Colorado 4-H
Textile Experiments

Colorado State University Extension

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ACKNOWLEDGEMENTS

This manual adapted by the State 4-H Clothing Curriculum Development Committee from the original *4-H Textile Experiments* written by Jane Hill, Certified Home Economist and volunteer leaders and Judy Meier, Colorado State University Cooperative Extension agent, from Boulder County.

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INTRODUCTION

Congratulations! You are about to begin a series of fun experiments designed to help you learn more about fabrics. The textile experiments in this manual are quick, easy exercises that will help you think about how your garment fashion fabric reacts in everyday situations.

Before you begin, be sure and read over all the experiments and select the one that interests you the most. Remember that the textile experiment you select could also serve as the basis for a school science fair project!

Project Guidelines

Complete one (1) experiment using your garment fashion fabric each year.

Additional Help

1. Experiments may be repeated in a subsequent year if you use different fabrics.
2. Pictures are optional
3. Include the completed experiment sheets with your 4-H Clothing e-record.
4. Mount samples (on 8 ½" X 11" heavy paper) and include with your e-record.

Your answers will vary depending on fabric you select, but be sure to record all results. There are no right or wrong answers.

Some additional resources you might use are the STEAM Clothing Manuals, commercial sewing or textile books from the library, the Colorado State University Extension county agents or sewing leader or teacher.

Good Luck and have FUN!

INTRODUCTION TO TEXTILE EXPERIMENTS

Experimentation is a process of learning how things work and why they happen. It may challenge individuals to become curious about the answers and do further investigations. Some facts are listed below that may provide answers to the experiments that follow. These experiments are only a beginning step. Ask yourself what other experiments can be tried.

- There are four major natural fibers and 23 man-made fibers currently available for use in garments or household items.
- The weight and weave of the fabric will affect how easily the material will ignite and burn.
- Too hot of water and dryer temperatures can set fabric wrinkles in some fabrics that are difficult or impossible to remove.
- Some fabrics will dissolve when exposed to undiluted liquid chlorine bleach.
- Chlorine and nonchlorine bleaches brighten, whiten, and enhance color.
- Extremely soft water combined with calcium and magnesium ions can cause soap build up in clothing.
- Some fabrics will shrink when exposed to high water, dryer or iron temperatures.
- Heat sensitivity is a property of fibers that results in shrinking, softening, or melting when heat is applied.
- White vinegar can be used to set or remove permanent creases in fabric.
- Fabrics may separate, pill or wear more quickly due to exposure to abrasion.
- Various fabrics react differently to lengthy exposure to the sun.*
- Textiles are used for personal hygiene products, food retail, sports and recreation, transportation, animal care, agriculture, medical, protective gear and building materials. Each use requires different fabric characteristics.*

NOTE: An asterisk (*) indicates suggestions for "Design Your Own" Experiments. See Experiment #14.

EXPERIMENT #1 –BURN TEST

DO THIS IN THE KITCHEN WITH AN ADULT!

Materials

1. 2" squares of the following fabrics:
    a. 100% wool fabric
    b. 100% cotton fabric
    c. 100% polyester fabric
    d. Your garment fashion fabric
2. Tweezers, pliers or tongs to hold fabric tightly
3. Matches, lighter or candle
4. Bowl of water for safety
5. Four 4" X 4" (minimum) pieces of aluminum foil.
6. Pen/marker

Procedure

1. Label samples and foil with fiber contest of each sample.
2. Pull up 3 to 5 fibers from each sample and place on labeled foil.
3. Hold first sample with tweezers over foil.
4. Light with match, lighter or candle.
5. Observe flame, ash, residue and burning characteristics (smell).
6. Record your observations.
7. Repeat with other samples.
8. Record your observations.

Observations

Sample	**Burn or Melt**	**Shrinks from Flame (y/n)**	**Odor**	**Describe ash or residue**
Wool Fabric				
Cotton Fabric				
Polyester Fabric				
Fashion Fabric				

Conclusion

1. Why is it important to do a burn test on fabrics?

2. Why do you think polyester reacted the way it did? How does this present a safety concern? Did your fabric react differently? Did the natural and synthetic fibers burn the same or differently?

3. Why do firemen recommend wool blanket? Which fibers would you use to smother a fire? Which fibers would you use if making a garment for a toddler?

4. What implications does the burn test have when wearing garments made using fabrics that contain these fibers?

EXPERIMENT #2 – CRUSH TEST

Materials

3-8" square fabric samples that include:

A woven 100% cotton fabric

A knit fabric such as from an old T-shirt

Your garment fashion fabric

Procedure

1. Label samples and record below with fabric names.
2. Wad up a sample in your fist, hold for 10 seconds and release.
3. Observe immediately and 2 minutes later.
4. Record what you observed.
5. Repeat with remaining samples and record observations.

Observations

Sample	Immediate Results	Change After 2 Minutes
Woven Cotton		
Knit		
Garment Fashion Fabric		

Conclusions

1. Explain why it is important to do this test on fabrics?

2. Did the knit differ from the woven fabric in this test? How might the results you observed impact wearability of a garment made from these fabrics?

3. What other factors other than design, might influence the appearance and wearability of a garment?

EXPERIMENT # 3 – BLEACH TEST

DO THIS WITH AN ADULT!

Materials

- Liquid chlorine bleach
- Liquid nonchlorine bleach
- Fabric samples, two 2" squares each of:
  - 100% Wool
  - 100% Cotton
  - 100% Synthetic
  - Garment Fashion Fabric
- 2 plastic straws or eyedroppers (use one for each bleach)
- 2 glass or ceramic bowls (to hold straws/eyedroppers between samples)
- Aluminum foil (approximately 12" in length)

Procedure

1. Label each sample and place on aluminum foil.
2. Insert straw into liquid chlorine bleach. Place finger over end of straw to suspend bleach in the straw. **Do not place straw in your mouth!** Place 1 to 2 drops of liquid chlorine bleach on one 2" square of each fabric.
3. Record results immediately and after 15 minutes.
4. Repeat steps 2 and 3 using nonchlorine bleach.
5. Carefully discard foil and remain liquids.
6. Allow samples to dry, mount on heavy paper and label. Include in your e-record.

Observations

Sample	**Chlorine Bleach**		**Nonchlorine Bleach**	
	Immediate results	After 15 minutes	Immediate results	After 15 minutes
Wool				
Cotton				
Synthetic				
Fashion fabric				

Conclusions

1. Which fibers were most affected by the chlorine bleach? On which fabrics, would chlorine bleach be inappropriate?

2. Which fibers were affected by the nonchlorine bleach?

3. How can bleach help in fabric care?

4. Why is it important to read manufacturer's instructions on laundry aids? On care labels?

**How can overuse of chlorine bleach be sued to create a fashion effect, i.e. dying, reverse dyeing or stone wash?*

**Will a change in the concentration of bleach vary the outcome of this experiment?*

**What are some health considerations related to bleach use?*

EXPERIMENT # 4 – SHRINK TEST

Materials

- At least 8" squares of new, unwashed fabric cut on grain
  - 100% wool – 2 squares (do not use washable wool for this experiment)
  - 100% cotton – 2 squares
  - Garment fashion fabric –2 squares
- Hot water (at least 100˚F in temperature) – sink (use a spoon to agitate to prevent skin burns)
- Clothes or hair dryer
- Ruler
- Towel

Procedure

1. Cut squares of fabrics, measure carefully, label and record below.
2. Soak and agitate all squares in hot water for at least 5 minutes.
3. Remove fabric from water and blot out excess. Do not wring.
4. Allow one square of each fabric to dry flat. Measure when dry and record below.
5. Dry one square of each fabric in a clothes dryer or with a hair dryer, set on high. Measure and record.

Observations

Sample	**Original Size**	**Size after aid dry**	**Size after machine dry**
Wool			
Cotton			
Fashion fabric			

Conclusions

1. Which fabric changed size the most? How might that result affect your use and care of this fabric?

2. How might the results differ if you agitated fabric in cold water? Line dried? Used a cool dryer temperature?

3. Why is it important to read care labels on garments or fabric bolts?

**How will this experiment differ is you use washable wool?*

EXPERIMENT #5 – FABRIC SOFTENER AND STATIC ELECTRICITY

Materials

- A variety of 5 washable garments: include some with synthetic fabrics (for example, dress socks, synthetic underwear or blouse)

OR

- 8" squares of at least 5 different fabrics: include synthetics and garment fashion fabric
- Washer and dryer
- Fabric softener: liquid or dry sheets
- Detergent without fabric softener

Procedure

1. Use all garments or fabrics, wash and dry them without fabric softener.
2. Remove from dryer. Carefully observe evidence of static electricity (i.e. garments cling to each other), softness and wrinkles.
3. Record your observations below.
4. Wash and dry garments or fabrics. Use fabric softener as directed by manufacturer.
5. Repeat steps 2 and 3.

Observation

Type of fabric or garment	Without Softener			With Softener		
	Static Electricity	Softness	Wrinkles	Static Electricity	Softness	Wrinkles
a.						
b.						
c.						
d.						
e.						

Conclusions

1. Why do we use fabric softener?

2. On what fabrics do you think fabric softener works best?

3. How do you feel when you wear garments that have not been treated with fabric softener? Explain.

**What might be the effect if double or triple strength fabric softener was used? (NOTE: Do no use garments for this experiment)*

**How would the results of this test differ on a rainy day? Why?*

**What other variables affect the outcome of this test?*

**What are some of the health considerations related to use of softener products?*

EXPERIMENT # 6 – ACETONE TEST FOR ACETATE FIBERS

DO THIS WITH AN ADULT!

Materials

- 2" x 2" squares of each:
  - One acetate fabric
  - One nonacetate fabric, e.g., 100% Cotton (may include garment fashion fabric if not an acetate/acetate blend)
  - One acetate blend fabric
- Eye dropper or plastic straw
- Acetone nail polish remover (check label for acetone base)
- Glass custard cup
- Glass rod or wooden stick (chop stick or toothpick)
- Paper towels

Procedure

1. Label your samples – 1 ,2 and 3
2. Test warp and filling threads
   a. Remove some warp threads and some filling threads from sample #1. Keep warp and filling threads separate.
   b. Place warp yarns in glass dish.
   c. Place 1 or 2 drops of acetone on the yarns.
   d. Rub stirring rod (toothpick) across dampened parts.
   e. Record observations. IF THREADS DISSOLVE READILY, THE FIBERS ARE ACETATE
   f. Repeat steps b-e for filling threads
   g. Repeat steps a-f for fabric sample #2
3. Test corners of samples #2 and #3
   a. Place corner of sample #2 in dish
   b. Place 1 or 2 drops of acetone on the corner
   c. Record observations
   d. Clean off the glass dish with a paper towel immediately after each test to prevent hardening of the solution
   e. Repeat steps a-d for fabric # 3

NOTE: If there is a small amount of acetone in the fabric, no change may be noticed until the fabric dries. Then, a definite stiffening can be felt.

Observations

Sample	Visual Changes	Changes in hand (how the fabric felt)
Warp #1 100% acetate		
Filling #1 100% acetate		
Warp # 2 Nonacetate		
Filling # 2 Nonacetate		
Corner #2 Nonacetate		
Corner # 3 Acetate blend		

Conclusions

1. Acetate thread is made from a chemical liquid solution. Use this information to explain the changes you observed in fabric #1 when dampened with acetone.

2. When would this type of test be helpful to you?

EXPERIMENT #7 –

PERMANENTLY SET CREASES WITH WHITE VINEGAR

Materials

- 3 washable fabric sample of different fibers at least 8" x 8" (You may use new or old fabric or old garments)
- Plain white vinegar
- Bowl
- Straw or eyedropper
- Steam iron

Procedure

1. Label samples: a, b, and c
2. Pour about ¼ cup of white vinegar into a small bowl
3. Press a crease lengthwise through each sample with a steam iron
4. Wet ½ of the crease with white vinegar by using your finger on the straw or an eye dropper
5. Press this ½ of the crease with the iron
6. Launder all samples per care instructions
7. Record your observations

Observations

Describe your sample	Describe pressed crease after washing	Describe crease pressed with vinegar after washing
a.		
b.		
c.		

Conclusions

1. What was the effect of using vinegar to set in creases?

2. Were any of the fabrics damaged by this experiment? If yes, explain how.

3. Even if none of the fabrics were damaged, do you think vinegar might be hazardous to use on some fabric? Why or why not?

4. How might vinegar help prepare fabric before pattern layout?

EXPERIMENT #8 – ABRASION TEST

Materials

- Four 8" square fabric samples
  - Woven denim
  - Any silky, thin knit fabric
  - A rough-textured woven or knit fabric
  - Your project fashion fabric (different from a, b, or c)
- Sand paper – medium to fine grade

Procedure

1. Label each sample
2. Scratch (abrade) the surface of each fabric 20 times with the sand paper
3. Observe changes in each fabric. Repeat
4. Repeat step 2 using new sandpaper. Record appearances after 40 strokes.

Observations

Describe your sample	**Changes in fabric after 20 strokes**	**Changes in fabric after 40 strokes**
a.		
b.		
c.		
d.		

Conclusions

1. What characteristics of the sample fabric made them susceptible or resistant to abrasion?

Explain

2. How do the results of this test help in fabric selection?

3. Why would it be important to consider intended garment use when purchasing a ready-made garment?

EXPERIEMENT # 9 – HEAT TEST

DO THIS WITH AN ADULT!

Get permission to use an iron because the experiment may leave fiber residues on the iron's sole plate. Check to see if an old iron is available to use for this experiment.

Materials

- 3 fabric samples at least 8" X 8" such as synthetics, cotton-polyester blend, wool, or rayon and project fashion fabric.
- Iron
- Pressing cloth
- Water and spray bottle or wet cloth

Procedure

1. Label each sample and identify below with fiber names.
2. Set iron temperature to HIGH
3. Using 1 piece of each type fiber or fiber blend, press (don't move iron) for 15 seconds in one area.
4. Record observations
5. Check sole plate of iron for residue. To clean iron sole plate use a commercial iron sole plate cleaner or rub iron in table salt sprinkled onto a paper grocery sack.
6. Repeat in new area and use a pressing cloth with no moisture. Record observation.
7. Repeat in a new area and use a pressing cloth with moisture. Record observation.
8. Repeat steps 1 through 6 for other fibers chosen.

Observations

Sample	Dry Iron	Pressing Cloth	Moisture w/ Pressing Cloth
a.			
b.			
c.			

Conclusions

1. Which fabric was the most heat sensitive?

2. Why do we sometimes use a pressing cloth?

3. Which natural fiber(s) require(s) a low setting on the iron? A high setting?

4. How would you ensure that the iron temperature is safe for your project fashion fabric?

5. If the iron is too hot, the fibers will soften enough to be flattened by the pressure of the iron or they will melt. Flattening the surface is called glazing. A glazed surface will look shiny. Did you find glazing results on any fibers tested? Which ones?

**Conduct an experiment to test the effects of heat and moisture on fabric dimensions.*

**How do temperature, time and moisture affect the results when applying fusible interfacing to fabric?*

EXPERIMENT # 10 – EFFECTS OF MARKING TOOLS

Materials

- Firmly woven 100% cotton fabric
- 100% polyester fabric
- Your project fashion fabric
- 3 or more marking tools (i.e. pencils, chalk, paper, etc.)
- Instructions for use of marking tools, if available
- 1 eraser or dry cloth
- 1 damp cloth
- Steam iron

Procedure

1. Cut 5 pieces from each fabric, 3" x 3" on grain, number 1-5
2. On all samples, make a line with each tool chosen (i.e. three tools will be three lines)
3. Record your observations based upon the following:
    a. Sample 1 –brush with the eraser of a dry cloth after 10 minutes
    b. Sample 2 – rub lightly with a damp cloth after 10 minutes
    c. Sample 3 – press with a steam iron after 10 minutes
    d. Sample 4 – machine wash, tumble dry and press
    e. Sample 5 – let sit and record after 24 hours.

Observations

Fabric	Tool Used	Sample #1	Sample #2	Sample # 3	Sample # 4	Sample # 5
Cotton						
Polyester						
Fashion Fabric						

Conclusions

1. Did the marking tools react as the instructions stated?

2. Which ones reacted differently than expected, and under what circumstances?

3. What cautions should be taken when using marking irons?

4. Why do instructions caution the user to "test the marking tool on the fabric first"?

5. What other methods may be used to mark fabrics?

EXPERIMENT # 11 – BIAS STRETCH

Materials

- Samples from a variety of fabrics and weaves, including a sample from your project fashion fabric (10 maximum)
- One sheet of white card stock
- Ruler

Procedures

1. Cut one sample 1" X 2" on true bias for each fabric and weave sample
2. Draw 2 straight lines the length of the paper, 2" apart.
3. Staple one end at the left side of the card stock, pull the other end of the sample until distortion* begins to be seen. (*Distortion is when the weave begins to come apart, or when a seam would not hold.) This is an approximate guess on your part.
4. Have another person mark how far the sample stretched.
5. Let sample relax
6. Identify fabric and weave, if possible
7. Record observations
8. Repeat steps 1 through 7 for each remaining fabric example

Observations

Sample Fabric	Sample Weave	Inches of Stretch	Conditions of relaxed sample

Conclusions

1. Which fabric/weave stretched the most without distortion? What do you think might be the reason?

2. Which fabric/weave stretched the least? What do you think might be the reason?

3. Give some examples of when bias is used in sewing.

4. When would bias stretch be advantageous?

5. When would bias stretch become a problem?

6. How could you prevent the bias from stretching?

7. If a fabric has more stretch in a bias, would the garment be:

    a. More comfortable?

    b. Easier to care for?

    c. Last longer?

EXPERIMENT # 12 –

DURABILITY OF MEANDING A TEAR METHOD

Material

- Three 6" squares of garment fashion fabric
- One small piece of the fabric 1" x 1"
- Matching thread
- Iron-on interfacing
- Fabric glue
- Iron-on mending tape
- Scissors
- Sewing machine
- Hand sewing needles
- Iron

Procedures

1. Finish the edge of the sample piece.
2. Make eight small 1" cuts in various places on the fabric with the scissors.
3. Mend each cut using the following:
    a. By hand sewing the edges together
    b. Using iron-on mending tape
    c. Using iron-on interfacing (2 layers)
    d. Self-fabric on back, zig-zag on front
    e. Interfacing on back, zig-zag on front
    f. Fabric glue
    g. Leave one cut unmended.
4. Wash and dry the fabric piece with the family laundry, three separate times.
5. Observe the results after each dryer cycle before proceeding onto the next wash.
6. Mount your sample.

Observations

Method	**#1 -Wash and Dry**	**#2 – Wash and Dry**	**#3 – Wash and Dry**
Hand sewn			
Iron-on mending tape			
Iron-on interfacing			
Self-fabric/zig-zag			
Interfacing/zig-zag			
Interfacing/fabric glue			
Fabric glue only			
Zig-Zag only			
Unmended			

Conclusions

1. Which method or methods of mending had the most durability after three washings?

2. Which method or methods look best to you?

3. What happened to the cut that was left unmended?

4. Which mending would be best for a tear located on:
    a. front of a shirt?

    b. underside of a sleeve

    c. top side of a collar?

    d. along the hem of a garment?

5. When would it be important to have a durable, attractive mend on a cut in a garment?

EXPERIMENT #13 – STAIN REMOVAL

Materials

- Five 4" X 4" samples of project fashion fabric
- Ketchup
- Crayon
- Ink pen
- Mustard
- Grape or cranberry juice
- White vinegar
- Water
- Commercial stain removal product
- Household soap or detergent
- 2 bowls
- Brushes
- Clean rags and paper towels

Procedures

1. Record fiber content of your project fashion fabric and specific care instructions for cleaning.
2. Read instructions on the manufacturer's label of the stain removal product.
3. Lay your samples on a clean dry surface, spread ¼ teaspoon of ketchup, crayons, ink from pen, mustard and juice on different samples.
4. Try to wipe up the excess food item with a paper towel.
5. Clean one spot using a mixture of 1 Tablespoon white vinegar and 4 Tablespoons of water. Rub the area lightly with a soft rag. Pat out excess moisture.
6. Use the stain removal product on one spot according to the manufacturer's instructions.
7. Clean one spot with plain hot water, rubbing out the excess moisture
8. Clean one spot with plain cold water, rubbing out the excess moisture
9. Clean one spot with warm water and a small amount of detergent.
10. Record observations.

Observations

Stain removal method	**Appearance of stain**
Vinegar and water	
Stain removal product	
Hot Water	
Cold Water	
Warm water and soap or detergent	

Conclusions

1. Which method or methods removed the food stain the best?

2. What similar characteristics can be observed about all of the stains?

3. Which method would be a wise choice for you to use? Why?

4. What commercial product instructions were important to observe?

5. What information did you find regarding the fiber content or suggested care for your garment fashion fabric? How might the impact the stain removal method you use?

6. What other fiber/fabrics around your home may require stain removal methods? Do you think the results would be the same? Different? Why?

EXPERIMENT # 14 – DESIGN YOUR OWN

USING SOME OF THE SUGGESTED ACTIVITIES (*) OR YOUR OWN IDEAS, CREATE AN EXPERIMENT.

What do you want to find out?

Materials needed?

Procedures to follow:

Observations: (charts, graphs, etc.)

Conclusions

1. Discuss two situations in which the information you learned would be helpful