Day 6.5 Warm-Up

1. A piece of metal weighing 59.047 grams was heated to 100.0°C and then put into 100.0 mL of water (initially at 23.7°C). The metal and water were allowed to come to an equilibrium temperature, determined to be 27.8°C. Assuming no heat lost to the environment, calculate the specific heat of the metal in J g^{-1} $°C^{-1}$.

1 mole of

2. The formation of MgO(s) from its elements can be represented by the equation below:

$$Mg(s) + 1/2\ O_2(g) \rightarrow MgO(s)$$

   a) Write the balanced equation for the formation of $Al_2O_3(s)$ from its elements. Coefficients can be fractions.

1 mole of

   b) The ΔH° for the equation in (a) is -1676 kJ/mol_{rxn}. Calculate the amount of heat released when 15.0 grams of aluminum reacts with excess oxygen.

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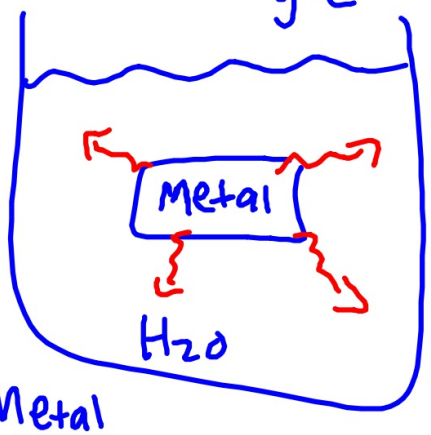
$\frac{J}{g°C}$



Water

$T_1 = 23.7°C$

$T_2 = 27.8°C$

$100\ mL\ H_2O = 100\ g\ H_2O$

$C_p = 4.184\ \frac{J}{g°C}$

Metal

$1715.44\ J = (59.047\ g)(C)(100 - 27.8)$

$C = .402\ \frac{J}{g°C}$

$q = mC\Delta T$

$q = (100\ g)(4.184\ \frac{J}{g°C})(27.8°C - 23.7°C)$

$q = 1715.44\ J$

2. The formation of MgO(s) from its elements can be represented by the equation below:

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a) Write the balanced equation for the formation of $Al_2O_3(s)$ from its elements. Coefficients can be fractions.

1 mole

b) The $\Delta H°$ for the equation in (a) is -1676 kJ/mol_{rxn}. Calculate the amount of heat released when 15.0 grams of aluminum reacts with excess oxygen.

kJ

a) $2Al_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow Al_2O_{3(s)}$ $\Delta H = -1676\ \frac{kJ}{mol\ rxn}$

b) 1 mol rxn = 2 mol Al

1 mol rxn = $\frac{3}{2}$ mol O_2

1 mol rxn = 1 mol Al_2O_3

1 mol rxn = −1676 kJ

$$15\ g\ Al \times \frac{1\ mol\ Al}{26.98\ g} \times \frac{1\ mol\ rxn}{2\ mol\ Al} \times \frac{1676\ kJ}{1\ mol\ rxn} = 466\ kJ$$