Threads and Needles

Unit: Science of Textiles and Manufacturing

Problem Area: Textile Construction Techniques

Lesson: Threads and Needles

Student Learning Objectives.

Instructions in this lesson should result in students achieving the following objectives:

1. **Summarize thread types and uses.**
2. **Determine thread weights and intended uses.**
3. **Summarize needle types, sizes, and uses.**

Resources.

The following resources may be useful in teaching this lesson:

E-unit(s) corresponding to this lesson plan. CAERT, Inc. http://www.mycaert.com.

Ahles, Carol Laflin. "Thread Essentials," *Threads*®. Accessed March 9, 2016. http://archives.threadsmagazine.com/?iid=84272&startpage=page0000006#folio=37.

Cream, Penelope, Ed. *The Complete Book of Sewing.* DK, 1996.

"Hand Sewing Needle Guide," *Sewing and Craft Alliance*. Accessed March 9, 2016. http://www.sewing.org/files/guidelines/22_110_hand_sewing_needle_guide.pdf.

"Sewing Basics: Hand-Sewing Needles," *Make Something: It's Good to Be Crafty*™. Accessed March 9, 2016. http://makesomething.dritz.com/Sewing-product-info/hand-sewing.

"Sewing Machine Needle Charts," *Sewing and Craft Alliance.* Accessed March 9, 2016. http://www.sewing.org/files/guidelines/22_115_sewing_machine_needle_charts.pdf.

Superior® Threads. Accessed March 9, 2016. http://www.superiorthreads.com.

"A Thread of Truth," *YLI Corporation*. Accessed March 9, 2016. http://www.ylicorp.com/CPanel/Document/A_THREAD_OF_TRUTH.pdf.

Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint Projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

Key Terms. The following terms are presented in this lesson (shown in bold italics):

- antistatic sewing thread
- ballpoint needle
- betweens needle
- button and carpet thread
- buttonhole twist
- calyx-eyed needle
- cotton thread
- crewel needle
- denim needle
- embroidery thread
- eye
- fire-retardant thread
- leather needle
- machine embroidery needle
- metallic needle
- metallic thread
- milliner needle
- needle
- nylon thread
- overlock needle
- ply
- polyester thread
- polymer
- polypropylene thread
- rayon thread
- scarf
- sharps needle
- silk thread
- spring needle
- thread
- universal point machine needle

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask students: "How are your clothes constructed?" "What tools are used to construct garments?" "What materials are needed to stitch and secure garment pieces?" Give students a few moments to think this over. Then list student responses on the board or post electronically. Discuss the list, and divide it into categories: equipment (sewing machines, pressing equipment, etc.), hand tools (seam gauge, needles, etc.), and threads or cording. Next, make a list of household and personal items "stitched" with thread (e.g., patio furniture cushions and rugs, clothing garments, firefighter and EMS garments, sportswear, outdoor flags and artistic structures, tents, sleeping bags, backpacks, handbags, shoes, hats, and luggage).*

> *Project "How It's Made: Cotton Yarn," at https://www.youtube.com/watch?v=vBVqPu2v25I to provide an overview of thread production.*

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Summarize thread types and uses.

Anticipated problem: What are garment and commercial thread types and their uses?

I. Thread types and uses

A. ***Thread*** is a tightly twisted strand of two or more ply of yarn that appears circular when cut in a cross section. All threads begin as simple yarns: Short fibers twisted together or continuous filaments produce the yarns. ***Ply*** is the number of component yarns twisted together to produce a thread. Sewing thread differs from yarn in that thread is used to construct garments, and yarn is a collection of fibers used to weave or knit into a textile fabric. So thread can be made of yarn, but yarn is not made of threads. About 95 percent of all thread is produced for commercial or industrial purposes.

1. Three basic types of thread are based on origin: animal, plant, and synthetic. Thread is used for hand sewing and for sewing machines. It is manufactured for use in commercial and industrial sewing and for individual or home use.
2. Thread is wound on spools marked with the size or fineness of the thread. The engineers who design sewing threads are called seam engineers. They produce and test prototype threads for new fabrics and products.
3. Synthetic fiber threads are stronger than natural threads.

4. All thread types are smooth and must be friction-free.
5. All thread must be strong enough to endure the wearing of a garment or the "wear and tear" inflicted on outdoor or indoor commercial products (e.g., tents, sleeping bags, coats, flags, and patio furniture textiles).

B. Thread types and uses

1. Natural fiber threads are cotton, silk, and rayon. They are plant-based and will shrink.
   a. ***Cotton thread*** is a fibrous material produced from cellulose (plant materials) and spun to yield staple cotton fibers. Cotton thread has limited strength and little stretch (e.g., not used to stitch stretchy fabrics). Uses include:
      (1) Stitching lightweight woven fabrics (e.g., quilting and patchwork)
      (2) Heirloom sewing and repairs
      (3) Decorative stitching and embroidery
      (4) Stitching linen fabrics and garments
      (5) Basting (e.g., Cotton basting thread is inexpensive and breaks easily; it can be easily removed from the fabric construction.)
   b. ***Silk thread*** is a fibrous material made from the natural continuous fiber produced from silkworm cocoons. Silk thread is strong and smooth. It has a fine diameter and a lustrous sheen. Uses include:
      (1) Hand sewing and tailoring (e.g., sewing buttons and finishing the edges of a buttonhole)
      (2) Fabrics and garments of natural origin (e.g., wool, and silk)
      (3) ***Buttonhole twist*** is shiny silk thread about three times the diameter of sewing silk and is strong and may be permanently stretched.
   c. ***Rayon thread*** is a continuous, natural cellulose fiber created by forcing the cellulose solution through fine spinnerets (a perforated plate). It is produced from regenerated cellulose fiber (mostly wood pulp) that is chemically converted to a soluble compound. Rayon thread has little strength and no stretch. However, it does tolerate high heat temperatures. Types of rayon include viscose, modal, and lycocell. Rayon thread is not recommended for garment or other product construction. Uses include:
      (1) Decorative stitching
      (2) Machine embroidery
2. Synthetic fiber threads: polyester and nylon
   a. ***Polyester thread*** is a single yarn or single-ply material produced from petroleum products. Polyester is strong, does not shrink, has an excellent ability to stretch and recover, is usually colorfast, and is resistant to high temperatures. Four common types of polyester thread are spun polyester, multifilament, trilobal, and textured. Uses include:
      (1) Stitching for fire-resistant and fire-retardant garments for firefighters, racecar drivers, infant and toddler pajamas and sleepers, and crib linens

(2) Stitching fabrics (synthetics and stretch knits and other preshrunk fabrics)

b. ***Nylon thread*** is a clear fibrous material made from a single yarn or single ply produced during a two-stage polymerization process. Nylon is strong, does not shrink, has an excellent ability to stretch and recover, is usually colorfast, and is resistant to high temperatures and to oil and grease. However, its strength makes the thread brittle. Uses include:
   (1) Fishing line
   (2) Stitching fabrics (e.g., synthetics and stretch knits)
   (3) Surgical thread

c. Special synthetic thread features include:
   (1) ***Fire-retardant thread*** is a fibrous material that is more resistant to fire than others because of the chemical treatment and/or the manufactured fireproofing of the fibers. It is used in sewing clothing and gear for first responders, firefighters, racecar drivers, and other people who need protection from fire and heat. These threads are made by chemical companies (e.g., DuPont) and are known by names such as Nomex™ and Kevlar™. Fire-retardant threads do not melt and can withstand heat temperatures of 700°F.
   (2) ***Polypropylene thread*** is a versatile polymer that serves as a plastic and as a fiber. A ***polymer*** is a large chain molecule made up of monomers (small molecules). "Poly-" means many, and "-mer" means part; so a polymer has many parts. Polypropylene thread is well suited for automotive and outdoor use, as it does not absorb water (e.g., indoor/outdoor carpeting, car mats, computer fabrication rooms, and other uses). It is a natural type of antistatic thread. ***Antistatic sewing thread*** is a fiber that prevents the buildup of static electricity or reduces its effects. Antistatic threads prevent the effects of abrasion on seams and have a heat tolerance up to 266°F.

C. Specialty threads

1. ***Button and carpet thread*** is fibrous material composed of extremely strong and thick fibers, especially compared to all-purpose thread products. It is typically made from silk or polyester fibers and is not used for all-purpose sewing projects, as its appearance is not suitable for most jobs. (NOTE: A person may need a different sewing machine and/or a different needle to use button and carpet thread—such as a top-stitching needle). Uses include:
   a. Attaching buttons (e.g., to garments, upholstery, trekking clothing and camping gear)
   b. Sewing carpets
   c. Outdoor equipment and durable goods (e.g., backpacks, tents, sleeping bags, and shoes)
2. ***Metallic thread*** is a manufactured fiber produced from metals, which may be used alone or in conjunction with other substances (e.g., plastic-coated metal, metal-coated plastic, or a core completely covered by metal). Wrapping metal

around a fiber core is the typical way a metallic thread is produced. It is combined with other fibers (e.g., plastic) to add strength and long-term durability. These threads are constructed by beating soft metals (e.g., gold, silver, copper, and bronze) into thin sheets and then cutting the sheet into thin strips (ribbons). The main use is decorative (e.g., adding glitter and sparkle to a fabric).

3. ***Embroidery thread*** is a yarn that has been manufactured or hand spun for embroidery or needlework and is available in different fiber forms.
   a. Rayon is the most popular embroidery thread because the stitches are smooth and lead to a higher quality embroidery work. It is also a lower cost alternative to silk thread. However, it deteriorates over time and must be well maintained.
   b. Polyester has become one of the most popular embroidery threads on the market because it is strong and economical.
   c. Cotton is the only 100 percent natural fiber thread made for embroidery machines. It is soft and durable. In addition, it easily adjusts to fabric for shrinkage. Other types of embroidery thread are metallic, silk, and wool.

Teaching Strategy: *Many techniques can be used to help students master this objective. Use VM–A through VM–E to review.*

Objective 2: Determine thread weights and intended uses.

Anticipated Problem: What are thread weights and their intended uses?

II. Thread weights and uses

A. Thread weight is the thickness of the fiber and is an important consideration when selecting thread for any sewing project. Thin threads blend in, and heavy threads show. Three methods to measure thread weight are weight, denier, and Tex.
   1. Weight is the most commonly understood method for thread selection in the United States. In the weight system, a smaller number means heavier thread. It is actually a measurement of length. For example, a thread labeled as 40 wt. has 40 kilometers of thread that weigh 1 kilogram. A 30 wt. thread is heavier because it takes only 30 kilometers of thread to weigh 1 kilogram.
   2. Denier is often used for embroidery threads. The weight is in grams of 9,000 meters of thread. If 9,000 meters weighs 120 grams, it is a 120-denier thread. For example, many polyester and embroidery threads are 120/2; that equals two strands of 120-denier thread for a 240-denier total. Larger denier numbers are heavier threads.
   3. Tex is weight in grams of 1,000 meters of thread. If 1,000 meters weighs 25 grams, it is a tex 25. Larger tex numbers are heavier threads. Typically, a higher ply number means stronger thread. Examples of common ply expressions are 40/3 and 60/2.

B. Thread weight affects several aspects of a sewing project: field densities, needle size, and tension.

1. Field density: Most digitized designs are created for a 40-weight thread. This weight works well with embroidery projects. However, if a person selects a 30-weight thread, the embroidery design may appear lumpy, may jam the machine, or might break threads.
2. Needle size: In general, a person selects a needle whose eye is 40 percent larger than the diameter of the thread. For example, use a 75/11 or 8012 needle for 40-weight thread. A 30-weight thread works best with a 90/14 or a 100/16 needle.
3. Tension: On most sewing machines, thread tension is achieved by applying pressure to one side of a spring that presses on a tension disk. Tension is applied to the thread as it passes between a pair of tension disks. For example, if the tension is too high, the thread may be damaged (break or shred). If the tension is too low, the thread "loops" on the back of the fabric.

Teaching Strategy: *Bring a series of different weights of thread for students to review, touch, and scrutinize.*

Objective 3: Summarize needle types, sizes, and uses.

Anticipated Problem: What are needle types, sizes, and uses?

III. Needle types, sizes, and uses

A. Hand-sewing needles

1. A ***needle*** is a small and thin rod-like metal device with a sharp point on one end and a hole for thread at the other. Hand-sewing needles vary according to name, numbered size, length of needle, sharp of the eye, and type of point.
   a. The needle's name is usually determined by its key quality or its end use. The number indicates the size and length of the shaft of the needle.
   b. An ***eye*** is the part of the needle that carries the thread so the machine can keep forming stitches. [NOTE: Using a needle with an eye that is too small or too large can cause thread to shred and break.]
   c. The point of a needle is the first contact with the fabric and is responsible for how the needle pierces the fabric.
2. The most common points are sharps, ballpoint, and universal.
   a. A ***sharps needle*** is a general-purpose sewing needle of medium length with a round eye and a sharp point. Sharps are used for household sewing, dressmaking, and appliqué work. The sizes range from 1 to 10. Size 1 is the longest and the thickest, and size 10 is the smallest and thinnest.
   b. A ***ballpoint needle*** is a specialty needle with a rounded point (tip) to avoid damaging knit fabrics. It is perfect for sewing knit fabrics because the ball-

shaped point passes through the knit yarns without damaging the loops. The sizes are 5 through 10.

c. A ***betweens needle*** (quilter) is a needle that is shorter and a bit thinner than a sharp. It has a small, rounded eye and is designed to pass easily through heavyweight fabrics (including denim) and quilts. This type of needle enables the user to stitch quickly and accurately when tailoring, quilting, and doing detailed stitches. Betweens are often sold in sizes 3 through 10 (sometimes size 12). Size 12 is the finest and shortest of these needles.

d. A ***calyx-eyed needle***, also known as a self-threading needle, is a needle used for general sewing projects. Its key feature is a cut in the top of the needle that allows thread to be pulled "into" the eye from above. Any sewer with low vision or dexterity issues would choose this needle. It comes in a variety of sizes, from 1 to 10.

e. A ***crewel needle*** is an embroidery needle with a sharp point and a large oval eye. The larger oval eye makes threading thicker yarns and multiple embroidery floss strands easier. Sizes are from 1 to 10, and they are short to medium in length.

f. A ***milliner needle*** (milliner straw needle) is a needle that has a sharp point, a round eye, an even shaft, and length that exceeds the average needle at 1⅝ inches. It is used for hat making (millinery). A milliner needle is the longest hand-sewing needle and is often used for basting and pleating tasks as well as to create decorative stitches. The sizes range from 1 to 10.

B. Machine and industrial sewing needles

1. A ***universal point machine needle*** is a device that has a sharp point and is slightly rounded for sewing knits and woven fabrics.
2. A ballpoint machine needle has a medium ballpoint perfectly suited for sewing knits and some stretch fabrics. [NOTE: Ballpoint needles do not form straight stitching as well as sharp needles.]
3. A ***denim needle*** (jeans needle) is a modified medium-size ballpoint needle with a reinforced blade that penetrates extra thick fabric and quilts.
4. A hemstitch needle has a wing on each side that creates a decorative opening on light- to medium-weight fabrics.
5. A ***leather needle*** is a device that has a cutting point that penetrates leather and similar materials. [NOTE: This needle is not used for knit or woven fabrics.]
6. A ***machine embroidery needle*** is a device that has a large eye and a scarf that protects the thread against breaking or shredding. It is used with rayon, acrylic, and specialty threads. A ***scarf*** is a groove out of one side of the needle. It allows the bobbin case to hook to intersect with the upper thread and form stitches.
7. A ***metallic needle*** is a specialty needle for a sewing machine that has an elongated eye, a slightly rounded tip, and an enlarged groove that allows for

extra room during stitching. This specialty needle nearly eliminates shredding of metallic threads.

8. An ***overlock needle*** is a specialty needle designed for use on serger machines. It is suitable for all fabrics.
9. A machine-quilting needle is a slim needle with an acute (very sharp) point and tapered tip to pierce tightly woven quilting fabrics without damaging the threads.
10. A sharps machine needle features a narrow shaft and a sharp point to pierce the threads of woven fabrics. It is used for stitching smooth, finely woven fabrics (e.g., silks, chintz, lightweight, and microfiber fabrics).
11. A ***spring needle*** is a specialty machine needle designed for free-motion quilting, embroidery, and monogramming. A wire coil surrounds the shaft and acts as a presser foot. This coil depresses the fabric as the needle goes through and releases the fabric when the needle is raised.
12. A stretch machine needle has a specifically designed eye and scarf to reduce skipped stitches. It is used to stitch knits, elastic, or stretch fabrics.
13. A topstitch machine needle has a long eye perfect for all types of decorative sewing.
14. Triple machine needles are three needles attached to a single shaft and are only available in universal point style. They are only used on a sewing machine with zigzag capabilities that threads from front to back.

Teaching Strategy: *Use VM–F and VM–G to review. Assign LS–A.*

Review/Summary.

Use the student learning objectives to summarize the lesson. Have the students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. If a textbook is being used, questions at the ends of chapters may be included in the Review/Summary.

Application.

Use the included visual master(s) and lab sheet (s) to apply the information presented in the lesson.

Evaluation.

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. b
2. f
3. a

4. e
5. c
6. g
7. d
8. h

Part Two: Completion

1. polyester
2. metallic
3. button and carpet
4. nylon
5. overlock
6. ply

Part Three: Multiple Choice

1. c
2. a
3. a
4. d
5. b
6. a

Sample Test

Name _____

Threads and Needles

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. thread
b. cotton thread
c. rayon thread
d. calyx-eyed needle
e. silk thread
f. antistatic sewing thread
g. sharps needle
h. ballpoint needle

_____1. A fibrous material produced from cellulose (plant materials) and spun to yield staple cotton fibers

_____2. A fiber that prevents the buildup of static electricity or reduces its effects

_____3. A tightly twisted strand of two or more ply of yarn that appears circular when cut in a cross section

_____4. A fibrous material made from the natural continuous fiber produced from silkworm cocoons

_____5. A continuous, natural cellulose fiber created by forcing the cellulose solution through fine spinnerets (a perforated plate)

_____6. A general-purpose sewing needle of medium length with a round eye and a sharp point

_____7. A needle used for general sewing projects

_____8. A specialty needle with a rounded point (tip) to avoid damaging knit fabrics

Part Two: Completion

Instructions: **Provide the word or words to complete the following statements.**

1. A synthetic fiber produced from petroleum is _____ thread.
2. A manufactured fiber produced from metals, which may be used alone or in conjunction with other substances, is _____ thread.
3. A thread composed of extremely strong and thick fibers, especially compared to all-purpose thread products, is _____ thread.
4. Surgical thread is produced from synthetic _____ fiber.
5. The needles designed for the serger machine are _____.
6. The number of component yarns twisted together to produce a thread is called a/an _____.

Part Three: Multiple Choice

Instructions: **Circle the letter of the correct answer.**

1. The thread well suited for automotive and outdoor use is _____.

   a. silk
   b. cotton
   c. polypropylene
   d. rayon

2. One of the three methods of thread measurement is _____.

   a. weight
   b. ply
   c. strength
   d. None of the above

3. The number on the needle package indicates the _____ of the shaft of the needle.

   a. size and length
   b. weight and strength
   c. name and size
   d. use and cleaning

4. Needles that are short with a small round eye are _____.

    a. sharps
    b. ballpoint
    c. universal
    d. betweens

5. A needle with a wing on each side that creates a decorative opening on light to medium fabrics is a/an _____.

    a. embroidery
    b. hemstitch
    c. sharps
    d. ballpoint

6. A needle designed for free motion, quilting, embroidery, and monogramming is _____.

    a. spring
    b. betweens
    c. metallic
    d. cotton

THE HISTORY OF THREAD

Garments were originally created for two purposes: warmth and protection. At that point in history, thread was a thin strip of animal hide used to stitch

together hide and fir. A modern suede jacket's detailing has a distinctive handpicked topstitching. Is the topstitching on the suede jacket leather thread or a modern synthetic thread?

COTTON AND SILK THREAD

Cotton thread is produced from cellulose (plant materials) and is spun to yield staple cotton fibers. Cotton thread has limited strength and little stretch. Silk thread is made from the natural continuous fiber produced from silkworm cocoons. It is strong and smooth. In addition, silk thread has a fine diameter and a lustrous sheen.

POLYESTER KEVLAR: BULLETPROOF VEST

Fire-retardant thread is more resistant to fire than other threads because of chemical treatment and/or the manufactured fireproofing of the fibers. It is used in sewing clothing and gear for first responders, firefighters, racecar drivers, and other people who need protection from fire and heat. These threads are made by chemical companies and are known by names such as Nomex™ and Kevlar™. Fire-retardant threads do not melt and can withstand heat temperatures of 700°F. Note the texture and weave of the Kevlar bulletproof vest.

BUTTON AND CARPET THREAD

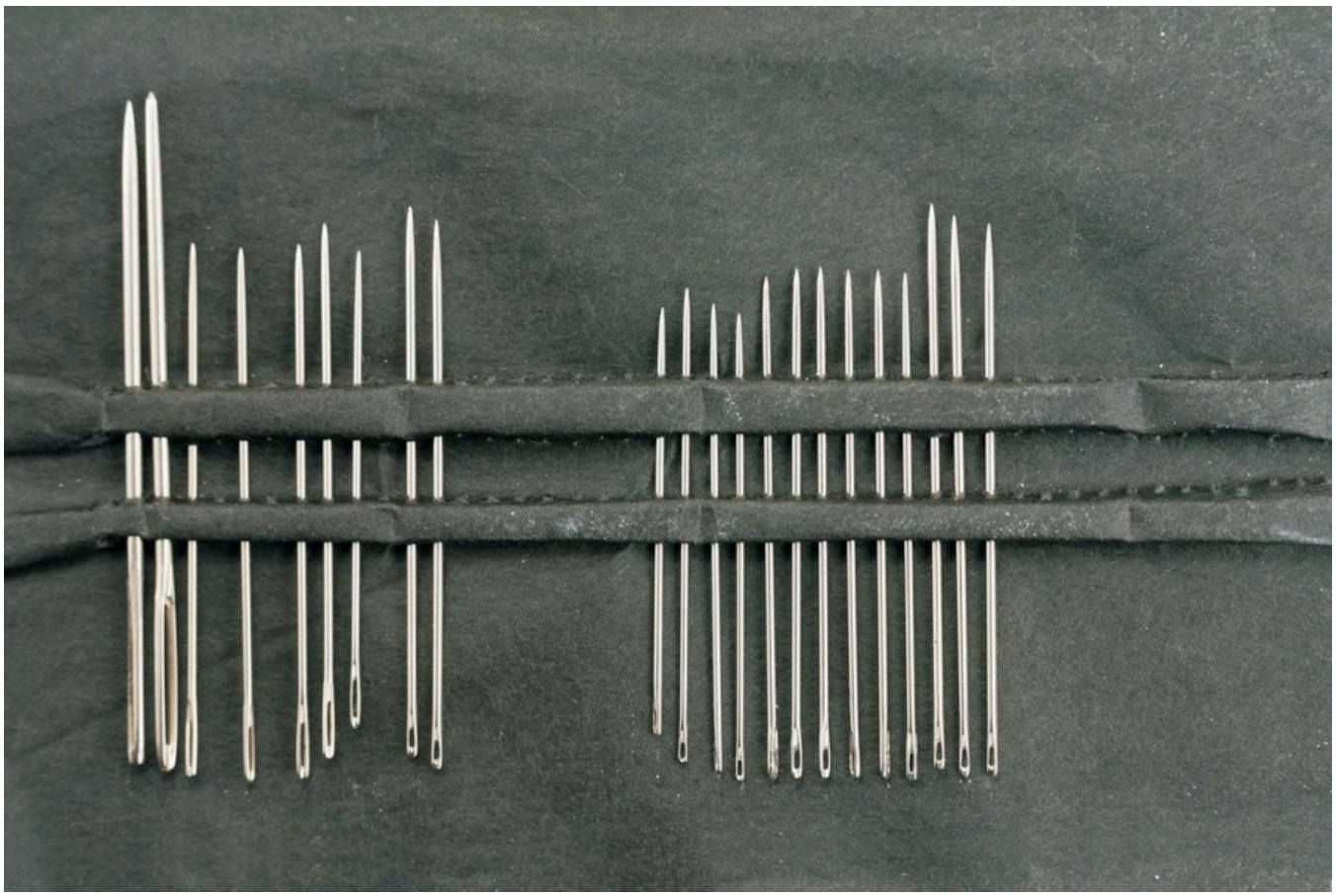
Button and carpet thread is composed of extremely strong and thick fibers, especially compared to all-purpose thread products. It is typically made from silk or polyester fibers. Uses include attaching buttons to garments and upholstery; sewing carpets; and outdoor equipment and durable goods (e.g., backpacks, tents, sleeping bags, shoes, and boots).

METALLIC THREAD

Metallic thread is a manufactured fiber produced from metals, which may be used alone or in conjunction with other substances. The main use of these threads is decorative: adding glitter and sparkle to a fabric. Note the gold threads in this Indian Sari.

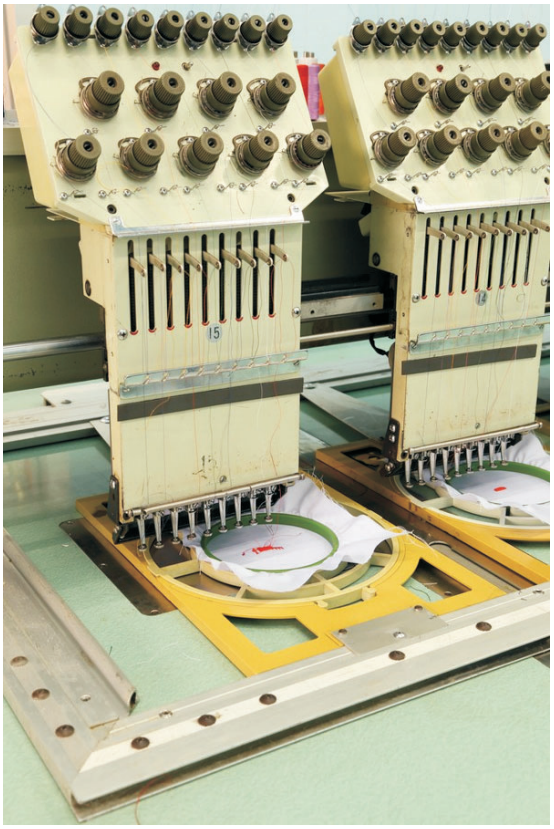
NEEDLES

A needle is a small and thin rod-like metal device with a sharp point on one end and a hole for thread at the other. Hand-sewing needles vary according to name, numbered size, length of needle, sharp of the eye, and type of point.



MACHINE EMBROIDERY

Professional and industrial embroidery sewing machines create patterns on textiles.



LS–A

Name _____

Thread Weights and Needle Types Chart

Purpose

The purpose of this activity is to create a chart of thread weights and needle types and their intended uses.

Objectives

1. Create a table to illustrate thread types, weights, and intended uses.
2. Create a table to illustrate hand-sewing needle types, sizes, and intended uses.

Materials

- lab sheet
- class notes
- textbook
- writing utensil
- examples of different types of threads and hand-sewing needles (provided by the instructor)
- OPTIONAL: device with Internet access

Procedure

1. Review your notes about threads and needles.
2. Work independently to complete this lab sheet.
3. Review the threads and examples provided by your instructor. Create a chart that illustrates the type of thread, the thread weight, and the intended use. Use your notes, your text, and/or the Internet to complete the chart.

Thread Type	Thread Weight	Intended Use

4. Review the needle examples provided by your instructor. Create a chart that illustrates the type of needle, the needle size and weight, and the intended use. Use your notes, your text, and/or the Internet to complete the chart.

Needle Type	Needle Size	Intended Use

5. Turn in your completed lab sheet to your instructor.

Thread Weights and Needle Types Chart

1. Use the YLI Corporation's "A Thread of Truth" guide as a reference at http://www.ylicorp.com/CPanel/Document/A_THREAD_OF_TRUTH.pdf.
2. Use the Sewing Craft and Alliance's "Hand Sewing Needle Guide" as a reference at http://www.sewing.org/files/guidelines/22_110_hand_sewing_needle_guide.pdf.