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Grades 3-5

# CONDUCTION OF HEAT: CONDUCTORS AND INSULATORS

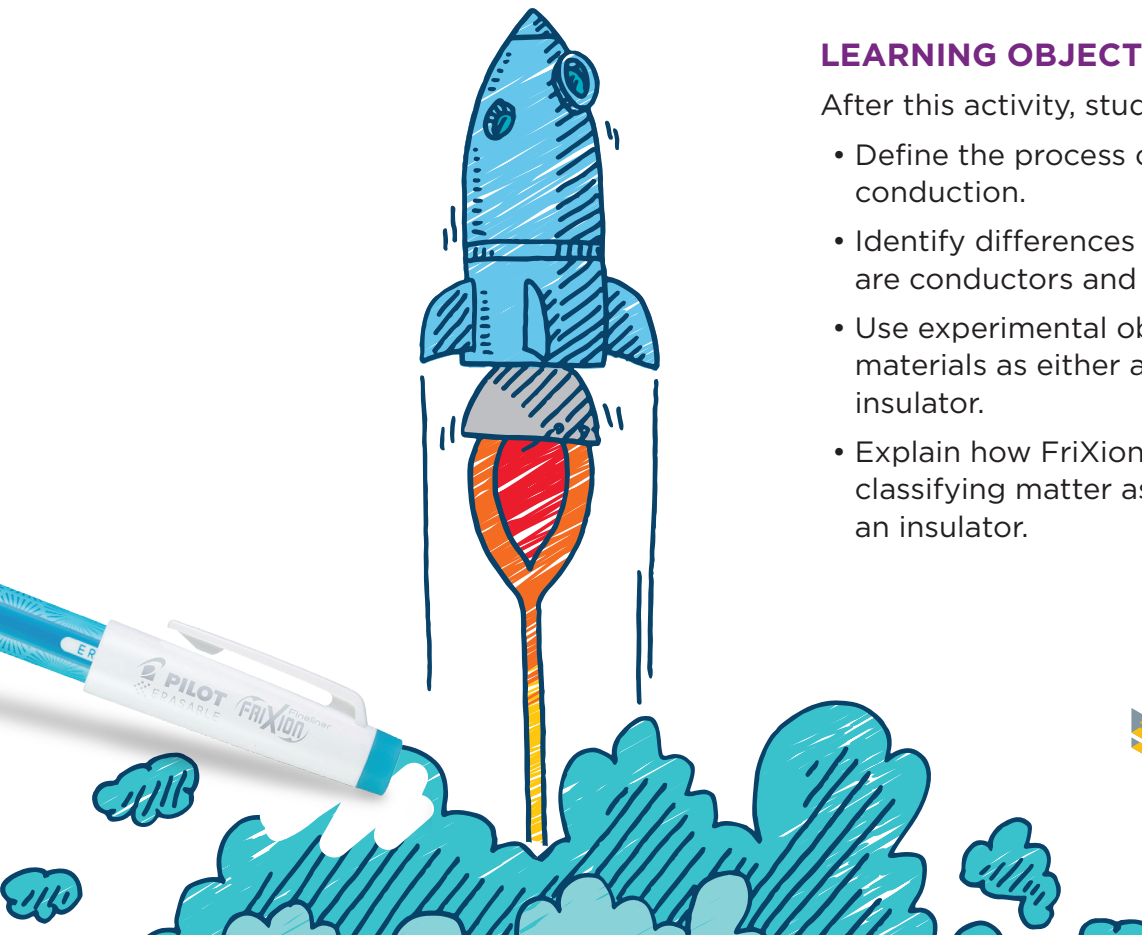


Students learn about thermal conductivity as they investigate how heat moves through a variety of different materials. They categorize the materials as thermal insulators or conductors based on the outcome of their experimentation.

## LEARNING OBJECTIVES

After this activity, students should be able to:

- Define the process of heat transfer via conduction.
- Identify differences between materials that are conductors and insulators.
- Use experimental observations to classify materials as either a conductor or an insulator.
- Explain how FriXion ink is helpful in classifying matter as a conductor or an insulator.



Developed by





## MATERIALS LIST

- FriXion pens
- Paper
- Hair dryer or heat gun
- Tape
- Aluminum foil, cut into squares approximately 4" x 4"
- Cardboard squares, approximately 4" x 4"
- Styrofoam squares, approximately 4" x 4"

## INTRODUCTION/MOTIVATION

How exactly does heat move through materials? Are some things better than others at allowing heat to move through them? The process of heat moving through a material is known as conduction, and some materials are better than others at conducting heat.

A conductor is any item or material that provides a path for energy to flow. This means that heat and thermal energy can move freely around, in and through a conductor. Metals are good examples of materials that are generally excellent conductors of heat.

The opposite of a conductor is an insulator. An insulator is any item or material that does not let heat or thermal energy flow through it. We use insulators all of the time to help us keep our homes warm in the winter, as well as in oven mitts to protect our hands from getting burned by a hot pan in the oven!

One way we will test the ability of heat to flow through a material is by using FriXion pens. FriXion pens work with a thermo-sensitive ink and use three types of chemical compounds that rely on acid-based interactions, temperature sensitivity, and covalent bonding. Therefore, the ink will react if a surface is warm and allows heat to easily move through it compared to a material that insulates the ink from heat.

## EXPERIMENTAL PROCEDURE

1. Before beginning experimentation, read the introduction and have students predict which materials they think will be conductors and which will be insulators.
2. Pass out several Pilot FriXion pens, paper, tape and samples of the materials to be tested to each student group.
3. Have students use FriXion pens to draw a grid of lines or scribbles onto a piece of paper. While the lines do not need to be uniform, make certain that students cover the majority of the page.
4. Have students carefully tape each material onto their paper so that the materials cover a portion of the page.



5. Holding a hair dryer directly over each material sample at a height of approximately one inch, heat each sample for 45-60 seconds. During this time the FriXion ink around the material should disappear due to the heat. This step should be done by an adult.
6. Peel off each material and reveal if the ink remains or has disappeared due to heat being conducted. Have students record their results.

## DISCUSSION QUESTIONS

- While your samples were being heated, how could you tell that heat was being transferred?
- Did any of the results that you observed surprise you?
- Based upon your results, which materials were conductors?
- Based upon your results, which materials were insulators?
- What other materials could you test to identify them as either conductors or insulators?