

Energy, Temperature, and Heat

Objectives

1. To understand the general properties of energy
2. To understand the concepts of temperature and heat
3. To understand the direction of energy flow as heat

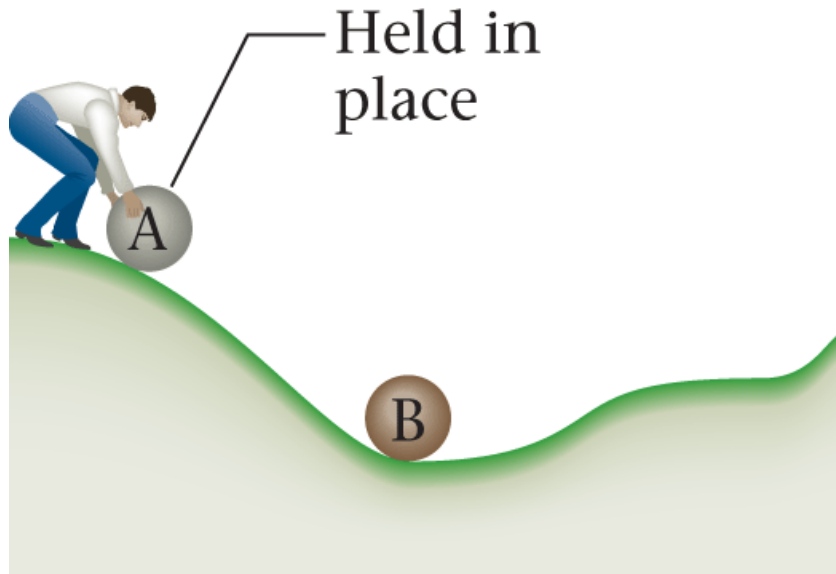
Section 10.1

Energy, Temperature, and Heat

A. The Nature of Energy

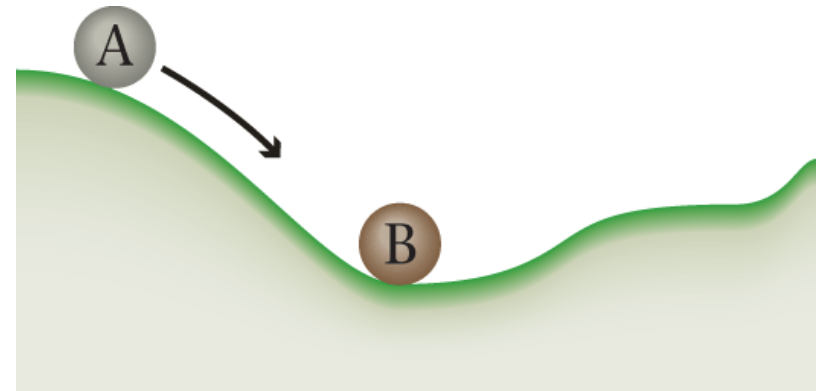
- **Energy** is the ability to do work or produce heat.

Potential energy
Energy of position



Kinetic energy
Energy of motion

$$E = \frac{1}{2} mv^2$$



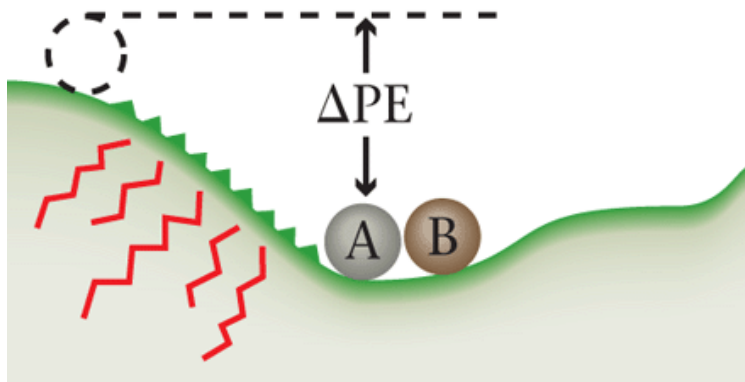
Section 10.1

Energy, Temperature, and Heat

A. The Nature of Energy

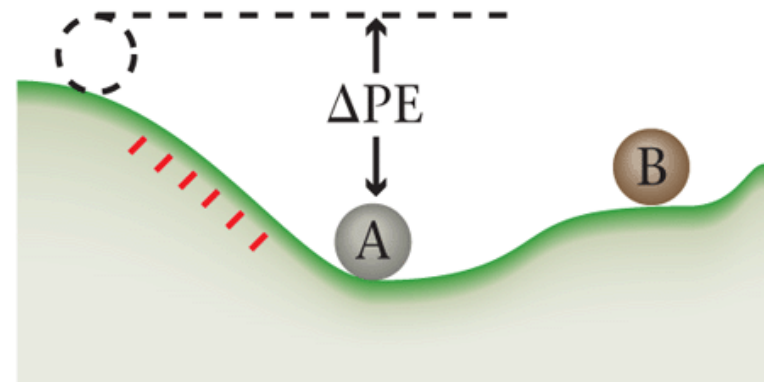
- Law of conservation of energy
 - Energy can be converted from one form to another but can neither be created or destroyed.

Rough surface



Less work
More heat

Smooth surface



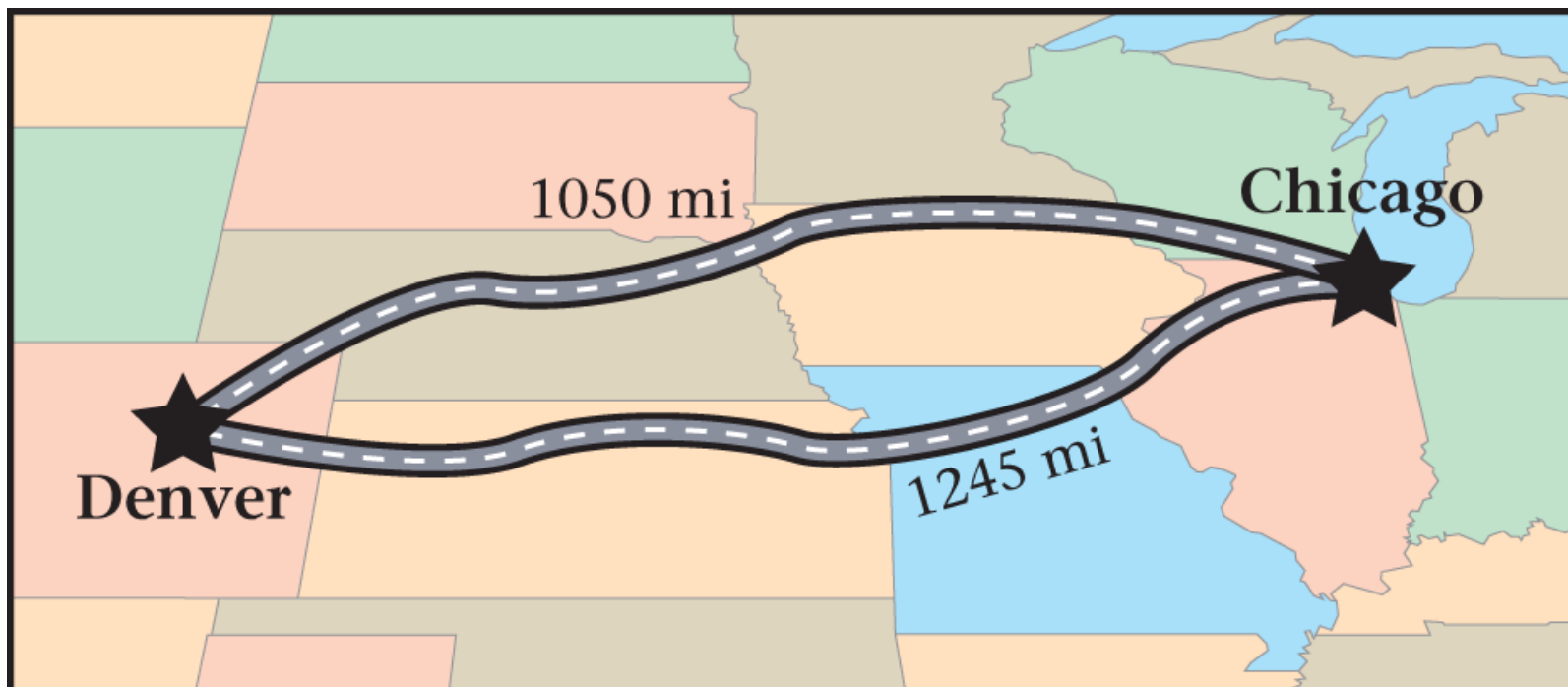
More work
Less heat

Section 10.1

Energy, Temperature, and Heat

A. The Nature of Energy

- State function
 - Property of the system that changes independent of path
 - Is this a state function?

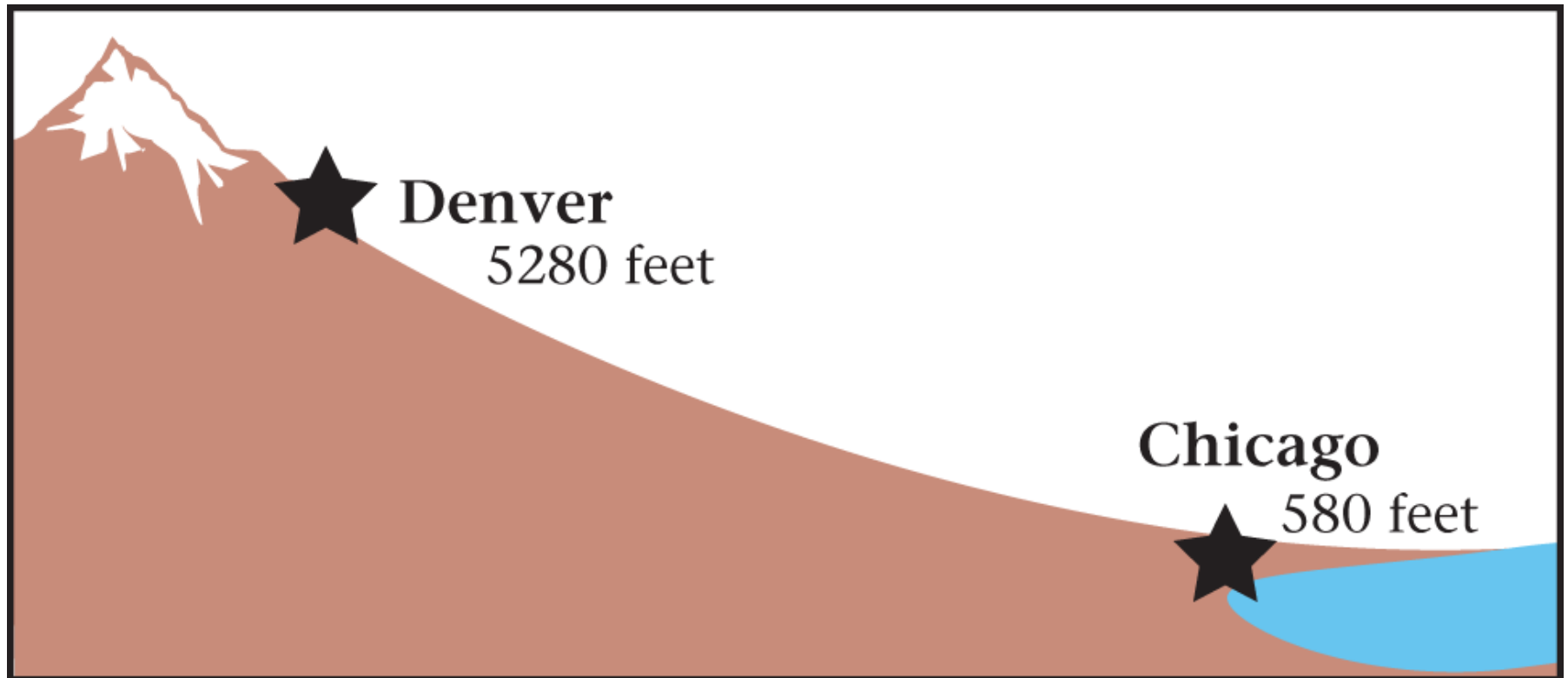


Section 10.1

Energy, Temperature, and Heat

A. The Nature of Energy

– Is this a state function?



Energy, Temperature, and Heat

A. The Nature of Energy

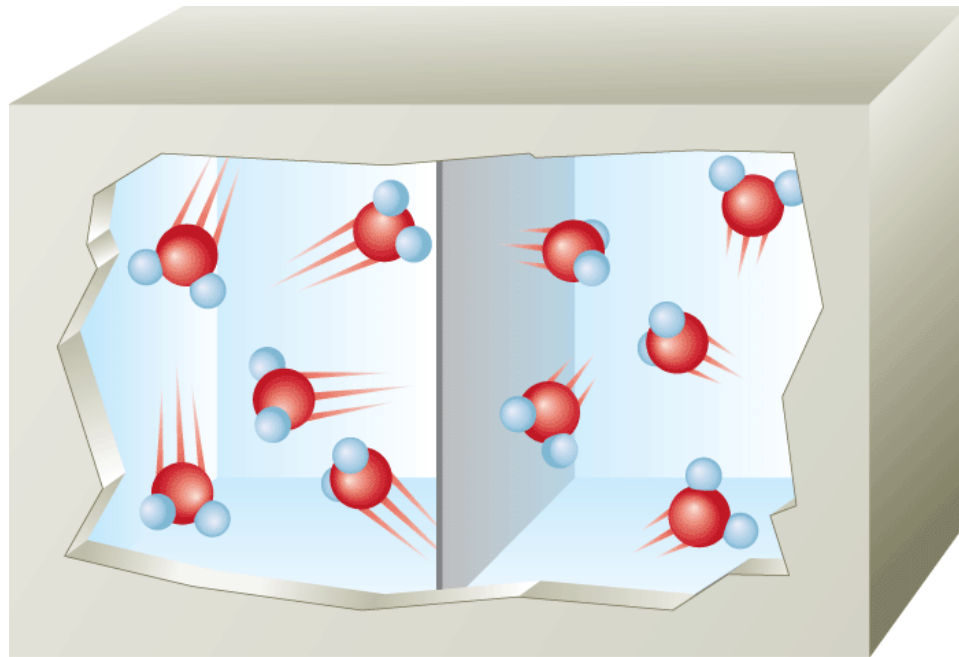
- Are these state functions?
 - Energy
 - Work
 - Heat

Section 10.1

Energy, Temperature, and Heat

B. Temperature and Heat

- **Temperature** is a measure of the random motions of the components of a substance.



Hot water
(90. °C)

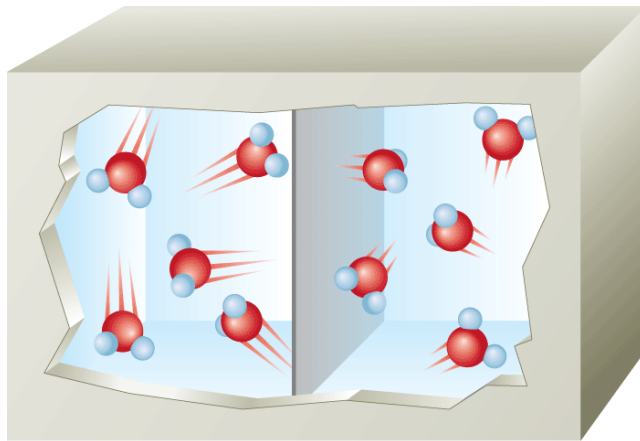
Cold water
(10. °C)

Section 10.1

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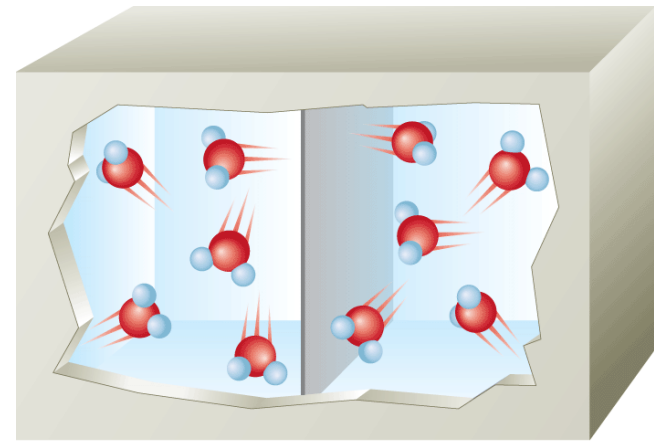
B. Temperature and Heat

- **Heat** is a *flow* of energy between two objects due to a temperature difference between the objects.
 - Heat is the way in which thermal energy is transferred from a hot object to a colder object.



Hot water
(90. °C)

Cold water
(10. °C)



Water
(50. °C)

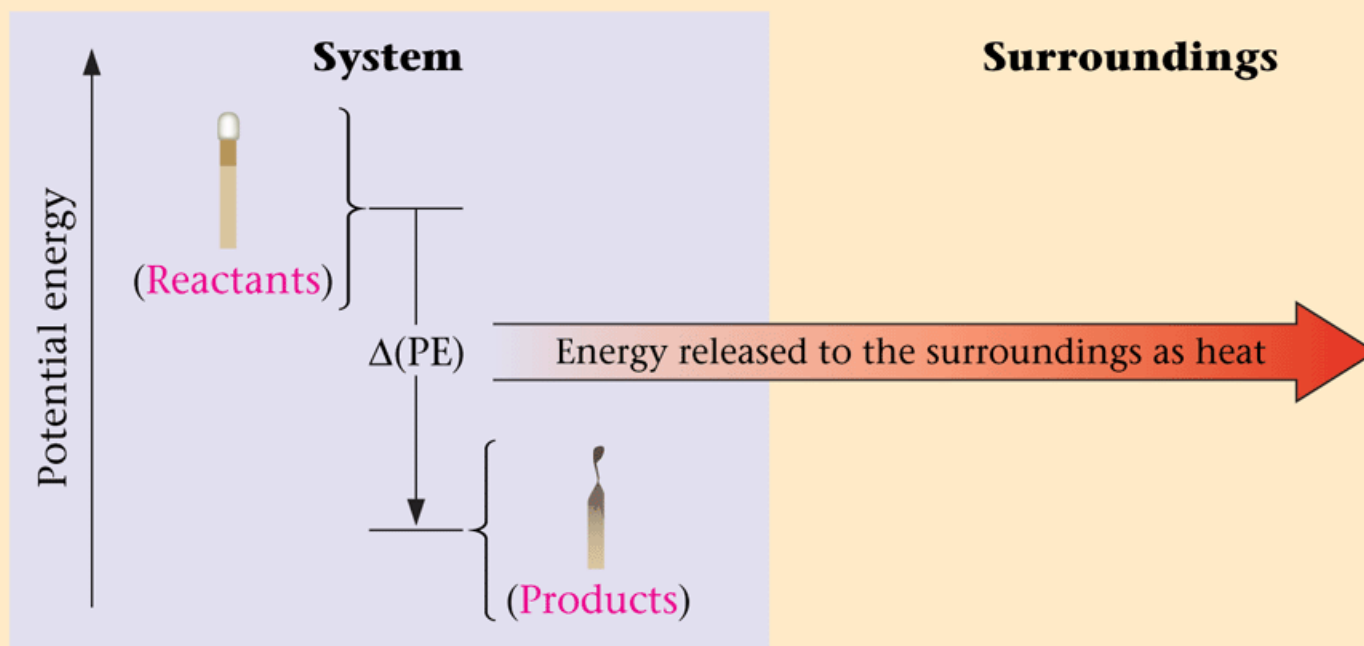
Water
(50. °C)

Section 10.1

Energy, Temperature, and Heat

C. Exothermic and Endothermic Processes

- **System** – part of the universe on which we focus attention
- **Surroundings** – everything else in the universe
- Burning a match



Energy, Temperature, and Heat

C. Exothermic and Endothermic Processes

- **Exothermic** – energy flows out of the system
- **Endothermic** – energy flows into the system

