Specfic Heat

Specific Heat

- Physical Property that is unique to the material

- Amount of energy required to heat 1 gram of a substance by 1 degree Celsius

Specific Heat

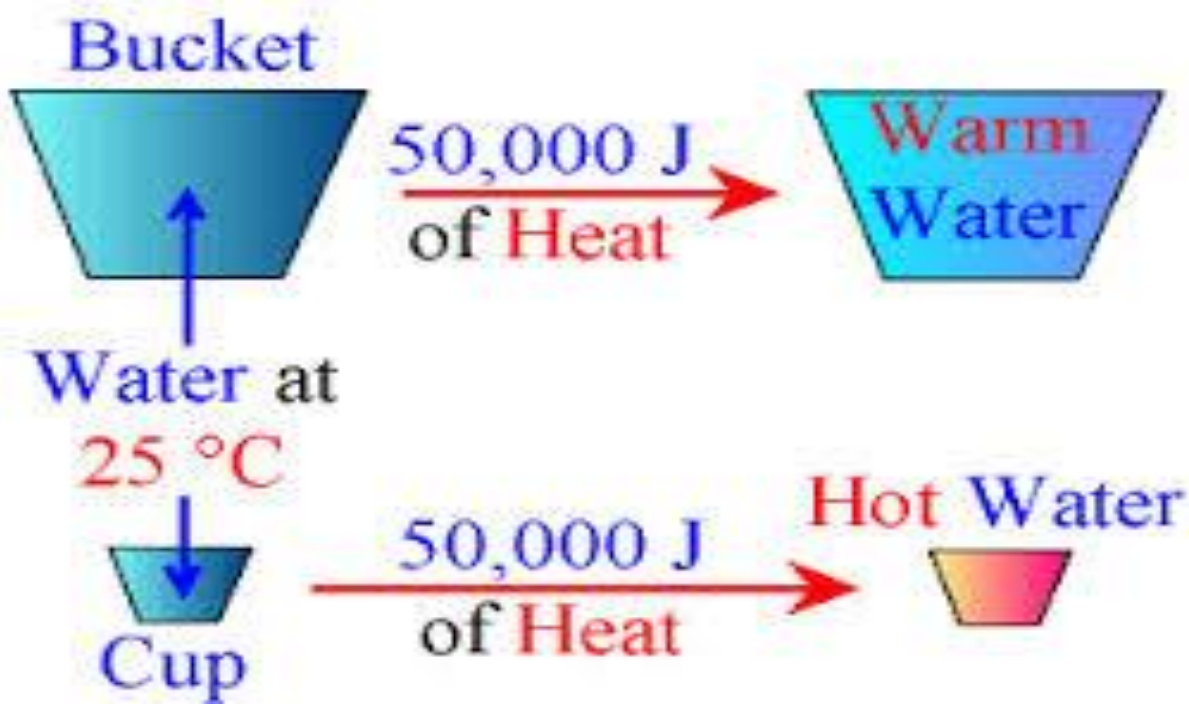
- The amount of heat energy required to raise the temperature of one grams of a substance by 1 ºc

Substance	C = J/gºc	Substance	C = J/gºc
Lead	0.129	Aluminum	0.897
Iron	0.449	Ethanol	2.44
Copper	0.385	Water (l)	4.184

Why do you suppose the bottom some aluminum pans are coated with copper?

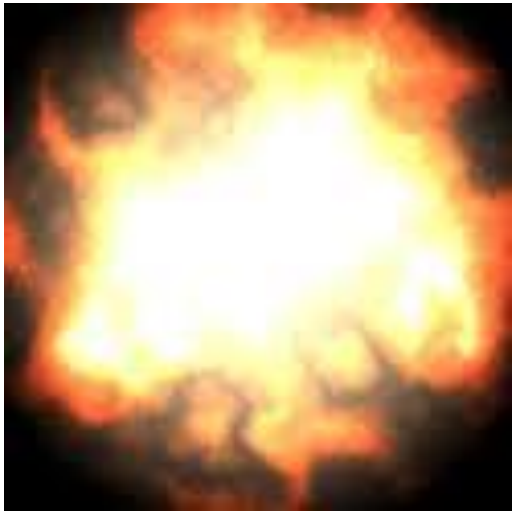
Heat- sum of the kinetic energy of all particles in a system (Q)

- Temperature; the average of the kinetic energy of the particles in a system



Heat- sum of the kinetic energy of all particles in a system (Q)

- Heat always flows from hot to cold!
- So why do we add ice cubes to a drink?



What happens if a hot piece of metal is added to water?

By convention, the sign of q is a signal showing the direction of heat transfer. When heat is transferred out of a material, the sign of q is negative. Conversely, when heat is absorbed by a material, q is positive. The signs of q, along with the necessary associated temperature changes, are summarized in Table 2.

Table 2. Heat Transfer

Direction of Heat Transfer	Sign of q	Sign of ΔT	Change in Temperature of Material
Heat is absorbed (transferred into a material)	+	+	Temperature increases
Heat is delivered (transferred out of a material)	-	-	Temperature decreases

According to the Law of Conservation of Energy, the heat delivered by the the heated metal, qmetal, must be equal to the heat absorbed by the water, qwater, and its surroundings. Incorporating the sign convention given in Table 2 gives Equations 4 and 5.

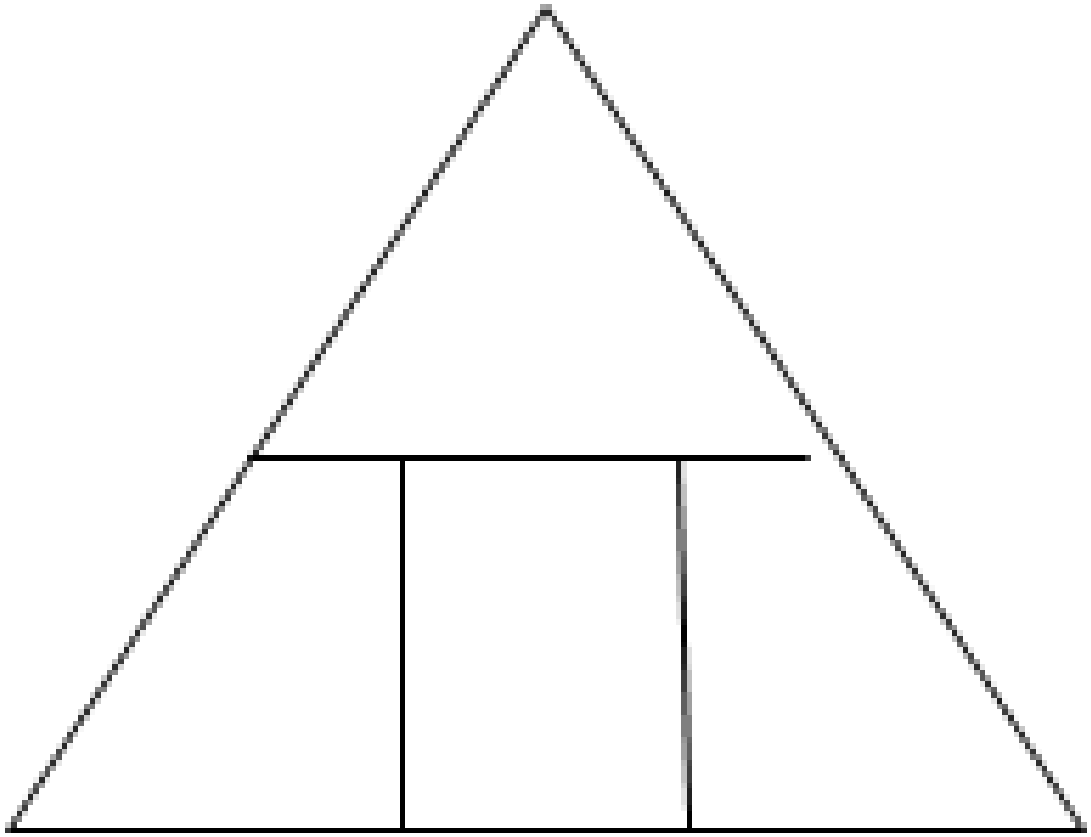
$$q_{metal} = - q_{water} \qquad \text{(Equation 4)}$$

Heat Capacity

- Amount of energy required to change a given sample by a given amount
  - $Q = m C \Delta T$
- Q= Heat= Joules
- C= specific heat (table value) J/g^0c

  (unique to material)
- $\Delta T = T_{Final} - T_{Initial}$

Create a conversion triangle



Problems Finding Energy

- 1. a. How much energy is required to warm 5.00 grams of copper from 22.00c to 40.00c?

Copper 0.385J/g^{o}c

- b. How much energy is lost when 2.00 grams of lead is cooled from 25.00c to 15.00c?

Finding Mass

- 2. a. How many grams of water are in a sample if it required 166 joules of energy to be warmed from 20.00c to 40.00c?

Water (l) 4.184J/g^{o}C

- b. A sample of iron lost 66.6 joules of energy when cooled from 50.00c to 35.00c. What was the sample mass?

Finding Temperature

- 3. a.What is the final temperature if 25.0 grams of gold absorbs 32.25 joules of energy at 25.00c?

Gold 0.129J/g^{o}c

- 3b. What was the initial temperature of a 12.0 gram sample of iron if it absorbs 107. joules of energy ending at 31.00C?

Finding Identity

- 4. a. What is the identity of a material if 25.0 grams of the sample will absorb 59.3 joules of energy when warmed from 20.00c to 30.00c?

- b. A cube with a mass of 15.00 grams of “gold” colored material absorbs 38.7 joules of energy when warmed from 20.0oc to 40.00c. Is it gold?

Last ONE!

- c. What material will gain 111 joules of energy if 25.0 grams are warmed from 20.00c to 30.00C?