Calorimetry Worksheets

$q = mC_p\Delta T$

Where: q = total heat flow, m = mass, Cp = specific heat, & ΔT = change in temp.

Example:

Calculate the number of joules required to warm 1.00×10^2 grams of water from 25.0°C to 80.0°C.

Heat energy = mass x specific heat x change in temperature

$= (1.00 \times 10^2 g)\ (4.184 J)\ (80.0 - 25.0)\,C^o = 23{,}012\ J = 2.30 \times 10^4 J$

Example: g C^o

Calculate the number of joules released when 72.5 grams of water at 95.0°C cools to 28.0°C.

Heat energy = mass x specific heat x change in temperature

$= (72.5g)\ (4.184J)\ (95.0 - 28.0)C^o = 20323.78J = 2.03 \times 10^4 J$

Problems: g C^o

Solve the following problems on a separate sheet of paper. You must use the set-up illustrated above. Be sure to include units and show how the units cancel out. All final answers should be boxed.

1. How many joules are needed to warm 25.5 grams of water from 14.0°C to 22.5°C?

2. Calculate the number of joules released when 75.0 grams of water are cooled from 100.0°C to 27.5°C.

3. Calculate the heat, in joules, needed to warm 225 grams of water from 88.0°C to its boiling point, 100.0°C.

4. The specific heat of gold is 0.128 J/gC^o. How much heat would be needed to warm 250.0 grams of gold from 25.0°C to 100.0°C?

5. The specific heat of zinc is 0.386 J/gC^o. How many joules would be released when 454 grams of zinc at 96.0°C were cooled to 28.0°C?

Specific Heat

Many times Calorimetry problems involve solving for one of the other quantities such as specific heat of temperature change. This is done by simply using algebra to rearrange the formula $q = mC\Delta T$.

Example:
Calculate the specific heat of gold if it required 48.0 joules of heat to warm 25.0 grams of gold from 40.0°C to 55.0°C.

$$C = \frac{q}{m\Delta T} = \frac{48.0\ J}{25.0\ g\ (55.0 - 40.0)C^o} = \frac{48.0\ J}{(25.0\ g)(15.0\ C^o)} = 0.128\ \frac{J}{gC^\circ}$$

Example:
What would be the final temperature if 8.94×10^3 joules of heat were added to 454 grams of copper, specific heat 0.386 J/gC°, at 23.0°C?

$$\Delta T = \frac{q}{mC} = \frac{8.94 \times 10^3\ J}{454\ g\ (0.386\ \frac{J}{g\ C^o})} = 5.101 \times 10^1\ C^o = 51.0\ C^o$$

$\Delta T = t_f - t_i$

$t_f = 23.0 + 51.0 = 74.0^oC$

Problems:
Solve the following problems on a separate sheet of paper. You must use the set-up illustrated above. Be sure to include units and show how the units cancel out. All final answers should be boxed.

1. What would be the final temperature if 3.31×10^3 joules were added to 18.5 grams of water at 22.0°C?

2. A sample of lead, specific heat 0.138J/gC°, released 1.20×10^3J when it cooled from 93.0°C to 29.5°C. What was the mass of this sample of lead?

3. Calculate the specific heat of platinum if 1092 joules of heat were released when 125 grams of platinum cooled 65.2 Celsius degrees.