Honors Physics – Ch 9-10 Practice Problems

1. On January 22, 1943, the air temperature at Spearfish, South Dakota, rose 49.0°F in 2 min to reach a high temperature of 7.00°C. What were the initial and final temperatures in degrees Fahrenheit? What was the temperature in degrees Celsius before the temperature increase?

2. In 1993, Russell Bradley carried a load of bricks with a total mass of 312 kg up a ramp that had a height of 2.49 m. Suppose Bradley puts the load on the ramp and then pushes the load off the edge with a horizontal speed of 0.50 m/s. If the bricks absorb half their total mechanical energy, how much does their internal energy change?

3. A 0.190 kg piece of copper is heated and fashioned into a bracelet. The amount of energy transferred as heat to the copper is 6.62×10^4 J. If the specific heat of copper is 387 J/kg·°C, what is the change in the temperature of the copper?

4. Lake Superior contains about 1.20×10^{16} kg of water, whereas Lake Erie contains only 4.8×10^{14} kg of water. Suppose aliens use these two lakes for cooking. They heat Lake Superior to 100.0°C and freeze Lake Erie to 0.0°C. Then they mix the two lakes together to make a "lake shake." What would be the final temperature of the mixture? Assume that the entire energy transfer by heat occurs between the lakes.

5. A quantity of ethyl alcohol at a temperature of 78°C absorbs 2.11×10^6 J from the surrounding air, causing it to completely evaporate. If the latent heat of vaporization of ethyl alcohol at 78°C is 8.45×10^5 J/kg, what is the mass of the ethyl alcohol that is vaporized?

6. Nicholas Mason inflated a balloon using just the power of his lungs. The balloon's final radius was 1.22 m. If 642 kJ of work was done to inflate the balloon, at what net pressure was the balloon inflated? ($V_{sphere}=\frac{4}{3}\pi r^3$)

7. The rate of nuclear energy production in the United States in 1992 was about 5.9×10^9 J/s. Suppose one second's worth of this energy is transferred by heat to an ideal gas. How much work must be done on or by this gas so that the net increase in its internal energy is 2.6×10^9 J?

8. The oldest working steam engine was designed in 1779 by James Watt. Suppose this engine's efficiency is 8.0 percent. How much energy must be transferred by heat to the engine's surroundings if 2.5 kJ is transferred by heat into the engine? How much work is done?