

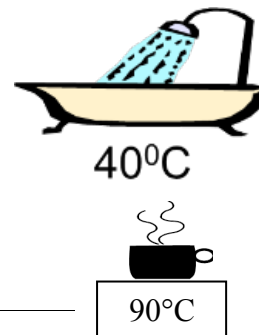
Specific Heat Notes

- Heat (q) is the _____ (energy of motion, kinetic energy), measured in Joules (J) or calories (cal)
 - A food Calorie (Cal) is 1000 cal or 1 kcal
 - 1 cal = 4.184 J (We will use J exclusively)

- Temperature (T) is the *average* kinetic energy of a sample, measured in $^{\circ}\text{C}$ or K

Temperature is not the same as thermal energy (or heat).

- Thermal Energy is the sum of the kinetic energies of all of the particles:
bathtub @ 40°C has more thermal energy than a cup of tea at 90°C



- Specific Heat (c) is the _____
 - Measures how easy it is to change the temperature of a material by adding/removing energy (heat)

- Water has one of the highest specific heats: $c = \frac{1 \text{ cal}}{\text{g} \cdot ^{\circ}\text{C}} = \frac{4.184 \text{ J}}{\text{g} \cdot ^{\circ}\text{C}}$

- Difficult to change T of H_2O (requires a large amount of heat)

- Other materials have lower c values

- Calculations involving energy & specific heat

- During heat transfer, $q = (m)(c)(\Delta T)$, where

q is heat (energy) in J

m is the mass of the sample, in g

c is the specific heat

$\Delta T = T_{\text{final}} - T_{\text{initial}}$ is the temperature change

- Ex: 5.00 g of water increases in T by 2.00°C . What is the energy absorbed?

$$q = (5.00 \text{ g}) \left(4.184 \frac{\text{J}}{\text{g} \cdot ^{\circ}\text{C}} \right) (2.00^{\circ}\text{C}) = 41.8 \text{ J}$$

- ex: The specific heat of calcium = $0.647 \text{ J/g} \cdot ^{\circ}\text{C}$. What is the final temperature if 20.0 g Ca at 21.3°C absorbs 135 J heat?

$$q = mc\Delta T \Rightarrow \Delta T = \frac{q}{mc} = \frac{135 \text{ J}}{(20.0 \text{ g}) \left(0.647 \frac{\text{J}}{\text{g} \cdot ^{\circ}\text{C}} \right)} = 10.4^{\circ}\text{C}; T_{\text{final}} = 21.3^{\circ}\text{C} + 10.4^{\circ}\text{C} = \boxed{31.7^{\circ}\text{C}}$$

Problems:

- How much heat is needed to raise the temperature of a 55.0 g sample of aluminum ($c = 0.900 \text{ J/g} \cdot ^{\circ}\text{C}$) from 22.4°C to 94.6°C ?
- What is the final temperature of a 28.2 g sample of iron ($c = 0.450 \text{ J/g} \cdot ^{\circ}\text{C}$), originally at 20.0°C , that absorbs 3.50 kJ heat?