

BSU Summer RET Lesson Plan

Lesson title: Using magnetic fields/ electromagnetic research project

Terry Adoflson- Physical Science/ physics teacher Kuna High School

Grade level/ class: 9th Grade /Advanced Physical Science

Summary:

Students review the nature of magnetic fields and electromagnets, and look at what might be in the future using magnetic shape memory alloys (MSM).

Then students will participate in a unit culminating project simulating research by building a windmill, a generator, and a motor that each must work together

Engineering/research connection:

Using research in order to build the devices of the future is a common theme for engineers. As the need for renewable energy increases ideas such as wind power will become more important.

Pre reg knowledge

The final project is designed as a culminating project for a unit on electricity and magnetism so the student should have a basic understanding of electric and magnetic principles, a knowledge of electromagnets and Faraday's law of induction.

Learning objectives

The student will be able to draw and describe a magnetic field, work with a group to construct a device, utilize the scientific method in order to test and analyze ways to optimize their design

Standards-Idaho state standards

**SP2-HS-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).**

**PS3.B: Conservation of Energy and Energy Transfer**

**PSP1-HS-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.**

**PSP1-HS-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.**

**PSP2-HS-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy**

**PSP2-HS-5. Develop and use a model of two objects interacting through electric or**

**magnetic fields to illustrate the forces between objects  
and the changes in energy of the objects due to the interaction.**

Intro /motivation

Probably no force more effects our daily lives than the electromagnetic force. We use it to heat and cool our homes, run our refrigerators computers appliances and sometimes even cars. All of that relies on our ability to change energy from one source to electricity.

This lesson finishes a unit on magnetic fields and introduces some ideas for uses of magnetic fields in the future specifically involving magnetic shape memory materials (MSM). and then the project at the end brings students the opportunity to design a generator and motor as well as introduce the use of alternate energy sources (wind).

Lesson backgrounds/concepts for teachers

You want to give your students the worksheet for magnetic field review and give them access to the magnetic field Google slideshow in order to fill out the notes when they have completed this they should begin the Science Expo windmill project. Notes are in the slide show. Materials for the final project are left vague intentionally so that a teacher can adapt to classroom budgets and availability. However a good deal of wire and many small magnets will be required.

vocabulary/definitions

Magnetic field a region around a magnetic material or a moving electric charge within which the force of magnetism acts.

Magnetic flux It is the number of **magnetic** field lines passing through a surface (such as a loop of wire). ... The SI unit of **magnetic flux** is the Weber (Wb)

Magnetic shape-memory alloys Magnetic Shape Memory Alloys (MSMs) are the metal alloys which exhibit changes in their shape when exposed to magnetic fields

Faraday's law of induction **Faraday's law** of induction is a basic **law** of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF)—a phenomenon called electromagnetic induction.

An emf is created in a conductor when the conductor is exposed to a changing magnetic field.

Lesson closure-The final piece of the project is a presentation by the groups of their findings and the results of their project.

Attachments assessments