Specific Heat Worksheet

\[ C_p = \frac{q}{m \Delta T} , \text{ where } q = \text{ heat energy}, \ m = \text{ mass}, \ \text{and } T = \text{ temperature} \]

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 heat capacity of iron.

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?

3. To what temperature will a 50.0 g piece of glass raise if it absorbs 5275 joules and its heat capacity is 0.50 J/g°C? The initial temperature of the glass is 20.0°C.

4. Calculate the heat capacity of a piece of wood if 1500.0 g of the wood absorbs \(6.75 \times 10^4\) joules of heat, and its temperature changes from 32°C to 57°C.

5. 100.0 mL of 4°C water is heated until its temperature is 37°C. If the specific heat of water is 4.18 J/g°C, calculate the amount of heat energy needed to cause this temperature change.

6. 25.0 g of mercury is heated from 25°C to 155°C, and absorbs 455 joules of heat. Calculate the heat capacity of mercury. What is the Specific heat capacity of silver metal if 55.00 g of the metal absorbs 2800 joules of heat and the temperature rises 15.0°C?

7. 6.9°C

8. What is the change in temperature of 150.0 g of chloroform if it absorbs 1000 joules of heat, and the specific heat of chloroform is 0.96 J/g°C?
Thermochemistry Problems

1. \[ C_{4H10} = 4.184 \text{ J/g°C} \]

2. How much energy must be absorbed by 20.0 g of water to increase its temperature from 283.0 °C to 303.0 °C?
   \[ 1674 \text{ J} \]

3. When 15.0 g of steam drops in temperature from 275.0 °C to 250.0 °C, how much heat energy is released?
   \[ -750 \text{ J} \]

4. How much energy is required to heat 120.0 g of water from 2.0 °C to 24.0 °C?
   \[ 11,046 \text{ J} \]

5. If 720.0 g of steam at 400.0 °C absorbs 800.0 kJ of heat energy, what will be its increase in temperature?
   \[ 556 \text{ °C} \]

6. How much heat (in kJ) is given out when 85.0 g of lead cools from 200.0 °C to 10.0 °C? 
   \( C_p \) of lead = 0.129 J/g °C
   \[ -2.083 \text{ kJ} \]

7. If it takes 41.72 joules to heat a piece of gold weighing 18.69 g from 10.0 °C to 27.0 °C, what is the specific heat of the gold?
   \[ 0.13 \text{ J/g°C} \]

8. It takes 333.51 joules to melt exactly 1 gram of H₂O. What is the molar heat of fusion for water, from this data?

9. A certain mass of water was heated with 41,840 Joules, raising its temperature from 22.0 °C to 28.5 °C. Find the mass of water.
   \[ 1539 \text{ g} \]

10. If 10.0 g water at 0.0 °C is mixed with 20.0 g of water at 30.0 °C, what is the final temperature of a mixture?

10. 15.0 g of water at 0.0 °C are added to 40.0 g of water at 40.0 °C. What is the final
8. A certain mass of water was heated with 41,840 Joules, raising its temperature from 22.0 °C to 28.5 °C. Find the mass of water.

If 10.0 g water at 0.0 °C is mixed with 20.0 g of water at 30.0 °C, what is the final temperature of a mixture?

If 15.0 g of water at 0.0 °C are added to 40.0 g of water at 40.0 °C. What is the final temperature of the mixture?

11. For the following questions, refer the the letters on the graph as your answers

a. being warmed as a solid
b. being warmed as a liquid
c. being warmed as a gas
d. changing from a solid to a liquid
e. changing from a liquid to a gas
f. What is its boiling temperature?
g. What is its melting temperature?
h. How many joules were needed to change the liquid to a gas?
i. Where on the curve do the molecules have the highest kinetic energy?
j. If the sample weighs 10.0 g, what is its heat of vaporization in J/g?
Spec. HT. Wk-5

1. \[ Q = mc \Delta T \]
\[ C = \frac{Q}{m \Delta T} = \frac{1586.75 \text{ J}}{(15.75 \text{ g})(150 \text{ °C})} = 0.36 \frac{\text{ J}}{\text{ g} \cdot \text{ °C}} \]

\[ Q = 1586.75 \text{ J} \]

\[ m = 15.75 \text{ g} \]

\[ \Delta T = T_f - T_i = 175 - 25 = 150 \text{ °C} \]

( same for 4, 6, 7 )
\[ Q = mc \Delta T \Rightarrow Q = mc (T_f - T_i) \]

\[ T_f = T_i + \frac{Q}{mc} = \frac{5275 \text{ J}}{50 \text{ g} \times 0.5 \text{ J/g}^\circ\text{C}} + 20^\circ\text{C} \]

\[ Q = 5275 \text{ J} \Rightarrow T_f = 231^\circ\text{C} \]

\[ m = 50 \text{ g} \]
\[ \Delta T = 0.5 \text{ J/g}^\circ\text{C} \]
\[ T_i = 20^\circ\text{C} \]
\[ Q = m \cdot c \Delta T \]

\[ c = \frac{Q}{m \cdot \Delta T} = \frac{67500 \text{ J}}{1500 \text{ g} \cdot (25^\circ C - 15^\circ C)} = 13.8 \frac{\text{J}}{\text{g} \cdot ^\circ \text{C}} \]

\[ m = 1500 \text{ g} \]

\[ Q = 67500 \text{ J} \]

\[ \Delta T = \frac{T_f - T_i}{c} = \frac{57^\circ C - 32^\circ C}{13.8 \frac{\text{J}}{\text{g} \cdot ^\circ \text{C}}} = 2^\circ C \]