Chemistry Worksheet Name: _____

Calorimetry Basics Block: _____

Answer each question in the space required. Show all work. Pay attention to the sign (+ or −) conventions commonly used with Thermochemistry, significant figures and units.

1. A 450 gram piece of iron is heated from 22 °C to 87 °C. Use this information to complete the following table. Be sure to include units! The specific heat of iron (Fe) is 0.449 J g^{-1} $°C^{-1}$.

$T_{initial}$	T_{final}	ΔT	mass	q	c_{molar}

2. You have 180 grams of water in an insulated cup at 45 °C.
   a. How much heat must be removed from the water to cool it to 0 °C?

   b. Energy must be removed from the 180 g of water at 0 °C to freeze it into ice. Is this process endothermic or exothermic? Is q greater than, less than, or equal to zero for this process?

   c. The molar enthalpy of fusion, ΔH°_{fus}, (energy required to melt one mole of ice) for water is 6.01 kJ/mol. How much energy must be removed from the 180 g of water at 0 °C to freeze it into ice?

   d. Once water as frozen into ice, the ice can be cooled to temperatures far below zero Celsius. The specific heat for ice is 2.03 J g^{-1} $°C^{-1}$, which differs from that of water since the molecules in a solid cannot move around freely. If 3.5 kJ of energy is removed from the ice at 0 °C from (c) what will be the final temperature of the ice?

   e. How much heat must be put into the ice to return it to water at 45 °C? Explain your answer.

Chemistry Worksheet Name: _____

Calorimetry Basics Block: _____

3. The table below lists the specific heat for several common metals. Notice that metals have relatively low specific heat values compared to water.

Specific Heats for Several Common Metals J g^{-1} °C^{-1}					
Al	0.903	Fe	0.449	Pb	0.128
Cu	0.385	K	0.757	Zn	0.388

   a. Which metal requires more heat per gram to warm it up? Explain your answer.

   b. How many joules are needed to heat a 125 gram chunk of copper from an initial temperature of 10.0 °C to a final temperature of 95.0 °C?

   c. If the same quantity of heat from (b) is used to heat a 125 gram piece of aluminum initially at 10.0 °C, what will be the final temperature?

4. Anthracite coal is nearly all carbon; when burned, the only products are carbon dioxide and lots of heat. When 10 grams of anthracite coal is burned, 300 kJ of energy is evolved.
   a. Write a balanced chemical equation for the burning of anthracite coal, assuming the coal is 100% carbon.

   b. Is the burning of anthracite coal endothermic or exothermic? Is *q* greater than, less than, or equal to zero for the burning of anthracite coal?

   c. How much heat is evolved when 250 g of anthracite coal is burned?

   d. What amount (mass) of coal is needed to heat 1.5 kg of water at 25 °C to its normal boiling point (NBP)? Assume all of the heat from burning is absorbed by the water.

   e. If 2.5 g of anthracite coal is used to heat 250 g of water initially at 10 °C, what will be the final temperature of the water, assuming all of the heat is absorbed by the water?