

Science Matters

Grade Six Physical Science



Energy in Earth Systems

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Grade 6 Physical Science: Energy in Earth Systems

Introduction and Conceptual Flow Narrative

Introduction: This *Grade 6 Physical Science Unit* focuses on energy in earth systems and addresses the California Science Standards for 6th grade for the topic of energy in Earth systems and Investigation and Experimentation Standards. By the end of the unit students know that the sun is the major source of energy for earth systems. Solar energy reaches the Earth as radiation in the form of visible light. Convection currents distribute the sun's heat in the atmosphere and oceans. Heat is transferred in Earth solids by conduction. Energy can be carried from one place to another by heat flow, waves including water, light, sound or by moving objects. Energy is transferred and transformed between different forms of energy. Applications of energy doing work include experiences with windmills, water wheels, heat from a peanut, solar powered batteries and balloons.

Concepts about Energy in Earth Systems are used throughout the following grade six Earth Science Units: Plate Tectonics, Earthquakes and Volcanoes, and Weathering and Erosion. Energy provides the force to change the surface of the Earth through weathering and erosion. Interior energy (heat) provides the force to move and change Earth materials below the surface. The interior convection currents change the surface of the Earth through Earthquakes and Volcanoes as well as the Plate Tectonic movement.

The *Grade 6 Physical Science Unit on Energy in Earth Systems* is presented to students through a series of investigations using indirect evidence (models) and direct evidence, experiments, active learning experiences, researching using a variety of sources, questions, and assessments. Assessments include: pre-, post and one formative assessment.

Conceptual Flow Narrative: The *Grade 6 Conceptual Flow Narrative for Physical Science: Energy in Earth Systems* builds on the concepts presented on the conceptual flow graphic by describing the concept(s) addressed in each lesson and the links that connect each lesson to the next. Lessons are linked to the previous lesson and the lesson that follows via a conceptual storyline enabling the development of student understanding as they progress from one concept to the next.

After students have completed the Pre-Assessment, they begin their exploration of Energy with **Lesson 1 “Forms of Energy”**. Forms of Energy is an introduction to the many forms of energy that can do work. Energy station materials are explored and discussed to clarify characteristics of each form of energy. This lesson links to the next lesson, which further classifies energy into potential and kinetic energy.

During the previous lesson, students learned that there are multiple forms of energy. **Lesson 2 “Potential and Kinetic Energy”** continues the exploration of energy by using observations collected in the first lesson and identifying characteristics of potential energy (stored energy or the ability to do work) and kinetic energy (energy in motion). The transfer and transformation between forms of energy is explored in the next lesson.

Lesson 3, “Energy Transfer & Transformation,” links to the previous lesson by providing applications that transfer and transform energy to another form to complete a task. The Rube Goldberg designs challenge students to explain changes that stay in the same form of energy (transfer) and changes that change energy to another form (transform). During the next lesson, explanations for the sun’s transfer and transformation of solar energy is explored.

Having learned that energy is transferred and transformed in the previous lessons, **Lesson 4 “Thermal Energy Flow in Materials”** begins with an investigation that measures how materials are heated using radiant energy (light) from the sun. Two additional demonstrations provide examples of how heat continues to flow through other Earth materials such as air and liquids. Another investigation explores how different materials transfer heat by conduction at different rates.

Differences in how thermal energy flows in materials (uneven heating) causes wind on Earth. Wind energy can be harnessed to do work. During **Lesson 5 “Wind Energy** experiments with windmills transfers wind energy to mechanical energy providing forces to turn windmills. In the next lesson, students learn the energy from the force of moving water can be used to do work.

Moving water provides the force to move a water wheel in “ **Lesson 6 “Energy from Water Wheels”**”. The water wheel is like the windmill in previous lesson and both can transfer or transform energy to another form to do work. Examples include providing energy for turbines to generate electricity or lifting heavy objects. In the next lesson, students learn energy from food provides heat for fuel for humans.

Lesson 7, “Peanut Energy” explores how peanuts store energy that transforms to heat energy when burned. The energy of the peanut (foods) can be transformed into energy used by living things to function and stay alive.

Lessons 1-7 develop conceptual understanding of transfer and transformation of energy in Earth systems. The formative assessment #1 assesses student understanding of the multiple ways energy can be transferred and transformed.

In “**Formative Assessment #1**,” students design a logical series of transfer and transformation using pictures of a variety of forms of energy. Evidence from the assessment indicates the understanding of transfer and transformation possibilities.

Energy that is transferred or transformed starts with a source. **Lesson 8 “Solar Energy”** introduces a comparison of sources of energy for batteries. Solar batteries use the sun as a source for energy. Chemical batteries use chemical reactions as a source for energy. This links to the next lesson that explores renewable and non-renewable sources for energy.

Lesson 9 “Renewable and Non-Renewable Energy Sources” summarizes that all energy has a source. Renewable sources replenish within a lifetime. Non-renewable energy sources are not replenished within a lifetime. Benefits and drawbacks of different sources are explored.

Upon completion of the eight lessons, students take a **Post-Assessment** to determine their overall understanding of the concepts presented in the unit.

Grade Six Planning Guide

Grade Six lessons are multi day and need additional time for particular lessons. This guide is intended to provide approximate days/sessions needed for each lesson.

Lesson	*Time	Concept
<i>*Pre-assessment</i>	1 day	
6.1 Forms of Energy	2 days	Energy is the ability to do work and has many forms.
6.2 Potential and Kinetic Energy	1 day	Energy can be potential (stored energy) or kinetic (energy of motion).
6.3 Energy Transfer and Transformation	3 day	Energy can be transferred and transformed using Rube Goldberg Machine Designing.
6.4 Thermal Energy Flow in Materials.	2-3 days	Light energy radiating the sun is transformed and transferred through conduction and convection to Earth systems.
6.5 Energy from the Wind	2 days	Wind energy caused by uneven heating of the Earth is transformed to a windmill to do work.
6.6 Energy from Water Wheels	2 days	Moving water can do work by transferring energy to waterwheels.
6.7 Peanut Energy	1 days	Stored Energy in peanuts is transformed to heat energy.
<i>* Formative Assessment #2</i>	1 day	
6.8 Solar Energy	1 days	Introduces renewable and nonrenewable energy source for batteries.
6.9 Renewable-Nonrenewable Energy	2 days	Renewable and nonrenewable energy sources are evaluated for drawbacks and benefit.
<i>* Post Assessment</i>	1 day	

