

Standard 6.2.3

Strand 6.2: ENERGY AFFECTS MATTER	Matter and energy are fundamental components of the universe. Matter is anything that has mass and takes up space. Transfer of energy creates change in matter. Changes between general states of matter can occur through the transfer of energy. Density describes how closely matter is packed together. Substances with a higher density have more matter in a given space than substances with a lower density. Changes in heat energy can alter the density of a material. Insulators resist the transfer of heat energy, while conductors easily transfer heat energy. These differences in energy flow can be used to design products to meet the needs of society.	
Standard:6.2.3 MS-PS3-4	Plan and carry out an investigation to determine the relationship between temperature, the amount of heat transferred, and the change of average particle motion in various types or amounts of <u>matter</u>. Emphasize recording and evaluating data, and communicating the results of the investigation.	
	Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	Energy and Matter - Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). - The transfer of energy can be tracked as energy flows through a designed or natural system.
DCI	PS3.A: Definitions of Energy - Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. PS3.B: Conservation of Energy and Energy Transfer - The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.	
Student Friendly Objectives	I can determine the relationship between temperature, the amount of heat transferred, and the change of average particle motion in various types or amounts of matter. I can record and evaluate data and communicate my results.	
Anchor Phenomena	There is a relationship between the change in particle motion, the amount of heat transferred, the type of matter, and amount of matter.	

Possible Scenarios	boiling water, condensation on a bottle, tile vs carpet, bouncy ball	
Vertical Learning Progression Alignment	Previous Science Content (Discussed in K-5 Standards)	Future Science Content (Discussed in 9-12 Standards)
	• Moving objects contain energy. The faster the object moves, the more energy it has. • Energy can be moved from place to place by moving objects, or through sound, light, or electrical currents. • Energy can be converted from one form to another form..	• The total energy within a system is conserved. • Energy transfer within and between systems can be described and predicted in terms of energy associated with the motion or configuration of particles (objects). • Systems move toward stable states.

What students should be doing:

1. Identifying the phenomenon under investigation
 - a. Students identify the phenomenon under investigation involving thermal energy transfer.
 - b. Students describe the purpose of the investigation, including determining the relationships among the following factors:
 - i. The transfer of thermal energy.
 - ii. The type of matter.
 - iii. The mass of the matter involved in thermal energy transfer.
 - iv. The change in the average kinetic energy of the particles.
2. Identifying the evidence to address the purpose of the investigation
 - a. Individually or collaboratively, students develop an investigation plan that describes the data to be collected and the evidence to be derived from the data, including:
 - i. That the following data are to be collected:
 1. Initial and final temperatures of the materials used in the investigation.
 2. Types of matter used in the investigation.
 3. Mass of matter used in the investigation.
 - ii. How the collected data will be used to:
 1. Provide evidence of proportional relationships between changes in temperature of materials and the mass of those materials.
 2. Relate the changes in temperature in the sample to the types of matter and to the change in the average kinetic energy of the particles.
3. Planning the investigation
 - a. In the investigation plan, students describe:
 - i. How the mass of the materials are to be measured and in what units.
 - ii. How and when the temperatures of the materials are to be measured and in what units.
 - iii. Details of the experimental conditions that will allow the appropriate data to be collected to address the purpose of the investigation (e.g., time between temperature measurements, amounts of sample used, types of materials used), including appropriate independent and dependent variables and controls.