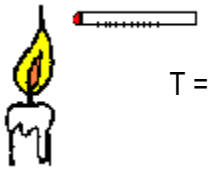
Demo: Bunsen burner flame



T = 600ºC, but **q**uantity of heat ≠ **T**emperature

Aim: How can we measure quantity of heat?

"Hey, it's cold in this room. Tell the custodian to send up some ~~temperature~~." *heat*

1) **Heat** – is the form of energy that can cause a **change in temperature (ΔT)**.

q → ΔT
quantity of heat → change in temperature

$$\Delta T = T_2 - T_1$$

change in temperature = final temperature − initial temperature

The amount of heat released by a fire can't be measured directly by placing it on a scale.

Instead, it can be measured indirectly by placing a beaker of water above it so that it absorbs the heat and, thereby, undergoes a change in temperature.

Demo: Heating a beaker of water

2) *Altogether, to measure quantity of heat we use:*

$$q = m \cdot C \cdot \Delta T$$

quantity of heat | mass | specific heat capacity | change in temperature

Units: J | g | J/gºC | ºC

(Refer to Table T)

Specific heat capacity – amount of heat needed to raise the temperature of 1 gram of a substance by 1ºC.

Refer to Table B: $C_{H_2O} = 4.18$ J/g ºC

(Note: Table B has J/g K, it's the same thing because the change in temperature is the same for Celsius & Kelvin.)

Every substance has its own specific heat capacity. In this course, we use only water.

Substance	**Specific Heat Capacity**
Water	4.18 J/g ºC (Table B)
Al	0.92
Cu	0.38 (lowest specific heat; best conductor)
Glass	0.84
*Ice	2.09

The lower the specific heat capacity, the greater the conductivity

3) Now, let's do some problems! See class worksheet below.

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$q = m\ C\ \Delta T$

Practice Problems

SHOW ALL WORK!! START BY WRITING THE FORMULA. CIRCLE & LABEL ALL THE DATA. DON'T FORGET TO USE PROPER UNITS. BE PRECISE.

1) 50.0 grams (M) of water ($C = 4.18\ J/g°C$) were warmed from 25.0°C (T_1) to 35.0°C (T_2). How much heat (q) was needed to do so?

$$q = m \cdot C \cdot \Delta T$$

$$q = 50.0\ g \left(\frac{4.18\ J}{g°C}\right)(35.0 - 25.0\ °C)$$

$$10.0$$

$$q = 2090\ J$$

3 sig figs

2) A sample of water ($C = 4.18\ J/g°C$) is heated from 45°C (T_1) to 50°C (T_2) upon absorbing 500 J (q) of heat. What was the mass (m) of the water?

$m = ?$

$$q = m \cdot C \cdot \Delta T$$

$$500 = m \cdot 4.18\ (50 - 45)$$

$$5$$

$$500 = m \cdot 20.9$$

$$\frac{500}{20.9} = m$$

$$m = 23.92344$$

$$20\ g$$

1 sig fig

3) If 100. grams (M) of water absorbs 4200 J (q) of heat, what will be its change in temperature?

$\Delta T = ?$

$C = 4.18\ J/g°C$

$$q = m \cdot C \cdot \Delta T$$

$$4200 = 100.\ (4.18)\ \Delta T$$

$$4200 = 418 \cdot \Delta T$$

$$4200/418 = \Delta T = 10.0478 \rightarrow 10.\ °C$$

2 sig figs