### Today  12.7-12.11 Specific Heat

- HW25 Redo; HW27

### Wednesday  13  Heat Transfer

- HW28

### No Lab

### Friday  14  Thermodynamics 1st 3rd

### 12.4 & 12.7  Heat and Internal Energy

- **Thermal Equilibration**
- **Historic concept of Heat flow**
  - Motivational thought experiment: Mixing liquids of different Temperatures
  - Historic Model
    - Equation 12.4
      - Specific Heat
        - Value
        - Units

- **Example 1.** How much heat (energy) flows into a 0.01kg Al spoon when it moves from room temperature (24 °C) to boiling water (100°C)?

- **Justify Equation with Particle Picture**
  - Kinetic Energy
  - Potential Energy
    - Thermal Expansion and Potential Energy
  - Scaling up

- **Conceptual Question 1.** Two identical mugs contain hot coffee from the same pot. One mug is full, while the other is only one quarter full. Sitting on the kitchen table, which mug stays warmer longer? Explain.

### Calorimetry

- **Transfer of internal energy**
  - Conservation of Energy applied to particle systems
  - Transfer mechanism
    - Example 2. Say I poor 0.2 kg of boiling water into my room temperature 0.1 kg glass tea mug. Neglecting the effect of all the room temperature air around the cup, what would be the final temperature of the water and mug?

- **Phase Change**
  - Equation 12.5
    - Latent Heat
      - Example 3. How much energy does it take to boil a 0.2 kg of water? The Latent Heat of water’s vaporization is $22.6 \times 10^5$ J/kg

- **Example 4.** How much energy is required to just melt 0.45 kg of Al at 130 °C? $T_{melt} = 660°C$, $L_{melt} = 4.0 \times 10^5$ J/kg.
39. Blood can carry excess energy from the interior to the surface of the body, where the energy is dispersed in a number of ways. While a person is exercising, 0.6 kg of blood flows to the surface of the body and releases 2000 J of energy. The blood arriving at the surface has the temperature of the body interior, 37.0 °C. Assuming that blood has the same specific heat capacity as water, determine the temperature of the blood that leaves the surface and returns to the interior.

42. Ideally, when a thermometer is used to measure the temperature of an object, the temperature of the object itself should not change. However, if there is a significant heat flow between the object and the thermometer, the temperature will change. A thermometer has a mass of 31.0 g, a specific heat capacity of $c = 815 \text{ J/(kg \cdot °C)}$, and a temperature of 12.0°C. It is immersed in 119 g of water, and the final temperature of the water and thermometer is 41.5°C. What was the temperature of the water before the insertion of the thermometer?

55. Find the mass of water that vaporizes when 2.10 kg of mercury initially at 205°C is added to 0.110 kg of water at 80.0°C.

56. The latent heat of vaporization of H₂O at body temperature (37.0°C) is $2.42 \times 10^8 \text{ J/kg}$. To cool the body of a 75-kg jogger [average specific heat capacity = 3500 $\text{ J/(kg \cdot °C)}$] by 1.5°C, how many kilograms of water in the form of sweat have to be evaporated?