

Kelvin = unit of temperature

ABSOLUTE ZERO

- No molecular movement
- 0 K
- Never gotten to zero K

$$K = C + 273$$

We use CELSIUS for thermochemistry!



Specific Heat

**How much heat can something
absorb?**

Specific Heat

The amount of energy it takes to raise the temperature of 1 gram of something by 1 °C

Units:

$$\frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$$

Specific Heat

$$Q = mC\Delta T$$

Q = energy lost or gained

m = mass

C = specific heat

ΔT = "delta" T or change in temp

$$Q = m \times C \times (T_{\text{final}} - T_{\text{starting}})$$

Positive or Negative?

Gaining Heat	Endothermic	$\Delta T = +$	$Q = +$
Losing Heat	Exothermic	$\Delta T = -$	$Q = -$


Chart from perspective of the
SYSTEM


Showing work...

Couple of choices...

- UNITS:

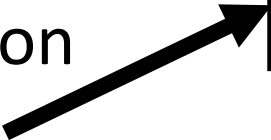
- Put units IN the math equation
- Make a list of variables and put the units there instead of in the math equation (*what Mrs. Farmer likes to do*)


$$5 \text{ J} = (10\text{g})(0.5 \text{ J/g}^\circ\text{C})(\Delta\text{T})$$


$$\begin{aligned} Q &= 5 \text{ J} \\ m &= 10\text{g} \\ C &= 0.5 \text{ J/g}^\circ\text{C} \\ \Delta\text{T} &= ? \\ 5 &= (10)(0.5)(\Delta\text{T}) \end{aligned}$$

- ALGEBRA

- Show rearranging your problem once the numbers are in (*what Mrs. Farmer likes to do*)
- Or show rearranging your equation before you put the numbers in


$$\Delta\text{T} = \frac{Q}{mc}$$

Specific Heat

$$Q = mC\Delta T$$

How much heat is needed to raise the temperature of 10 grams of a substance from 40 °C to 60 °C if the specific heat is 3.8 J/ g °C ?

$$Q = (10\text{g}) \left(3.8 \frac{\text{J}}{\text{g}^\circ\text{C}}\right) (60-40^\circ\text{C})$$

$$Q = (10 * 3.8 * 20) = 760 \text{ J}$$

*Positive because it is heating up!
It is ENDOthermic!*



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$$Q = (10 * 3.8 * 20) = 760 \text{ J}$$

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Specific Heat

$$Q = mC\Delta T$$

A 50 gram piece of hot metal is put into cold water. The metal transfers 5000 J of energy to the cold water. The specific heat of the metal is 6 J/g °C. What is the change in temperature of the metal?

*Negative because it is cooling down!
It is EXOthermic!*



$$\frac{-5000 \text{ J}}{(50\text{g}) \left(6 \frac{\text{J}}{\text{g}^\circ\text{C}}\right)} = \frac{(50\text{g}) \left(6 \frac{\text{J}}{\text{g}^\circ\text{C}}\right) (\Delta T)}{(50\text{g}) \left(6 \frac{\text{J}}{\text{g}^\circ\text{C}}\right)}$$

$$(-5000)/(50*6) = \Delta T$$

$$= -16.7^\circ\text{C}$$

*Negative because it is cooling down!
It is EXOthermic!*



$$\frac{-5000 \cancel{\text{J}}}{\cancel{(50\text{g})} \left(\cancel{6} \frac{\cancel{\text{J}}}{\cancel{\text{g}} \text{ } ^\circ\text{C}} \right)} = \frac{(50\text{g}) \left(6 \frac{\text{J}}{\text{g } ^\circ\text{C}} \right) (\Delta\text{T})}{\cancel{(50\text{g})} \left(\cancel{6} \frac{\cancel{\text{J}}}{\cancel{\text{g}} \text{ } ^\circ\text{C}} \right)}$$

$$(-5000)/(50 \cdot 6) = \Delta\text{T}$$

$$= -16.7^\circ\text{C}$$

Specific Heat

$$Q = mC\Delta T$$

A 2 gram sample of a metal was heated from 260 K to 300 K. It absorbed 52 J of energy. What's the specific heat?

$$260\text{K} - 273 = -13^{\circ}\text{C}$$

$$300\text{K} - 273 = 27^{\circ}\text{C}$$

*Positive because it is heating up!
It is ENDOthermic!*



$$\frac{52 \text{ J}}{(2\text{g}) (40^\circ\text{C})} = \frac{(2 \text{ g}) (\text{C}) (27^\circ\text{C} - -13)}{(2\text{g}) (40^\circ\text{C})}$$


$$(52)/(2*40) = \text{C}$$

$$= 0.65 \frac{\text{J}}{\text{g}^\circ\text{C}}$$



*Careful
with the
double
negative!*

*Positive because it is heating up!
It is ENDOthermic!*


$$\frac{52 \text{ J}}{(2 \text{ g}) (40^\circ \text{C})} = \frac{(2 \text{ g}) (C) (27^\circ \text{C} - 13)}{(2 \text{ g}) (40^\circ \text{C})}$$

The equation shows a double negative in the denominator of the right-hand side, which is highlighted by a blue diagonal line and a green arrow pointing up.

$$(52)/(2*40) = C$$

$$= 0.65 \frac{\text{J}}{\text{g}^\circ \text{C}}$$

*Careful
with the
double
negative!*