Name ANSWER KEY Hour _____

Measuring Heat Flow

Honors Chemistry

You must list the given, write the formula, and put a box around your final answer.

1. For problems a-g, find the energy change *(in joules)* and identify whether energy is being released or absorbed:

a. 175.0 g of water at 9.8 °C rose to 22.4 °C. (C_{water}= 4.18 J/g x °C)

$q = ?$
$m = 175\ g$
$\Delta T = 12.6\ °C$

$q = C\ m\ \Delta T$

$q = (4.18)(175)(12.6) =$ **9216.9 J → energy is absorbed**

b. 65.8 g of iron at 80.5 °C cooled to 62.6 °C. (C_{iron} = 0.45 J/g x °C)

$q = ?$
$m = 65.8g$
$\Delta T = 17.9\ °C$

$q = (0.45)(65.8)(17.9) =$ **530.0 J → energy is released**

c. 64.82 g of aluminum metal at 100.0 °C cooled to 82.5 °C. ($C_{aluminum}$ = 0.90 J/g x °C)

$q = ?$
$m = 64.82g$
$\Delta T = 17.5\ °C$

$q = (0.90)(64.82)(17.5) =$ **1020.9 J → energy is released**

d. 154.7 g of water at 44.85 °C is cooled to 18 °C. (C_{water} = 4.18 J/g x °C)

$q = ?$
$m = 154.7g$
$\Delta T = 26.85\ °C$

$q = (4.18)(154.7)(26.85) =$ **17,362.4 J → energy is released**

e. 132 g of copper at 32.2 °C rose to 45.0 °C. (C_{copper} = 0.39 J/g x °C)

$q = ?$
$m = 132g$
$\Delta T = 12.8\ °C$

$q = (0.39)(132)(12.8) =$ **658.9 J → energy is absorbed**

f. 35.5 g of ice is warmed from –35.0 °C to 0.0 °C but does not melt (C_{ice} = 2.03 J/g x °C)

$q = ?$
$m = 35.5g$
$\Delta T = 35\ °C$

$q = (2.03)(35.5)(35) =$ **2522.3 J → energy is absorbed**

g. 63.0 g of steam heats from 373.2 K to 405.0 K (C_{steam} = 2.01 J/g x °C)

$q = ?$
$m = 63g$
$\Delta T = 31.8$

$q = (2.01)(63)(31.8) =$ **4026.8 J → energy is absorbed**

2. Calculate the specific heat of an unknown metal if 351-g of the metal is warmed from 17.2 °C to 37.4 °C and absorbs 879.3 joules of heat.

$q = 879.3\ J$
$m = 351\ g$
$\Delta T = 20.2\ °C$

$C = \frac{q}{m\Delta T} = \frac{879.3}{(351)(20.2)} =$ **0.124 J/g°C**

3. Determine the specific heat of a 326.0-gram object that requires 259.2 joules to raise its temperature 22.0 °C.

$q = 259.2\ J$
$m = 326\ g$
$\Delta T = 22\ ^\circ C$

$$C = \frac{q}{m\Delta T} = \frac{259.2}{(326)(22)} = .036\ J/g^\circ C$$

4. Starting with a 84.0-g piece of iron at 13 °C, you added 2249 joules of heat. What is the new temperature of the iron? (C_{iron} = 0.45 J/g x °C)

$q = 2249\ J$
$m = 84\ g$

$$\Delta T = \frac{q}{cm} = \frac{2249}{(0.45)(84)} = 59.5^\circ C$$

new temp = 72.5 °C

5. Starting with a 269-g piece of copper at 272 kelvin, you added 2.9-kJ of heat. What is the new temperature of the copper in degrees Celsius? (C_{copper} = 0.39 J/g x °C)

$q = 2{,}900\ J$
$m = 269\ g$

$$\Delta T = \frac{q}{cm} = \frac{2900}{(0.39)(269)} = 27.6^\circ C$$

new temp = 26.6 °C

6. The temperature of a piece of aluminum changed from 27.5 °C to 13.7 °C when 248.0 calories of energy was removed from the metal. What is the mass of the aluminum? ($C_{aluminum}$ = 0.90 J/g x °C)

$$q = \frac{248\ cal}{1} \times \frac{4.18\ J}{1\ cal} = 1036.6\ J$$

$\Delta T = 13.8\ ^\circ C$

$$m = \frac{q}{c\Delta T} = \frac{1036.6}{(0.90)(13.8)} = 83.46\ g$$

7. Starting with a 47.5-g piece of copper at 99 °C, you removed 1458.4 joules of heat. What is the new temperature of the copper? (C_{copper} = 0.39 J/g x °C)

$q = 1458.4\ J$
$m = 47.5\ g$

$$\Delta T = \frac{q}{cm} = \frac{1458.4}{(0.39)(47.5)} = 78.7^\circ C$$

new temp = 20.3 °C

8. Determine the energy required to raise the temperature of 65.3 grams of aluminum from 25.8 °C to 68.1 °C. ($C_{aluminum}$ = 0.90 J/g x °C)

$m = 65.3\ g$
$\Delta T = 42.3\ ^\circ C$

$$q = Cm\Delta T = (0.90)(65.3)(42.3) = 2486.0\ J$$