

Calorimetry and Heat Transfer

Pre-Class Questions

Problem Set (due next time)

Ch 14 - 42, 47, 52, 61

Lecture Outline

1. Calorimetry and Temperature Changes
2. Calorimetry and Phase Changes
3. Conduction, Convection, and Radiation

A thermometer is in a container half-filled with 20°C water.

a. When an equal volume of 20°C water is added, the temperature of the mixture is

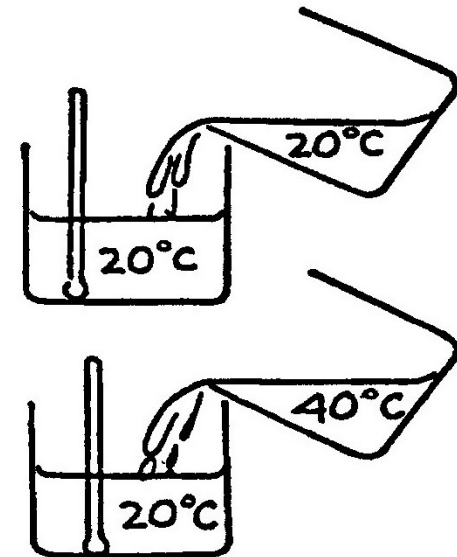
(10°C) (20°C) (40°C)

b. When instead an equal volume of 40°C water is added, the temperature of the mixture will be

(20°C) (30°C) (40°C)

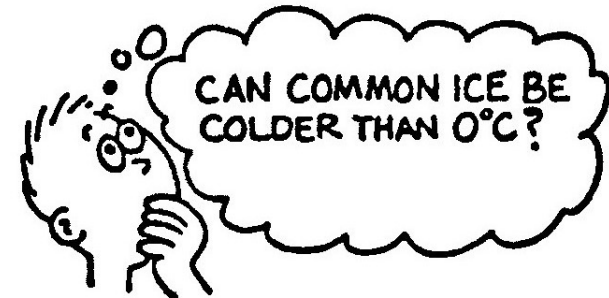
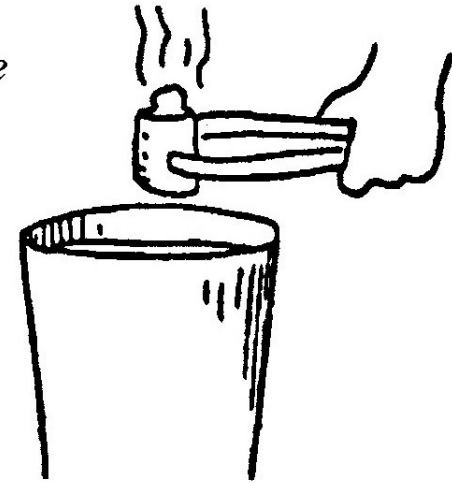
c. When instead a small amount of 40°C water is added, the temperature of the mixture will be

(20°C) (between 20°C and 30°C) (30°C) (more than 30°C)



A red-hot piece of iron is put into a bucket of cool water. *Mark the following statements true (T) or false (F).* (Ignore heat transfer to the bucket.)

- a. The decrease in iron temperature equals the increase in the water temperature. _____
- b. The quantity of heat lost by the iron equals the quantity of heat gained by the water. _____
- c. The iron and water both will reach the same temperature. _____
- d. The final temperature of the iron and water is halfway between the initial temperatures of each. _____



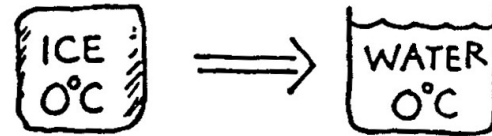
Conceptual PHYSICS

*Example 1: A 300g copper cylinder at 90°C is placed it in 500g of water at 20°C.
Find the final temperature.*

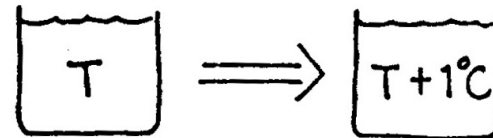
Change of Phase

All matter can exist in the solid, liquid, or gaseous phases. The solid phase exists at relatively low temperatures, the liquid phase at higher temperatures, and the gaseous phase at still higher temperatures. Water is the most common example, not only because of its abundance but also because the temperatures for all three phases are common. Study Section 23.8 in your textbook and then answer the following:

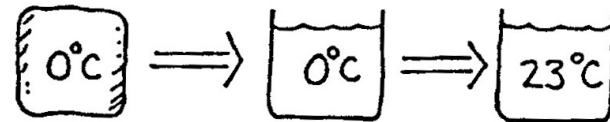
1. How many joules are needed to change 1 gram of 0°C ice to water?



2. How many joules are needed to change the temperature of 1 gram of water by 1°C ?



3. How many joules are needed to melt 1 gram of 0°C ice and turn it to water at a room temperature of 23°C ?



Example 2: To cool of a 500g glass of water at 20°C, 100g of ice at 0°C is added. Find the resulting temperature of the water. Hint: all the ice melts.

Conduction	atoms remain in place, but transfer energy to their neighbors through vibration.
Convection	atoms (or molecules) carry the energy from one place to another.
Radiation	electromagnetic waves (light) carries energy from one place to another.

What A Pane!

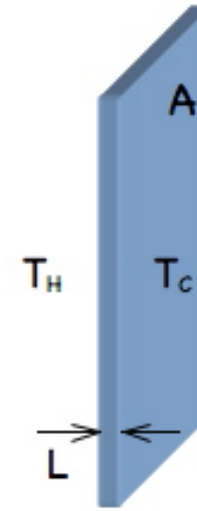
At the right is a window pane in an air conditioned home on a hot summer day.

A = the area of the window pane

T_H = the outside air temperature

T_C = the temperature of the cool indoor air

L = the thickness of the window pane



In the following sentences fill the blanks with the word increase or decrease.

1. Making the area of the window larger will _____ the heat conducted through the window.
2. As the temperature difference goes up, the heat conducted through the window will _____.
3. As the thickness of the glass increases the heat conducted through the window will _____.
4. If we replace the glass with Styrofoam, the heat conducted will _____.

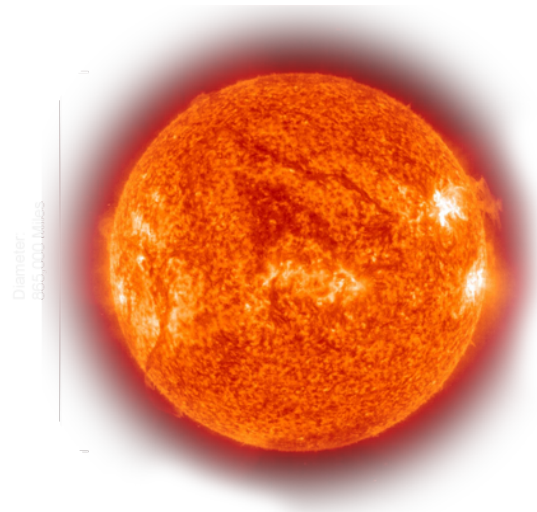
Sun Fun?

The sun emits radiation that transfers heat to Earth and the other planets.

List two changes to the sun that would increase the total radiation it emits.

1. _____

2. _____



Lecture 37 - Summary

The Law of Conservation of Energy requires the heat lost by one system must be gained by another.

Conduction $H = kA \frac{T_H - T_C}{L}$

Radiation $H = Ae\sigma T^4$