

Introduction: Thermal Physics (Heat)

Unit: Thermal Physics (Heat)

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This chapter is about heat as a form of energy and the ways in which heat affects objects, including how it is stored and how it is transferred from one object to another.

- *Heat & Temperature* describes the concept of heat as a form of energy and how heat energy is different from temperature.
- *Heat Transfer* describes how to calculate the rate of the transfer of heat energy from one object to another.
- *Specific Heat Capacity & Calorimetry* describes different substances' and objects' abilities to store heat energy.
- *Phase Diagrams* describes how to use a phase diagram to determine the state of matter of a substance at a given temperature and pressure.
- *Phases & Phase Changes* and *Heating Curves* addresses the additional calculations that apply when a substance goes through a phase change (such as melting or boiling).
- *Thermal Expansion* describes the calculation of the change in size of an object caused by heating or cooling.

New challenges specific to this chapter include looking up and working with constants that are different for different substances.

Use this space for summary and/or additional notes:

Standards addressed in this chapter:**MA Curriculum Frameworks (2016):**

- HS-PS2-6.** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- 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.
- HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields.
- HS-PS3-4.** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

*AP® only***AP® Physics 2 Learning Objectives:**

- 1.E.3.1:** The student is able to design an experiment and analyze data from it to examine thermal conductivity. [SP 4.1, 4.2, 5.1]
- 4.C.3.1:** The student is able to make predictions about the direction of energy transfer due to temperature differences based on interactions at the microscopic level. [SP 6.4]
- 5.A.2.1:** The student is able to define open and closed systems for everyday situations and apply conservation concepts for energy, charge, and linear momentum to those situations. [SP 6.4, 7.2]

Topics from this chapter assessed on the SAT Physics Subject Test:

- **Thermal Properties**, such as temperature, heat transfer, specific and latent heats, and thermal expansion.
- **Laws of Thermodynamics**, such as first and second laws, internal energy, entropy, and heat engine efficiency.
 1. Heat and Temperature
 2. The Kinetic Theory of Gases & the Ideal Gas Law
 3. The Laws of Thermodynamics
 4. Heat Engines

Use this space for summary and/or additional notes:

Skills learned & applied in this chapter:

- Working with material-specific constants from a table.
- Working with more than one instance of the same quantity in a problem.
- Combining equations and graphs.

Use this space for summary and/or additional notes: