

Unit 11 – Chapter 6: Thermochemistry

Name _____

Assignment #1: Heat Production, Specific Heat, $q = mC\Delta T$

Period _____

1) Consider the following reaction:



- How much heat is evolved for the production of 1.00 mol of $\text{H}_2\text{O}_{(l)}$?
- How much heat is evolved when 4.03 g of hydrogen is reacted with excess oxygen?
- How much heat is evolved when 186 g of oxygen is reacted with excess hydrogen?
- The total volume of hydrogen gas needed to fill the *Hindenburg* was $2.0 \times 10^8 \text{ L}$ at 1.0 atm and 25°C . How much heat was evolved when the *Hindenburg* exploded, assuming all the hydrogen reacted?

2) Consider the following reaction:



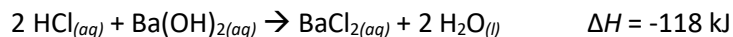
Calculate the enthalpy change for each of the following cases:

- 1.00 g methane is burned in excess oxygen.
- $1.00 \times 10^3 \text{ L}$ methane gas at 740.0 torr and 25°C is burned in excess oxygen.

3) The specific heat capacity of silver is $0.24 \text{ J}/^\circ\text{C} \cdot \text{g}$,

- Calculate the energy required to raise the temperature of 150.0 g Ag from 273 K to 296 K.
- Calculate the energy required to raise the temperature of 1.0 mol Ag by 1.0°C (called the *molar heat capacity* of silver).
- It takes 1.25 kJ of energy to heat a sample of pure silver from 12.0°C to 15.2°C . Calculate the mass of the sample of silver.

- 4) It takes 585 J of energy to raise the temperature of 125.6 g mercury from 20.0°C to 53.5°C. Calculate the specific heat capacity and the molar heat capacity of mercury.
- 5) A biology experiment requires the preparation of a water bath at 37.0°C (body temperature). The temperature of the cold tap water is 22.0°C, and the temperature of the hot tap water is 55.0°C. If a student starts with 90.0 g of cold water, what mass of hot water must be added to reach 37.0°C?
- 6) Hydrogen gives off 120.0 J/g of energy when burned in oxygen, and methane gives off 50.0 J/g under the same circumstances. If a mixture of 5.0 g of hydrogen and 10.0 g of methane is burned, and the heat released is transferred to 50.0 g of water at 25.0°C, what final temperature will be reached by the water?
- 7) A 110-g sample of copper (specific heat capacity = 0.20 J/°C · g) is heated to 82.4°C and then placed in a container of water at 22.3°C. The final temperature of the water and copper is 24.9°C. What is the mass of the water in the container, assuming that all the heat lost by the copper is gained by the water?
- 8) In a coffee cup calorimeter, 1.60 g of NH_4NO_3 is mixed with 75.0 g of water at an initial temperature of 25.00°C. After dissolution of the salt, the final temperature of the calorimeter contents is 23.34°C. Assuming the solution has a heat capacity of 4.18 J/°C · g, and assuming no heat loss to the calorimeter, calculate the enthalpy change for the dissolution of NH_4NO_3 in units of kJ/mol.
- 9) Consider the reaction:



Calculate the heat when 100.0 mL of 0.500 M HCl is mixed with 300.0 mL of 0.100 M $\text{Ba}(\text{OH})_2$. Assuming that the temperature of both solutions was initially 25.0°C and that the final mixture has a mass of 400.0 g and a specific heat capacity of 4.18 J/°C · g, calculate the final temperature of the mixture.