Specific Heat Problems Name Mr. Sudbury - Key Block_____ Date___

$$Q = mc\Delta T \qquad c = \frac{Q}{m\Delta T} \qquad m = \frac{Q}{c\,\Delta T} \qquad \Delta T = \frac{Q}{c\,m}$$

q = heat energy, m = mass in grams, and T = temperature in °C Remember, $\Delta T = (T_{final} - T_{initial})$.

Show all work and proper units.

1. A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.

   $\Delta T = 150°C$

   $Q = m \cdot c \cdot \Delta T$ so $c = \frac{Q}{(m \cdot \Delta T)}$

   $c = \frac{1086.75 J}{(15.75 g \cdot 150°C)} = 0.46\ J/g°C$

   0.46 J/g°C

2. How many joules of heat are needed to raise the temperature of 10.0 g of aluminum from 22°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C?

   $\Delta T = 33°C$

   $Q = m \cdot c \cdot \Delta T$ $\quad Q = (10.0 g) \cdot (0.90 \frac{J}{g°C}) \cdot (33°C)$

   $Q = 297 J$

   297 J

3. To what new temperature will a 50.0 g piece of glass be raised to if it absorbs 5275 joules of heat and its specific heat capacity is 0.83 J/g°C? The initial temperature of the glass is 20.0°C.

   $Q = m \cdot c \cdot \Delta T$ so $\Delta T = \frac{Q}{m \cdot c} = \frac{5275 J}{(50.0 g \cdot 0.83 \frac{J}{g°C})} = 127.1°C$

   147.1°C

   if the ΔT was 127.1°C and it "changed" from T_i of 20.0°C Then $T_f = 147.1°C$

4. Calculate the heat capacity of a piece of wood if 1500.0 g of the wood absorbs 6.75×10^4 joules of heat, and its temperature changes from 32°C to 57°C. $\Delta T = 25°C$

   67,500 J

   1.8 J/g°C

   $Q = m \cdot c \cdot \Delta T$

   so $c = \frac{Q}{m \cdot \Delta T} = \frac{67{,}500 J}{(1500.0 g \cdot 25°C)} = 1.8\ J/g \cdot °C$

5. 100.0 mL of 4.0°C water is heated until its temperature is 37°C. If the specific heat of water is 4.186 J/g°C, calculate the amount of heat energy needed to cause this rise in temperature.

   100 mL water = 100.0 g Water; $\Delta T = 33°C$

   $Q = m \cdot c \cdot \Delta T = 100.0 g \times 4.186 \frac{J}{g \cdot °C} \cdot 33°C = 13{,}813.8 J$

   13,814 J

$\Delta T = 130°C$

6. 25.0 g of mercury is heated from 25°C to 155°C, and absorbs 455 joules of heat in the process. Calculate the specific heat capacity of mercury.

$Q = m \cdot c \cdot \Delta T$ $\quad c = \frac{Q}{m\Delta T} = \frac{455 J}{(25.0 g \cdot 130°C)} = 0.14 \frac{J}{g \cdot °C}$

0.14 J/g·°C

7. What is the specific heat capacity of silver metal if 55.00 g of the metal absorbs 47.3 **calories** of heat and the temperature rises 15.0°C? $\Delta T = 15°C$ We don't know T_i or T_f but we know how much it rises. so that is the ΔT

$Q = m \cdot c \cdot \Delta T$ so $c = \frac{Q}{m \cdot \Delta T} = \frac{47.3 \text{ cal}}{(25.0 g \times 15°C)} = 0.126 \frac{cal}{g \cdot °C}$

0.126 cal/g·°C

Calories are also a unit for Energy... Just make sure your units cancel/match.

8. If a sample of chloroform is initially at 25°C, what is its final temperature if 150.0 g of chloroform absorbs 1000.0 **joules** of heat, and the specific heat of chloroform is 0.96 J/g°C?

$Q = m \cdot c \cdot \Delta T$ $\quad \Delta T = \frac{Q}{mc} = \frac{1000.0 J}{(150.0 g \cdot 0.96 \frac{J}{g \cdot °C})} = 6.94 °C$

31.94 °C

$T_i + \Delta T = T_f$

$25°C + 6.94°C = 31.94°C$