3- 5 YEARS IN PROJECT

The Nitty Gritty of Stains and Stain Removal

4-H Clothing and Textiles Project

Part of the Family and Consumer Sciences 4-H Project Series

Caring for your Clothes STEM

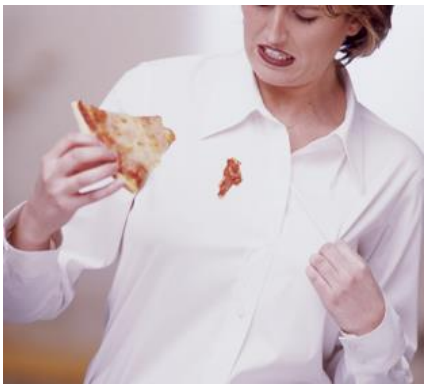
STEM concepts you will learn:
-The Chemistry behind why stains appear on your clothing.
-The Science behind treatments that will remove stains.

Project Outcomes: Discover what happens to fabric to cause a stain when spills take place.
Select and use proper techniques for removing stains from clothing.

Project Mastery Indicator: Completion of Experiment.

Have you ever spilled something on your clothes which caused a stain? Most of us have. Learning the science behind stains will help you discover how to remove them.

How a Stain Becomes a Stain



Stains come from many sources. Most of the stains we have come from spilling food on our clothing. Different foods create stains of different colors and different strengths. **Stains** are a result of a chemical reaction between the staining substance and the fabric. Stains primarily form when a substance is spilled onto a surface and the molecules are trapped inside the fibers and pores of the material. The spilled substance coats the underlying material and the newly formed stain reflects back light of its own color, which is how the stain becomes visible to the naked eye. It's the same concept of how we see color. Every wavelength of light is absorbed except the color you see. For example, if you spill mustard on your shirt, all the colors in the spectrum of visible light but yellow are absorbed. So you see the yellow mustard stain.
Source: http://www.sterlingcleaner.com/chemistry-stain-removal/

How does the kind of fabric that something is spilled on make a difference?
Water swells **natural fibers** (like cotton and wool) but not polyester or acrylic (which are **manufactured fibers**). So a water-based stain will go deeper into a natural fiber unless a special hydrophobic (water repellent) finish has been recently applied. Polyester or acrylic, in contrast, will repel water-based stains but adsorb oily ones unless a special finish has been fixed on those fibers.
Source: Smithsonian Museum Conservation Intitute.

Types of Stains

There are two fundamental types of stains: those that are water-based and those that are oil-based. Let's take a closer look at common stains and how they are classified.

Water-based Stains:
-coffee or tea
-ketchup
-cola
-fruit juice
-jelly
-milk
-blood
-ink

Oil-based Stains:
-margarine or butter
-chocolate
-cooking oil
-mayonnaise and salad dressings
-peanut butter
-deodorant
-makeup
-ring around the collar

Removing Stains

Stains can be a challenge to remove. How much of a challenge depends on:

1. the chemical nature of the fiber (in the clothing) and food and
2. the length of time the stain has set (the longer the stain has been on a garment, the harder it is to remove).

The standard advice for removing stains is to follow the "three P's of stain removal" – promptness, patience and perseverance. Using the correct cleaning product may help in reducing your frustration in removing stains.

Stain removal requires strong products such as **cleaning enzymes, bleach, or specialty solvents**.
Cleaning enzymes are included in some detergents and presoak products. They break stains into simpler forms that can then be attacked by detergents.
Cholorine and oxygen bleaches whiten, brighten, and loosen soils from fabrics. They break the connection between the stain and the fiber or they make the stain colorless through oxidation. Oxygen bleach is added to some detergents and is also sold as a separate product. Chlorine bleach is not added to detergent but is sold separately. All bleaches can damage fabric, so be sure to follow directions on the bleach and product labels.

GENERAL TIPS TO FOLLOW:

1. The earlier you start to treat any stain the better.
2. Always remove as much as you can by removing any excess of the stain substance and blotting (never rubbing) the area with clean water (an ice cube works in a pinch) or running it under cool water.
3. Try carrying a stain sick or wipe in your purse or car so you always have a way to immediately pretreat it if you can't get to work on removal immediately.
4. Remember that you should never put the garment in the dryer until you're sure the stain is out. The heat of the dryer could cause the stain to set and become permanent.

You will find many guides on the Internet that address how to remove specific stains. The American Cleaning Institute (ACI) offers a reliable source: https://www.cleaninginstitute.org/cleaning-tips/clothes/stain-removal-guide

HANDS-ON ACTIVITY – STAIN REMOVAL

Experimenting with Stains:

Now that you have learned the science behind stains, try this experiment. Have fun!!
IMPORTANT: Use the attached worksheet before, during, and after the experiment.


Supplies needed:
-Newspapers or plastic to protect surface
-permanent pen/marker
-100% cotton fabric
-Cotton tip swabs
-2 1-Gallon Plastic bags
-Detergent without enzyme and bleach (Arm & Hammer or Ivory Snow)
-Detergent with enzyme and bleach (Tide with bleach)
-Plastic spoon
-Hot Water
-Dishpan of cool water
-Paper towels
-Ketchup
-Mustard
-Grape juice
-Soy sauce

Note: Be sure to read the labels of the detergents ahead of time so you will use the correct ones for this experiment.

Experiment: (Answer the before questions on the worksheet first.)

1. Cut 2 pieces of cotton fabric into 6 inch X 6 inch squares
2. Label both pieces of the fabric as shown below:

K	G
M	S

3. Label one gallon plastic bag E & B (Enzyme and Bleach).
4. Using a cotton swab, apply a small amount of ketchup to each fabric sample on the K square, making a stain the size a little larger than a quarter.
5. Do the same thing with the mustard, grape juice, and soy sauce. Let set at least 5 minutes while you go to the next step.
6. Prepare the plastic bags that would simulate a "washing machine." Place about 1 teaspoon of a detergent that contains cleaning enzymes and oxygen bleach (such as Tide with bleach) in the bag marked E & B. In an unlabeled plastic bag place 1 teaspoon of a detergent that does not contain enzymes or bleach (such as Arm & Hamer or Ivory Snow).
7. Add hot tap water to fill one detergent bag about one-quarter full. Place one of the stained fabrics in the bag. Push out the excess air while closing the bag. Set aside and repeat with second bag.
8. Check that the bag seals are secure. Squeeze, roll, or shake the bags gently for 5 minutes to simulate a washing machine. Keep the bags over your work area.
9. Open one bag and remove the fabric sample. Pour the detergent water into the sink.
10. Spread out the empty bag and lay a paper towel on top of it.
11. Rinse the fabric in a dish pan of cool water. Spread the fabric on the paper towel to dry. The empty bag under the towel reminds you which detergent was used.
12. Repeat steps 9-11 with the second bag and fabric sample. Record your results on your Worksheet.

Adapted from: *In-Touch Science: Foods & Fabrics* (Cornell Cooperative Extension)

STAIN REMOVAL ACTIVITY WORKSHEET

Before starting the experiment answer the following questions:	
1. Create a hypothesis: What do you think will happen to the stains when using detergent with no enzymes or bleach?	Hypothesis:
2. Create a hypothesis: What do you think will happen to the stains when using detergent with enzymes or bleach?	Hypothesis:
3. What do enzymes do to stains?	
4. What does bleach do to stains?	
During the experiment answer the following questions:	
5. How does the water change as you agitate the bag?	
6. How are the stains changing as you agitate the bag?	
After the experiment answer the following questions:	
7. What happened in general to the stains after 5 minutes of agitation?	
8. Which stains were more difficult to remove?	
9. Which detergent is better for removing stains?	
To think about after the experiment:	
10. Would using cold water make a difference in the stain removal? If you think so, how?	
11. What would happen if you didn't agitate the bag?	
12. Would the stains be harder to remove the longer the stain is on a garment? Why or why not?	

What is one thing you have learned from this experiment that you will use?