Chemistry 14B
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Ch 8: First Law of Thermodynamics Worksheet

1. There are two parts to this problem.
   a. Calculate the heat that must be supplied to a 500.0 g copper kettle containing 400.0 g of water to raise its temperature from 22.0^oC to the boiling point of water, 100.0^oC. The specific heat capacity of solid copper is $0.38\,J/^oC \cdot g$

      1.45 x 10^5 J

   b. What percentage of the heat is used to raise the temperature of the water?

      90%

2. How many grams of water can be heated from 25.0^oC to 100.0^oC by the heat released from converting 49.7 g of PbO to Pb?

   The converting reaction is: $PbO_{(s)} + C_{(s)} \rightarrow Pb_{(s)} + CO_{(g)}$ ΔH = -106.9 kJ

   75.9 g

Note: This worksheet may contain problems adapted from Dr. Lavelle's past exams.

3. The internal energy of a system increased by 982J when it absorbed 492kJ of heat.

    a. How much work was done?

    -491kJ

    b. Was work done on the system or by the system?

    By the system

4. Calculate the change in internal energy of a system if the system released 342 J of heat and did 289 J of work on its surrounding.

    -631kJ

5. If an isolated system contained +100 kJ of energy, after 100 years, ΔU = 0

6. A balloon filled with 31.9 mol of Helium has a volume of 876 L at 0^oC and 1.00 atm pressure. At constant pressure, the temperature of the balloon is suddenly increased to 38.0^oC, causing the balloon to expand to a volume of 998L. (The molar heat capacity of Helium is 20.8 $J/^oC$ mol)

    a. What is the change in internal energy?

    15.1kJ

    b. How much heat is added?

    25.2kJ

    c. How much work is done?

    -10.1kJ

7. Explain each of the sign conventions for work and heat.

Heat (q):
+ = heat **added** into system
- = heat **released** from system

Work (w):
+ = work is done **on** system
- = work is done **by** system