1. What is meant by the term lower in energy? Which is lower in energy, a mixture of hydrogen and oxygen gases or liquid water? How do you know? Which of the two is more stable? How do you know?

2. A fire started in a fireplace by striking a match and lighting crumpled paper under some logs. Explain the energy transfers in this scenario using the terms *exothermic, endothermic, system, surroundings, potential energy, and kinetic energy.*

3. Liquid water turns to ice. Is this process endothermic or exothermic? Explain what is occurring using the terms *system, surroundings, heat, potential energy, and kinetic energy.*

4. In the equation $w = -P\Delta V$, why is there a negative sign?

5. A sample of an ideal gas at 15.0 atm and 10.0 L is allowed to expand against a constant external pressure of 2.00 atm at a constant temperature. Calculate the work in units of kJ for the gas expansion. (Hint: Boyle's law applies.)

6. A piston performs work of 210. L atm on the surroundings, while the cylinder in which it is placed expands from 10 L to 25 L. At the same time, 45 J of the heat is transferred from the surroundings to the system. Against, what pressure was the piston working? What is the internal energy change of the system?

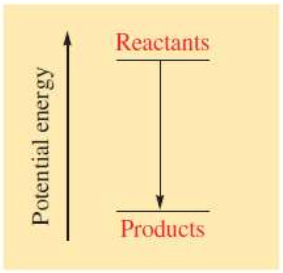
7. What is the difference between ΔH and ΔE at constant P?

8. For the process $H_2O(l) \rightarrow H_2O(g)$ at 298 K and 1.0 atm, ΔH is more positive than ΔE by 2.5 kJ/mol. What does the 2.5 kJ/mol represent?

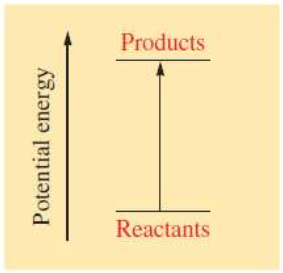
9. Explain how calorimetry works to calculate ΔH or ΔE for a reaction. Does the temperature of the calorimeter increase or decrease for an endothermic reaction? How about for an exothermic reaction? Explain why ΔH is obtained directly from a coffee cup calorimeter, whereas ΔE is obtained directly from a bomb calorimeter.

10. Hydrogen gives off 120. J/g of energy when burned in oxygen, and methane gives off 50. J/g under the same circumstances. If a mixture of 5.0 g hydrogen and 10. g methane is burned, and the heat released is transferred to 50.0 g water at 25.08C, what final temperature will be reached by the water?

11. Consider the following potential energy diagrams for two different reactions.



a.



b.

Which plot represents an exothermic reaction? In plot a, do the reactants on average have stronger or weaker bonds than the products? In plot b, reactants must gain potential energy to convert to products. How does this occur?