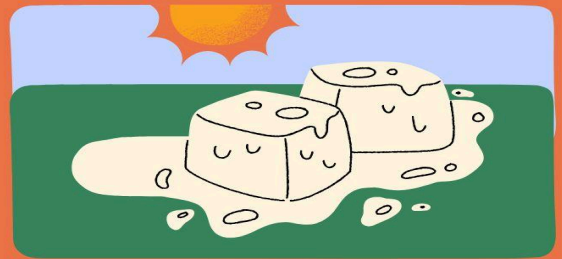


HEAT



Discussion Guide (for use during or after reading)

1. What is Earth's most important source of heat? Why is this considered the most important? (Sources of Heat, p. 10-11)
 - a. Heat is a form of energy. We often feel heat as warmth. The sun is Earth's most important source of heat because life could not exist without it.
2. What is thermal energy? (The Flow of Heat, p. 12-15)
 - a. Thermal energy is the force that makes particles of matter vibrate and move. The more thermal energy particles have, the faster they move. Thermal energy can transfer from particle to particle and from object to object.
3. Explain how thermal energy transfers from ice to water. (The Flow of Heat, p. 12-15)
 - a. Thermal energy and heat always flow from warmer objects to cooler ones. For example, ice in a glass of water has particles that move very slowly. The water is warmer than the ice and contains particles that move quickly. The thermal energy flows from the water to the ice, causing these particles to speed up. This causes the ice to melt and change state from a solid to a liquid. All the particles in the glass of water are now at the same temperature and move at the same speed.
4. What is meant by expand and contract when talking about heat? (Expansion and Contraction, p. 16-19)
 - a. When something expands, it increases in size. When something contracts, it decreases in size. Most solids and liquids expand when they are heated and contract when they lose heat.

5. Why is it important for engineers to understand thermal energy? (Expansion and Contraction, p. 16-19)
 - a. It is important for engineers to understand thermal energy because the process of heating and cooling plays a major role in their work. Temperatures vary, and engineers need to be able to design products that can withstand these changes and any expansion or contraction caused by them.
6. Use what you know about expansion and contraction to explain how glass thermometers measure temperature. (Expansion and Contraction, p. 16-19)
 - a. When heated, the liquid in a glass thermometer expands and rises up the tube so it can be read as a temperature. Likewise, cooler temperatures cause the liquid within the thermometer to contract and lower.
7. Use an example to illustrate the difference between physical and chemical changes. (Physical and Chemical Changes, p. 20-21)
 - a. A physical change occurs when matter changes shape or form, whereas a chemical change occurs when one or more substances are converted into one or more substances with different properties. For example, crumpling a piece of paper is a physical change because the paper has changed only its shape. Burning the paper is an example of a chemical change because one substance (the paper) is being changed into other substances (smoke and ash).
8. Describe the processes of conduction, convection, and radiation. (Conduction, Convection, and Radiation, p. 22-25)
 - a. Conduction, convection, and radiation describe ways in which heat can move.
 - b. Conduction is the movement of heat from one particle to another. Solids are often heated by conduction. Their particles do not move around as freely and instead vibrate in place, bumping into nearby particles and transferring heat and thermal energy.
 - c. Liquids and gasses have particles that move around more freely than in solids. Here, the particles carry heat as they move. Convection is the transfer of heat through moving particles to different areas, like a conveyer belt.
 - d. Radiation is the movement of heat without any matter to carry it, such as the heat from the sun that warms Earth.
9. Describe differences between conductors and insulators. (Conductors and Insulators, p. 26-27)
 - a. Conductors and insulators are both used to affect thermal energy and heat. Conductors are materials that help heat move easily between objects. Most conductors are metals. Insulators do the opposite! Insulators are materials that reduce the motion of heat. For example, we use jackets to insulate our bodies in the winter. Plastics make great insulators for heat.
10. What fun fact stood out to you and why? (Can You Believe It?!, p. 36-38)
 - a. Students' answers will vary.