the material and m/c controls. Your thighs should be parallel to the floor when seated.
- Keep your fingers and yourself away from moving parts of the m/c.
- At a time, one operator in m/c.
- In case of an accident, no matter how minor, report it to your supervisor.
- Know your fire drill.
- Do not try to make your own electrical repairs.
- Do not push the work through your hands; let the m/c feed the work.

For the safety of the m/c:

- Proper cleaning, oiling and covering of the m/c.
- Thorough knowledge of m/c prior to operating them.
- Instructions to be properly followed.
- After finishing off with the work switch off the machine and raise the pressure assembly or put a piece of material beneath it.
- Check for any looseness in the screws of the machine.
- Ensure that proper setting and adjustment of certain parts has been done.
- Check for enough polyamide granules in thermo folding machine.
- In case of spray gun, set it for proper pneumatic pressure and nozzle flow.

As different types of material is being used by footwear industry, resulting various complications during adhesive selection. One should be extra cautious while selecting particular adhesive for particular material. For example water based adhesive is not suitable for oily kind of leather.

A lot of application of adhesive should be avoided during upper closing, therefore it is advisable that one should use less adhesive while attaching the two or more components together. More use of adhesive can lead following question marks:

- Wastage of adhesive.
- Creates problem during making & stitching.
- Makes the upper more stiff & rigid.
- Stiffness affects the flexibility while walking.
- Increases the weight of the shoe.
- Upper surface becomes hard, leads uncomfortable walk.
- Increase the operation & material cost.

2. Primers

Storage of primers

The main purpose of the primers is to help chemically activate that outer layer of the upper material and the sole, where the film of adhesive would be applied and bonded together.

The expected shelf life of primers commonly in use is as follows:

Primer	**Shelf Life**
Lacsol	6 months
Satreat	3 months unopened.1 month opened
Super Satreat	2 months unopened.1 month opened
SAT EVA Primer	6 months
Isocyanate wipe (SDP 102	1 to 2 weeks

The shelf life of any product is that span of time from the date of manufacturing to the date of expiry as indicated by the manufacturer of that product.

Once a stock container has been opened, the shelf life may be reduced. If a primer shows signs of deterioration e.g. sediment or undue discolorations, do not use.

Halogenations primers such as Satreat should be kept in black polythene containers with the caps firmly screwed on to avoid degradation by exposure to sunlight or uptake of moisture.

The physical and the chemical treatment of the sole and the upper material are to be done before the adhesive is applied to either of them. The adhesive applied (shown in the table) should be compatible to both the surfaces. Enough time is then given to each one of them for drying (either in normal conditions or by forced drying). After that proper activation time and temperature should be given to heat the adhesive film on the upper and the sole so that proper and efficient bonding takes place**.**

Priming of sole:

Florescent chemicals visible in UV light must be added to primers and each pair sole must be checked under UV light sole that it's correctly primed. UV chamber may be used to check correct application of primers.

Small amount of primer should be taken out from the main bottle or container at a time. The container should not allow any light to reach the primer.

Correct amount of powder provided by supplier must be mixed according to instruction. Everyday new primer mixture should be used.

3. Finishing materials

When we address healthy and safety aspects in finishing, it is more related to the use of finishing materials at work place (solvent /chemicals).

The effects of solvents can be acute or chronic depending up on the concentration and length of exposure to the body. More effects are irritation and allergic reaction to skin, eyes and respiratory tract.

Solvents in the work place are major fire and explosion hazards. The improper storage, handling or transport may result in minor fire to major disaster resulting in loss of human life.

Fire in principle needs three elements to survive: fuel, heat and oxygen. To check any fire hazards these elements should be controlled.

In this respect we can classify the chemicals used in finishing department in two categories:

- Water based products: there is no risk of flammability during drying or application but some of the residues may ignite if exposed to a naked flame. Soil deposits must be disposed off correctly.
- Solvent based products: most of them contain low flash point solvents and they will ignite instantly if come in the contact of naked flame or a hot surface. Safety precautions must be respected.

Principle of prevention

The following are basic principles of operational control:

- Eliminate the hazards(replace as far as possible, solvent based chemicals to that of water based)
- Put a distance/shield between the solvent and worker.
- Provide general and local ventilation
- Protect the workers by using personal protective equipment like dust mask respiratory, protective goggles, gloves.
- Spillage, disposal, cleaning. Major spillage of solvent products should be immediately soaked by dust or sand to prevent spreading and in particular to avoid contaminating drains.

Factors Affecting Selection of Adhesives:

1	Safety	Whether flammable/non-inflammable; whether vapors harmful for inhalation, skin protection
2	Application	Hand (brush); machine; roller; spray-gun
3	Drying Time	Quick; Slow
4	Tack Retention Time/Open Time	Time available to make bond after drying
5	Shelf Life	The length of time an unopened package of adhesive can be expected to remain in usable condition under specified conditions of temperature and humidity.
6	Pot Life	Length of time, it can be used after opening of the container
7	Type of Stick	Dry; wet; self adhesive; heat & pressure
8	Compatibility	With materials to be bonded
9	Final Bond Strength	Permanent/Temporary; Flexibility; Resistance to heat/moisture
10	Cost	Low; High
11	Storage	Temperature conditions

Self-Check 7	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Instructions**:** Write all your answers in the provided answer sheet on pages 36.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Test I: Short answer questions: **(Total points: 10)**

1. Define OHS (occupational health and safety). (2 points)
2. What will happen if follow poor working condition in working area.(2 points)
3. State safety consideration while using adhesive. (2 points)
4. It is advisable that one should use less adhesive while attaching two or more components together. Why? (2 points)
5. State basic principle of operational control for using finishing materials. (2 points)

LG #22	LO #9. Determine performance of materials for footwear

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying physical properties of materials
- Identifying and describing performance characteristics of materials
- Describing types of surface finishes used on materials

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify physical properties of materials
- Identify and describing performance characteristics of materials
- Describe types of surface finishes used on materials

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Read the information written in the "Information Sheets 1".
- Accomplish the "Self-check 1" in page 12. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #2.
- Read the information written in the "Information Sheet 2".
- Accomplish the "Self-check 2" in page 16. Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 3". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #5.
- Read the information written in the "Information Sheet 3".
- Accomplish the "Self-check 3" in page 20. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to "Information Sheet 4". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #8.

Information Sheet 1	Identifying physical properties of materials

For more understanding of this information sheet refer to learning guide on information sheet 2.

- **Leather**

For making footwear, leather is being replaced nowadays by varieties of synthetic materials available in the market due to the cost factor. But leather is still the most suitable material for making footwear and is superior to synthetic leather or any other leather substitutes.
The leather is fibrous in nature and due to this it can perspire giving the feet extra comfort. Also, the leather has got poor thermal conductivity, keeping the wearer cool in the summer heat and warm when it is cold. The elasticity and plasticity of leather allows it to adjust individual foot shape. The tensile strength, bursting strength, tear strength, flexing endurance, shrinkage temperature etc. are also observed to be considerably high when compared to synthetic materials.
Additionally, the leather is repairable and eco-friendly justifying its suitability as the best material. The structure of hides and skins and the tanning methods involved determine the actual properties of the given leather.
Suitability of leather for upper materials is due to its:

- Elasticity and plasticity
- Strength and stretch
- Permeability
- Surface characteristics
- Ease of working and maintenance
-

- **Adhesives**

For a material to perform as an adhesive it must have four main requirements:

- It must "wet" the surfaces - that is it must flow out over the surfaces that are being bonded, displacing all air and other contaminates that are present.
- It must adhere to the surfaces - That is after flowing over the whole surface area it must start to adhere and stay in position and become "tacky".
- It must develop strength - The material must now change its structure to become strong or non-tacky but still adherent.

- **Textile**

Textile (fabric) is the term describes any woven or non-woven or knitted materials. Textile (fabric) derived from Fibers. Fibers may be of natural or synthetic (man-made) origin e.g. cotton, wool, silk, jute are the natural fibers whereas, nylon, viscose, Orion etc. are the synthetic fibers. Fibers are produced either as staples or filaments.

Fabrics and other man-made materials are now being used more and more in shoemaking. Brocades have been used in footwear for hundreds of years, but today a wide range of fabrics and non-leather materials enters into the construction of all types of footwear. Textiles in all the well-known natural synthetic categories are specially produced to meet the particular needs of the shoe industry.

- **Steel Shank**

The Shank is a metal strip that forms a part of the insole. It maintains the longitudinal arch of the foot. Generally shank is made of high grade carbon steel which is properly tempered in order to impart the required material properties. In ladies high heeled shoes, the shank is shaped in such a way that it extends into the heel. Dimensions of typical shank are 10 mm width x 1 mm thickness and length of 85, 95, 105 mm as per size of footwear.

There are various material used for making shank.

Metal: are manufactured from steel. Two thickness of steel are commonly used 1.2 m.m. and 1.42 m.m, the first being the more common. These are available in two widths: 9.5 m.m. and 12.7 m.m. although other widths and thickness are used.

Shank length (m.m.)	Minimum Total Shank Depths (m.m) for:	
	9.5 mm wide shanks	12.7 mm wide shank
Less than 50	2.18	1.22
50-74	2.82	2.18
75-99	3.40	2.82
100 and over	Not recommended	3.45

Wood: wooden shanks are not as strong as steel shank. But they are light in weight. Bamboo shanks are also used for a low heel shoes. In welted footwear a special board wooden shank is used which ultimately covers the space between welt ribs, doing an important job both filler and a shank. Wooden shanks are skived to give a tapered edge at each end and along the side.

Plastic: the plastic shanks are the edition among the shank materials. It is generally used for the PVC unit soles. The shanks are made from polystyrene or polypropylene injection moldings. It is hard plastic but less inflexible than wood or steel shank.

- **Soling material**

The ideal qualities for a soling material are as follows:

- Durability
- Flexibility
- Water proof
- Lightness in Weight
- Slip resistant
- Uniformity/Dimensional stability
- Cement holding
- Temperature resistant
- Stitch / Tack holding

Testing of soling materials

It is obvious that soling material possess some basic requirements in order to make them suitable for soling purposes. Testing is done to evaluate the required properties and to ensure the fitness for use. Very common tests are essential in case of soling materials are:

- General state of soling
- Flex crack resistance
- Abrasion resistance
- Dimensional stability
- Sole adhesion
- Slip resistance
- Durability

- **General state of soling**: Soling materials are to have some basic properties like light weight, flexible, offer adequate strength, water resistance etc. Those are very common responsible factors for selection to solve the purpose as well as to feel comforts. To evaluate them following are very usual tests. (a) Hardness/Softness (b) Density (c) Tensile strength (d) Water proofness (e) Water absorption

- **Flex crack resistance:** The shoe is repeatedly subject to compression forces and flexing deformation at each step during walking. The area gets increased when it is bending during stepping and comes to the normal state when the step is completed. The sole should posses adequate flex resistance to prevent from flexing deformation**.**

- **Abrasion resistance:** The sole as the bottom surface of the shoe is in continuous friction with the ground under body pressure during walking. It can be abraded of gradually by reducing its volume by contact area. Such abrasion may be quiet significant or quiet justify.

- **Dimensional stability**: The shoe while in wear is subject of repeated compression forces, which may spread cellular soling material and thus make the sole deformed and ugly. To evaluate this property some sort of testing is carried out which are (a) Compression set (b) Heat shrinkage (c) Shrinkage due to all change in moisture content

- **Sole adhesion**: It is one of the very important properties of the soling materials that it should readily stick on to the upper with a permanent strong bond to avoid bond failure during wear. The sole adhesion and bond strength depend upon various factors like type of material, type of adhesives quantum of pressure, heat reactivation, temperature and preparation of soling upper.

- **Slip resistance**: Slip resistance is expressed as coefficient of friction which is obtained numerically by dividing the horizontal force required to cause slip by a vertical force applied on a material.

- **Durability**: Durability of soling material in a combination of property such as abrasion resistance, hardness, stress applied, and density of the soling material. All these characteristics can influence the tear and wear resistance or as such durability.

Self-Check 1	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: ____________________

Instructions**:** Write all your answers in the provided answer sheet on page 8.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Test I: Short answer questions: (Total points: 8)

1. Write down the physical properties of the following footwear materials. (2 points each)
2. Adhesive
3. Soling materials
4. List the materials used for shank making. (2 points)
5. Why leather is suitable for upper making purpose. Write down four points.

    i. (2 points)

Note: **Satisfactory rating – 4 points and above Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Score = ___________

Rating: ____________

Answer Sheet

Information Sheet 2 Identifying & describing performance characteristics of materials

Incorrectly fitting footwear is common in problem and is strongly associated with forefoot pathology and foot pain. Wearing shoes that fit properly and support your feet is vital to avoid sore feet and to prevent or alleviate many common foot problems. Footwear can help sore feet by providing support, such as lace-up boots. Arch supports help distribute weight and remove pressure from the heel and forefoot. High-heeled shoes (high heels) place stress on the body and feet and can cause calluses, bunions, claw toes and corns.

Footwear that fits poorly or is in need of repair also contributes heavily to foot discomfort. Pointed toes and high heels are particularly inappropriate for working footwear.

Prolonged standing, hard flooring and inappropriate footwear are common working conditions. Are there jobs that are safe for feet? Statistics show there are not, really. Among teachers and workers in clerical occupations that belong to "safe" jobs, foot injuries account for from 15 percent to more than 20 percent of all disabling injuries. Not knowing about the need for foot protection in workplaces like schools or offices can play a role in the onset of foot problems.

Some of the effects of poorly made footwear are mentioned as follows.

- shape loss
- Problem in walking
- Foot Injury
- Pain in feet

In designing strategies to protect foot injury, one has to remember the fundamental principle of occupational health and safety: that occupational hazard should be eliminated at the source. The role of personal protective equipment is to minimize exposure to specific occupational hazards, not to eliminate them. Protective footwear does not guarantee total protection.

All workers should wear adequate protection against workplace hazards. For workers exposed to foot hazards, the required protection is protective footwear

All working footwear, for both men and women, whether it is safety wear or not, should provide comfort without compromising protective value. A steel toe cap should cover the whole length of the toes from tips to beyond the natural bend of the foot. A soft pad covering the edge of the toecap increases comfort. If the toecap cuts into the foot, either the size or style of the footwear is incorrect.

Soles come in a variety of thicknesses and materials. They need to be chosen according to the hazards and type(s) of flooring in the workplace.

Uppers of protective footwear come in a variety of materials. Selection should take into account the hazards, and individual characteristics of the worker's foot.

A steel midsole which protects the foot against penetration by sharp objects should be flexible enough to allow the foot to bend.

No one type of non-slip footwear can prevent the wearer from slipping on every surface type.

Self-Check 2	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Instructions: Write all your answers in the provided answer sheet on page 12.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Test I: Short answer questions: (Total points: 6)

1. Define effects of poorly made footwear. (2 points)
2. Define the causes of poor shoe fitting. (2 points)
3. Discuss the solution for the causes of poorly made foot wear. (2 points)

Note: **Satisfactory rating -100%**
You can ask your teacher for the copy of the correct answers.

Information Sheet 3 Describing types of surface finishes used on materials

Introduction

Leather can be classified into different categories based on the origin (type of animal) appearance of grain, sometimes tanning also and finishing. Another very important classification is done on the basis of finishing. The types of surface finishes used on leather are listed as under:

- **Velvety**

Nubuck, suede, split suede and reverse side suede comes under this category. The leather is given a velvety look either on the grain side or flesh side by buffing (rubbing by course emery paper) or snuffing (by fine emery paper). In this process small fibres called naps are raised on the surface which gives a velvety look.

Nubuck: In Nubuck leather, the grain side of the leather is made velvety by snuffing. This leather has got a very good writing effect.

Writing effect is the effect caused due to raised naps on the surface. When we apply our finger on the surface we get finger marks on the leather. This effect is called writing effect.

Note: Buff Nubuck has low writing effect.

Suede*:* If the grain side is having more deep defects, the flesh it is made velvety by buffing the flesh side. This leather is called Suede.

Split Suede: If the leather is made velvety by buffing the flesh surface in case of split leather, it is called Split suede. The suede effect on split leather can be obtained on both the sides and this leather can be utilized from both the sides.

- **Glazed**

It is type of finish; the glazing effect is obtained by glazing machine. Compactness of grain is required to sustain the high temperature and pressure of the machine.

- **Oil-pull up**

It is carried out on full grain leather (partially snuffed). The pull-up oil (free oil) is well sprayed with the season and finally the oil is sealed inside by top coat permitting the oil to move freely inside, responsible for color change when pulling the leather.

- **Patent**

Basically it is a PU finish in which a special type of curtain coater machine is utilized. The finish film thickness is restricted to be less than 0.15mm. The mirror like appearance is the unique feature if this finish.

- **Embossed**

The leathers are embossed in order to hide some defects or to create a particular appearance and surface effect, such as reptile embossing etc.

- **Smooth**

This is a type of corrected grain finish, the closed defects are covered by repeated coating of season and pressing on hydraulic press, finally plain plating is done to get smooth finished surface effect.

- **Film coated**

A PU coated leather is a type of leather with a thick film of PU laminated on it. This leather does not have breakability like leather because of thick PU film.

PU film coated leather is either a split or sometimes, a grained leather with a very thin film of PU laminated on it. This leather is made breathable.

Self-Check 3	Written Test

Name: ______________________________ Date: ____________________________

Time started: ________________________ Time finished: _____________________

Instructions**:** Write all your answers in the provided answer sheet on page 14-15.

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

Test I: Short answer questions: (Total points: 12)

1.Define the following types of surfaces finishes on leather. (8 points)

- Glazed
- Patent
- Film coated
- Embossed

2.Briefly explain what types leathers are come under the velvety category. (2 points)

3.What is the difference between suede and split suede? (2 point)

Note: **Satisfactory rating – 6 points and above Unsatisfactory - below 6 point**

You can ask you teacher for the copy of the correct answers.

Reference Materials

Book:

TTLM of footwear level one on os Version 4January 2012 **IND BFP1 TTLM 0212v1**

Galenleather.com/bog

TTLM of footwear level two on (OS) Version 4January 2012 **IND FP2 TTLM 0212v1**

www.geine leather , hhh.leather

AKNOWLEDGEMENT

We wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry who revision new OS on footwear and Teaching, Training and Learning Materials (TTLM) proposed in LIDI (LEATHER INDUSTY DEVELOPMENT INSTITUTE) .

experts of Oromia Regional TVET bureau and Federal TVET bureau in Bishoftu city BIN INTERNATIONAL HOTEL

This Teaching, Training and Learning Materials (TTLM) was developed on December, 2020 Bishoftu

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