TEMP VS. HEAT

temperature: average KE of molecules (how fast they're moving)

-- measured in Celsius or Kelvin

heat: energy transferred from a warmer object to a cooler one

-- measures ability to do work

-- measured in Joules or Kilojoules

endothermic: system absorbs heat (surroundings feel cool)

exothermic: system gives off heat (surroundings feel hot)

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ENERGY UNITS:

joule: SI unit for energy

--- 1000 J = 1 kJ

calorie: non-SI unit for energy

-- 1 cal = 4.184 Joules

Calorie (capitalized): nutritional unit for energy

-- 1 Cal = 1000 cal = 1 kcal

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LAW OF CONSERVATION OF ENERGY

First Law of Thermodynamics:
Energy can be neither created or destroyed.

Heat lost by the reaction (system) = heat gained by the surroundings (universe)

system: set of parameters that work is being done to (thing that we are looking at)

surroundings: outside of the system (everything around the thing that we are looking at)

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SPECIFIC HEAT

-- the amount of energy required to raise the temperature of 1 gram of a substance by 1°C

EQUATION:

$$q = mc\Delta T$$

Q = heat (J) c = specific heat constant (J/g*°C)

m = mass (g) ΔT = change in temp (final temp - initial temp) (°C)

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SPECIFIC HEAT

Substance	Specific Heat J/g°C @ 25°C
Water (l) (liquid)	4.184
Water (s) (ice)	2.03
Water (g) (steam)	2.01

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PRACTICE

How much heat energy is required to raise the temperature of a 55 g sample of water from 22.4 °C to 94.6 °C?

$q = mc\Delta T$

$q = ?\ J$

$m = 55g$

$c = 4.184\ J/g°C$

$\Delta T = 94.6 - 22.4 = 72.2°C$

delta = change

$q = 55 \cdot 4.184 \cdot 72.2$

$= 16,615\ J$

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PRACTICE

$\boxed{1\,mL = 1\,g \quad 1000\,mL = 1\,L}$ H_2O only!

If 980 kJ of energy are added to 6.2 L of water at 25°C, what will the final temperature of water be?

$q = mc\Delta T$

$q = 980\,kJ \times \frac{1000\,J}{1\,kJ} = 980{,}000\,J$

$m = 6.2\,L \times \frac{1000\,mL}{1\,L} \times \frac{1\,g}{1\,mL} = 6{,}200\,g$

$c = 4.184\,J/g°C$

$\Delta T = ?\,°C$

$980{,}000 = 6{,}200 \cdot 4.184 \cdot \Delta T$

$\Delta T = 37.8°C$

$25°C + 37.8°C$

$\boxed{= 62.8°C}$

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$q = ?\,J$

$m = 55\,g$

$C = 0.900\,J/g°C$

$\Delta T = 72.2°C$

$q = 55 \cdot 0.900 \cdot 72.2$

$\boxed{q = 3574\,J}$

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