

Chapter 9: Heat

Holt Text Sections

- 9-1 Temperature and Thermal Equilibrium
- 9-2 Defining Heat
- 9-3 Changes in Temperature and Phase

Summary

Chapter 9 starts the study of Heat and Temperature. Applications of conservation of energy in this chapter include the connection between mechanical work and heat. Ideal gases are defined and used to present the kinetic theory of gases. Phase changes, the relationship between heat given off or absorbed by a material and the corresponding temperature or phase change, and calorimetry are discussed. Finally, sections of this chapter deal with the processes of heat exchange.

Major Concepts

By the end of the chapter, you should understand each of the following and be able to demonstrate their understanding in problem applications as well as in conceptual situations.

- Temperature
 - The zeroth law of thermodynamics
 - Temperature scales
 - Absolute zero
- Thermal expansion
 - Linear
- Ideal gases
 - Definition
 - Equation of state
- Heat
 - Energy transfer
 - Mechanical equivalent
 - Specific heat
 - Calorimetry

- Latent heat
- Phase changes and energy conservation
- Mechanisms of heat exchange
 - Conduction
 - Convection
 - Radiation
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Formulas

$$^{\circ}\text{F} = 9/5 ^{\circ}\text{C} + 32$$

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$$

$$\text{K} = ^{\circ}\text{C} + 273$$

$$L = L_0(1 + \alpha \Delta T)$$

$$PV = nRT \quad \text{where } R = 8.315 \text{ J/mol K} \quad \text{OR} \quad 0.0821 \text{ L atm/mol K}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$4,186 \text{ J} = 1 \text{ kcal}$$

$$Q = m C \Delta T$$

$$Q_{\text{LOST}} = Q_{\text{GAINED}}$$

$$m C \Delta T_{\text{LOST}} = m C \Delta T_{\text{GAINED}}$$

$$- m C (T_f - T_0) = m C (T_f - T_0)$$

$$Q_{\text{SOLID-LIQUID PHASE CHANGE}} = m \Delta L_f$$

$$Q_{\text{LIQUID-GAS PHASE CHANGE}} = m \Delta L_v$$