

Terms

- thermochemistry-the study of energy changes that occur during chemical reactions or changes of state.
- heat (represented by 'q') is energy that transfers from one object to another because of a temperature difference between them.

Heat ALWAYS flows from a warmer object to a cooler one until the temperature is equalized.

- exothermic-the 'system' loses heat as the surroundings heat up
- endothermic-the 'system' gains heat as the surroundings cool down

Units of Heat Measurement

Heat flow is measured in two common units, calorie or joule.

- calorie (cal) is defined as the quantity of heat (q) needed to raise the temperature of 1g of pure water 1° C.
- 1 dietary Calorie, is equivalent to 1 kilocalorie, 1000 calories
- the joule is the SI unit
- 1 J of heat raises the temperature of water 0.239 ° C

$$1 \text{ J} = 0.239 \text{ cal} \quad 4.184 \text{ J} = 1 \text{ cal}$$

Heat Capacity and Specific Heat

Heat Capacity = the amount of heat required to raise the temperature of an object exactly 1

Specific Heat Capacity (represented by C)

-also called simply 'specific heat'

-the amount of heat required to raise 1g of a substance exactly 1

Table 17.1

Specific Heats of Some Common Substances

Substance	Specific Heat	
	J/(g·°C)	cal/(g·°C)
Water	4.18	1.00
Grain alcohol	2.4	0.58
Ice	2.1	0.50
Steam	1.7	0.40
Chloroform	0.96	0.23
Aluminum	0.90	0.21
Iron	0.46	0.11
Silver	0.24	0.057
Mercury	0.14	0.033

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Calculation of Specific Heat

$$C = \frac{q}{m \times \Delta T} = \frac{\text{heat (joules or calories)}}{\text{mass (g)} \times \text{change in temperature (°C)}}$$

Note!

$$\Delta T = T_f - T_i$$

Units are either

$$\frac{\text{J}}{\text{g}} \quad \frac{\text{cal}}{\text{g}}$$

SAMPLE PROBLEM 17.1

Calculating the Specific Heat of a Metal

The temperature of a 95.4-g piece of copper increases from 25.0°C to 48.0°C when the copper absorbs 849 J of heat. What is the specific heat of copper?

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Practice Problems

- When 435 J of heat is added to 3.4 g of olive oil at 21°C, the temperature increases to 85°C. What is the specific heat of the olive oil?
 - How much heat is required to raise the temperature of 250.0 g of mercury 52°C?
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- Using calories, calculate how much heat 32.0 g of water absorbs when it is heated from 25.0°C to 80.0°C. How many joules is this?
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- A chunk of silver has a heat capacity of 42.8 J/°C and a mass of 181 g. Calculate the specific heat of silver.
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- How many kilojoules of heat are absorbed when 1.00 L of water is heated from 18°C to 85°C?