

# BEMIDJI AREA SCHOOLS

## GENERAL PHYSICS

### Grades 9-12

#### I. HISTORY AND NATURE OF SCIENCE

##### A. Scientific World View

Standard: The student will understand the nature of scientific ways of thinking and that scientific knowledge changes and accumulates over time.

The student will:

1. Be able to distinguish among hypothesis, theory and law as scientific terms and how they are used to answer a specific question.

**Activity:** *Discussion and test on terms from Ch. 1 in book*

2. Be able to explain how scientific and technological innovations as well as new evidence can challenge portions of or entire accepted theories and models including but not limited to atomic theory.

**Activity:** *Acceleration labs to test theoretical value for gravity*

3. Recognize that in order to be valid, scientific knowledge must meet certain criteria including that it: be consistent with experimental, observational and inferential evidence about nature; follow rules of logic and reporting both methods and procedures; and, be falsifiable and open to criticism.

**Activity:** *Ongoing throughout during conclusion write-up of lab activities*

4. Explain how traditions of ethics, peer review, conflict and general consensus influences the conduct of science.

**Activity:** *Discussions on how the church beliefs had a strong influence on allowable scientific concepts*

5. Recognize that some scientific ideas are incomplete, and opportunity exists in these areas for new advances.

**Activity:** *Student activities concerning energy resources such as fuel cell designs, hybrid vehicles, etc.*

##### B. Scientific Inquiry

Standard: The student will design and conduct a scientific investigation.

The student will:

1. Design and complete a scientific experiment using scientific methods by determining a testable question, making a hypothesis, designing a scientific investigation with appropriate controls, analyzing data, making conclusions based on evidence and comparing conclusions to the original hypothesis and prior knowledge.

**Activity:** *Many labs have students creating testable procedures as well as student projects covering physics related topics.*

2. Distinguish between qualitative and quantitative data.

**Activity:** *Ongoing throughout the course, collecting data by measuring and by observing*

3. Apply mathematics and models to analyze data and support conclusions.

**Activity:** *Math: Calculations, using data collected in lab to find the following: Calories, joules, speed, density, force, acceleration, etc.*

**Models:** *Atomic and Kinetic theories*

4. Identify possible sources of error and their effects on results.

**Activity:** *Ongoing, an evaluation of lab experiences via analysis*

5. Know that professional scientists and engineers have ethical codes.

**Activity:** *Student research must be properly cited to acknowledge scientists*

6. Give examples of how different domains of science use different bodies of scientific knowledge and employ different methods to investigate questions.

**Activity:** *Kinematics will be investigated through lab experience and astronomical ideas will be investigated through observations and theories.*

### **C. Scientific Enterprise**

Standard: The student will understand the relationship between science and technology and how both are used.

The student will:

1. Provide an example of a need or problem identified by science and solved by engineering or technology.

**Activity:** *Fuel Cell research*

2. Provide an example of how technology facilitates new discoveries and the development of scientific knowledge.

**Activity:** *Identify specific fuel cell type most likely to be found in vehicles*

3. Know that technological changes and scientific advances are often accompanied by social, political, environmental and economic changes.

**Activity:** *Discussion as to why we are not using some technologies even when the technology is available to use.*

## D. Historic Perspectives

Standard: The student will recognize the historical and cultural context of scientific endeavors and how they influence each other.

The student will:

1. Be able to trace the development of a scientific advancement, invention or theory and its impact on society.

**Activity:** *Discussion on lasers*

2. Provide examples of scientific advancements contributed by other civilizations and cultures.

**Activity:** *Discussions about electronic advancements in the Far Eastern countries*

## II. PHYSICAL SCIENCE

### A. Energy Transformations

Standard: The student will understand energy forms, transformations and transfers.

The student will:

1. Know that potential energy is stored energy and is associated with gravitational or electrical force, mechanical position or chemical composition.

**Activity:** *P.E. vs. K.E. lab, Mechanical Energy Lab*

2. Differentiate between kinetic and potential energy and identify situations where kinetic energy is converted into potential energy and vice versa.

**Activity:** *Mechanical Energy Lab*

3. Differentiate between AC and DC current.

**Activity:** *Electricity labs and demonstrations, home wiring discussion*

4. Describe the production, storage and transmission of electricity.

**Activity:** *Circuit board lab and following diagrams*

5. Be able to describe physical and chemical changes in terms of the law of conservation of energy.

**Activity:** *Mechanical Energy lab and notes and word problems on conservation of energy.*

6. Describe the risks and benefits of fossil fuels, renewable sources and nuclear power as sources of usable energy.

**Activity:** *“Cars of the Future” video by Alan Alda and Fuel Cell discussions*

7. Describe applications of the different wavelengths of the electromagnetic spectrum.

**Activity:** *Spectrum tube analysis, discussion on wavelength difference.*

8. Describe energy, work and power both conceptually and quantitatively.

**Activity:** *Work worksheets and problems. Discussion on how the three are related.*

## **B. Motion**

Standard: The student will understand the nature of force and motion.

The student will:

1. Use Newton's three laws of motion to qualitatively and quantitatively describe the interaction of objects.

**Activity:** *3 Laws of Newton Demonstrations, Newton's 2<sup>nd</sup> Law Lab with carts and mass, 3<sup>rd</sup> Law Lab (collision carts)*

2. Describe the effect of friction and gravity on the motion of an object.

**Activity:** *Friction video, problems concerning the coefficient of friction, acceleration of Gravity, Air track gravity demo*

## **C. Forces of Nature**

Standard: The student will understand the forces of nature and their application.

The student will:

1. Recognize the factors that affect the presence and magnitude of gravitational, electromagnetic, weak and strong nuclear forces.

**Activity:** *Problems and discussions dealing with gravity and electromagnetic forces as well as demos*

2. Identify the dominant force or forces in a variety of interactions.

**Activity:** *Centripetal force discussions and worksheets*