1. For each of the variables in the equation \( q = ms\Delta T \) (\( q = mC_s\Delta T \) in Tro), define what each represents and the typical units of each.

2. How many joules of energy are required to heat a cup of coffee from 20.°C to 80.°C. Assume the cup of coffee contains 100.0 grams of water.

3. How many joules of energy are required to heat a 250.0 gram gold brick from 20.°C to 250.°C.

4. A 200.0 gram metal bar is heated from 20.0 °C to 100.0 °C. The process used 5.866 kJ of energy, what is the specific heat of the metal? What is the most likely identity of the unknown metal? Show work to support your answer.

5. What is the final temperature of a system where 125.0 grams of Pb is heated to 125°C and is dropped into 100.0 mL of water at 20.0°C?
6. The most common type of work encountered in chemical systems is given by the equation \( w = -P \Delta V \).

Define each variable and give the typical units of each variable.

7. How much work (in Joules) is required to inflate a balloon from 0.10 L to 2.00 L against an outside pressure of 0.85 atm (Rangely). What does the sign of the answer indicate about the work performed?

8. How much work (in kJ) is done by the following reaction: \( \text{C}_2\text{H}_4(g) + \text{H}_2(g) \rightarrow \text{C}_2\text{H}_6(g) \) given that 500.0 mL of \( \text{C}_2\text{H}_4 \) and 500.0 mL of \( \text{H}_2 \) react together to produce 750.0 mL of the product? Is energy flowing into or out of the system?

9. Answer the following questions about Enthalpy:
   (a) Define Enthalpy (\( \Delta H \)) using words.
   (b) Define Enthalpy using a mathematical equation.
   (c) Give the name and standard units for each variable.
   (d) Is Enthalpy a state function?
   (e) Under what conditions are \( \Delta H \) and \( \Delta E \) essentially equal?

10. For the reaction \( \text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(g) \) would you expect \( \Delta E \) or \( \Delta H \) to be larger. Explain.