



## Superconductivity

Submitted by: Frank Wood, Engineering Teacher, Oak Ridge High School, Oak Ridge, TN

### Learning Goals

- Students will learn the mechanism and uses of superconductors.
- Students will also receive practice for state mandated writing tests.
- Teachers will practice Common CORE curriculum requirements when using this lesson plan.

### Prior Knowledge Review

Students will have been previously introduced to Ohm's Law and the normal behavior of electrons in room temperature conductors.

### Hook

The instruction should discuss the problem of not being able to use electricity where it is not easily produced by natural methods.

### Real World Connection

Students have all been introduced to the concept of renewable power. This is relevant because we can reliably produce solar power in the desert and wind power in the mountains. However transmission of this power is an issue because of the voltage drop. Superconductors can and will play a major part in our future lives.

### Materials Needed

- "HowDoesSuperconductivityWork.pptx" will be shown to the class and posted in pdf format for students to review at home.
- Included in this PowerPoint is the video: SuperconductorGraph.wmv

### Activities and Pacing

#### Day 1

Students will view the PowerPoint presentation which provides information regarding charge, field forces, and the flow of charge. This can be viewed in class or as a homework assignment for the prior evening.

#### Opening (5 minutes)

Superconductors can and will play a major part in our future lives.

#### Assignment (40 minutes)

After watching the presentation, students will write an article that thoroughly discusses how superconductivity works and why we need superconductors.

Critical Questions to be answered in the article:

- Why do we need Superconductors?



- What are some of the magnetic effects of Superconductors?
- What structural property is common in all low temperature Superconductors?
- What happens to electrons in low temperature superconductors at normal temperatures?
- When low temperature superconductors are chilled to their critical temperature, how do the electrons react?
- What about the low temperature superconductor structure that creates the superconducting environment?
- Has anyone determined why high temperature superconductors work differently than low temperature superconductors?
- If low temperature superconductors work, why is it important to find superconductors that will work at high temperature or room temperature?
- What are the major benefits of superconductor use?

**Closing (10 minutes)**

**Review some of the critical questions and dispel the first day misconceptions.**

**Day 2**

**Opening (5 minutes)**

Remind students of the Critical Questions and organize the students into groups of 3 to 5 students.

**Activity 1 (10 minutes)**

Suggested format is that group members become experts in certain questions and share their information with the group. Instruct students to discuss their articles and to explain and defend their answers to the critical questions.

**Assignment (30 minutes)**

**Students are tasked to write a three paragraph article on superconductivity.**

**Closing (10 minutes)**

**Hold a class discussion, with all groups participating, discussing the critical questions.**

**Measurement Criteria**

- Students will be able to explain the normal method of electron flow.
- Students will discuss the difference between conduction of electrons normally and super conductor electron conduction.
- Students will be able to discuss graphically how they can show that superconductors are working.
- Students will discuss that the difference between superconducting material and non-superconducting material is within the crystalline structure and how the lattice is constructed.

**Standards**

- CLE 3231.5.1 Examine the properties of electric forces, electric charges, and electric fields.
- CLE 3231.5.2 Explore the flow of charge and electric currents.