Key

Heat Problems II

Standards:

- 3.1.10 B Describe the concepts of models as a way to predict and understand science and technology.
- 3.4.10 B Analyze energy sources and transfers of heat.

Specific Heat Capacities of some Common Substances

Substance	Cp (J/g°C)		Substance	Cp (J/g°C)
Water (l)	4.184		Iron (s)	0.45
Water (s)	2.03		Mercury (l)	0.14
Water (g)	2.0		Carbon (s)	0.71
Aluminum (s)	0.89		Silver (s)	0.24
Chloroform	0.230		Gold (s)	0.13

Problems:

1. A 250. g bar of aluminum absorbed 465 J of heat energy. If the bar was originally at 22.0 °C, what is its final temperature?

$\Delta T = \frac{Q}{m\,Cp} = \frac{465\,J}{250\,g} \cdot \frac{g\,°C}{.89\,J} = \boxed{2.1\,°C}$ $\quad 22.0 + 2.1C = \boxed{24.1\,°C}$

2. A 650. g piece of iron pipe absorbs 832 J of heat energy. By how much does the temperature of the pipe increase?

$\Delta T = \frac{Q}{m\,Cp} \quad \frac{832\,J}{650.\,g} \cdot \frac{g\,°C}{.45\,J} = \boxed{2.8\,°C}$

<u>STOP</u> working problems and wait for a short demonstration!

3. Where did the heat from the hot metal go? water
4. What device is used to measure heat changes? thermometer
5. If the demo where more properly conducted, where would all the heat lost by the hot bolt go? into the water
6. In fact, it would be accurate to say that in the above scenario, all the heat lost by the bolt was gained by the <u>water</u>.

   Or Q(metal) = Q(water)

   Or mCpΔT(metal) = mCpΔT(water)

53.2 °C

T 93.4 °C metal

Liquid water 35.4 °C

7. A piece of an unknown metal with a mass of ~~1.86~~ 50.86 kg is heated to ~~110.0~~ 93.4 °C and dropped into 3,572 cm^3 of water at 35.4 °C. The final temperature of the system was 53.2°C. What is the specific heat of the metal in J/g°C?

$Cp = \frac{Q_{metal}}{m\,\Delta T} = \boxed{.130\,\frac{J}{g\,°C}}$ $\boxed{Au}$

8. Identify the metal.

$\frac{266000\,J}{50.86\,kg \cdot 40.2\,°C} \cdot \frac{1\,kg}{1000\,g}$

$Q_{water} = m\,Cp\,\Delta T$

$3572\,g \cdot \frac{4.184\,J}{g\,°C} \cdot 17.8\,°C = 266{,}000\,J$