Unit II: Forces and Energy

Content Area: **Science**
Course(s):
Time Period:
Length: **15 weeks**
Status: **Published**

State Mandated Topics Addressed in this Unit

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N/A	N/A

Unit Summary

Core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world. An object's motion changes if a net force acts on the object. Energy causes change by affecting the movement and position of objects. Energy can be transformed from one form to another and transferred from object to object. Thermal energy can be transferred by conduction, radiation, and convection. Thermal energy also can be transformed into other forms of energy.

Enduring Understanding

Core concepts and principles of science and use measurement and observation tools to assist in categorizing,representing, and interpreting the natural and designed world. An object's motion changes if a net force acts on the object. Energy causes change by affecting the movement and position of objects. Energy can be transformed from one form to another and transferred from object to object. Thermal energy can be transferred by conduction, radiation, and convection. Thermal energy also can be transformed into other forms of energy.

Learning Objectives

- How do machines make it easier to do work?
- How do objects react to forces?
- How do you describe the motion of an object?
- How does an electric circuit work?
- How does heat flow from one object to another?
- How is energy conserved in a transformation?

Essential Skills

- Calculate an object's speed.
- Calculate the efficiency of a machine.
- Calculate the mechanical advantage of a machine.
- Classify, describe, and calculate the mechanical advantage of levers.
- Define and calculate power.
- Define and calculate the work done on an object.
- Demonstrate how to graph acceleration.
- Demonstrate how to graph motion.
- Describe a magnetic field.
- Describe and calculate the mechanical advantage of compound machines.
- Describe and calculate the mechanical advantage of pulleys and wheels and axles.
- Describe and calculate the mechanical advantages of inclined planes, wedges, and screws.
- Describe Earth's magnetic field.
- Describe friction and identify factors that determine the friction between two objects.
- Describe how a generator works.
- Describe how balanced and unbalanced forces are related to an object's motion.
- Describe how electric motors work.
- Describe how static electricity builds up and transfers.
- Describe measures that help protect people from electrical shocks and short circuits.
- Describe the basic features of an electric series and parallel circuits.
- Describe the characteristics of solenoids and electromagnets.
- Describe the factors that keep objects in orbit around Earth.
- Describe the function of a transformer.
- Describe the motion of an object as it accelerates.
- Describe the motion of an object during free fall.
- Describe what a force is.
- Describe what velocity is.
- Determine when an object is in motion.
- Explain how an electric current can be produced in a conductor.
- Explain how an electric current is produced.
- Explain how conductors are different from insulators.
- Explain how different forms of energy are related.
- Explain how electric charges and fields interact.
- Explain how electric current is related to magnetism.
- Explain how electrical energy can be transformed into mechanical energy. Describe how galvanometers work.
- Explain how energy, work, and power are related.
- Explain how heat is related to temperature and thermal energy. o Describe the three forms of heat transfer.

- Explain how machines make work easier.
- Explain how magnetic poles interact.
- Explain how momentum is determined and conserved.
- Explain how to calculate electric power and energy use.
- Explain how to determine an object's mechanical energy.
- Explain temperature and how it is measured.
- Explain what causes current to flow and how resistance affects current.
- Identify and describe the properties of magnets.
- Identify some characteristics of a magnetic field produced by a current.
- Identify the factors that affect the gravitational force between two objects.
- List other forms of energy.
- Name and describe the two basic types of energy.
- State Newton's first law of motion.
- State Newton's second law of motion.
- State Newton's third law of motion.
- State the law of conservation of energy.
- Use specific heat, conductors, and insulators, and thermal expansion to describe how materials respond to heat.

Standards

SCI.HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
SCI.HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
SCI.HS-PS2-5	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.
SCI.HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
SCI.HS-PS3-2	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 position of particles (objects).
SCI.HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
SCI.HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
SCI.HS-PS4-3	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-

world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Instructional Tasks/Activities

- Chapter Tests
- Foldables – organization of material
- Inquiry based PHET lab based on kinetic energy.
- Kahoot
- Lab activities
- PowerPoint presentation of material Group discussion
- Review game
- Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)
- Vocabulary quizzes
- Web quests

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Appropriate Content Specific Online Resource
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Slides
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Assessment Procedure

- Motion
    - Describing motion
    - Speed and Velocity
    - Acceleration
- Forces
    - The Nature of Force
    - Friction and Gravity
    - Newton's Laws of Motion
    - Momentum
    - Free Fall and Circular Motion
- Work and Machines
    - Work and Power
    - Understanding Machines
    - Inclined Planes and Levers
    - Putting Machines Together
- Energy
    - What is Energy?

        - Forms of Energy
        - Energy Transformations and Conservation
    - Thermal Energy and Heat
        - Temperature, Thermal Energy, and Heat
        - The Transfer of Heat
        - Thermal Properties
    - Electricity:
        - Electric Charge and Static Electricity
        - Electric Current
        - Electric Circuits
        - Electric Power and Safety
    - Magnetism and Electromagnetism
        - What is Magnetism?
        - Magnetic Fields
        - Electromagnetic Force
        - Electricity, Magnetism, and Motion
        - Electricity from Magnetism

- Acceleration
- Classroom Total Participation Technique
- Classwork
- DBQ
- Describing motion
- Electric Charge and Static Electricity
- Electric Circuits
- Electric Current
- Electric Power and Safety
- Electricity from Magnetism
- Electricity, Magnetism, and Motion
- Electricity:
- Electromagnetic Force
- Energy Transformations and Conservation

- Energy:
- Essay
- Exit Ticket/Entrance Ticket/Do Now
- Forces:
- Forms of Energy
- Free Fall and Circular Motion
- Friction and Gravity
- Inclined Planes and Levers
- Journal / Student Reflection
- Kahoot
- Magnetic Fields
- Magnetism and Electromagnetism:
- Momentum:
- Motion:
- Newton's Laws of Motion
- Other named in lesson
- Peer Review
- Performance
- Problem Correction
- Project
- Putting Machines Together
- Quiz
- Rubric
- Speed and Velocity
- Teacher Collected Data
- Temperature, Thermal Energy, and Heat
- Test
- The Nature of Force
- The Transfer of Heat
- Thermal Energy and Heat
- Thermal Properties
- Understanding Machines
- What is Energy?
- What is Magnetism?
- Work and Machines:
- Work and Power
- Worksheet

Resources

- https://www.brainpop.com
- www.//discoveryeducation.com
- https://phet.colorado.edu
- www.pbslearningmedia.org

- https://www.khanacademy.org/science/physics