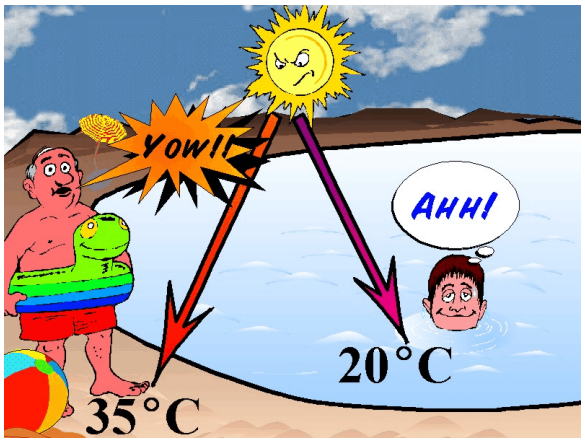
Specific Heat

The sun beat down on the beach, reflecting off the smooth surface of the lake and the bright white sand. A beach-goer stepped eagerly off the blanket anticipating the relief of the cool water. Yipes!!! The sand was hot! How could the sand be so hot and the water so cool with the same sun beating down on them? Simple. Water has a higher specific heat than sand. Water is more resistant to temperature change. The amount of heat needed to raise something's temperature is calculated as shown below.



$$\mathbf{Q = mC_p\Delta T}$$

Q = joules; m = mass in grams

ΔT = change in temperature [$\Delta T = T_f - T_i$]

T_f = final temperature (°C)

T_i = starting temperature (°C)

C_p = specific heat (J/g°C) = $\frac{Q}{m\Delta T}$

Sample Problem 1

The specific heat of gold is 0.134 J/g°C. How many joules will it take to make the temperature of a 20.0 g nugget go up 10.0°C?

$$Q = (20\ g)(0.134\ J/g°C)(10°C) = 26.8\ J$$

Sample Problem 2

What is the specific heat of silicon if a 5.00 g sample is heated from 22.0°C to 42.0°C by adding 75.24 J?

$$\Delta T = T_f - T_i = 42.0°C - 22.0°C = 20.0°C$$

$$C_p = \frac{Q}{m\Delta T}\frac{75.24\ J}{(5.00g)(20.0°C)} = 0.752\ \frac{J}{g°C}$$

Answer the following questions by referring to the examples and equations above.

1. The specific heat of aluminum is 0.88 J/g°C. How many joules will it take to make the temperature of a 50. g nugget go up from 20.°C to 70.°C?

2. What is the specific heat of silver if an 80.0 g sample is heated from 24.0°C to 49.0°C by adding 468.2 J?

3. The specific heat of iron is 0.46 J/g°C. How many joules will it take to make the temperature of a 150. g bar go up from 25°C to 60.°C?

4. What is the specific heat of copper if a 75 g sample is heated from 20.°C to 24°C by adding 117 J?