CHEM-C1230 Principles of Physical Chemistry 2021

Chap 2

Chapter 2

- **Question 1.** Electrical current is passed through a resistor immersed in a liquid in an adiabatic container. The temperature of the liquid is varied by 1°C. The system consists solely of the liquid. Does heat or work flow across the boundary between the system and surroundings?
- Internal energy $\Delta U = q - w$ (w is work is done **by** the system)
- What is the value of q in this case?
- Is work being done?
- Notice that the temperature of the liquid is varied by 1°C

Chapter 2

- **Question 2.**
- Part A. Explain how a mass of water in the surroundings can be used to determine q for a process.
- The heat capacity is the ability of the system to store heat (or energy). When energy is added to the system, its temperature increases.

$$C = \lim_{T \to 0} \frac{q}{T_f - T_i} = \frac{dq}{dT}$$

- Part B. Calculate q for the system if the temperature of a 1.00-kg water bath in the surroundings increases by 1.25∘C. $C_P = 4.18\ \mathrm{J \cdot K^{-1} \cdot g^{-1}}$ for water.

- The temperature of surroundings increases, so the system loses heat to the surroundings:
- $Heat\ q\ =\ -mC_P\Delta T$

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- **Question 4.**
- An ideal gas undergoes a single-stage expansion against a constant external pressure P_{ext} at constant temperature from T, Pi, Vi , to T, Pf, Vf.
- *Part A. What is the largest mass m that can be lifted through the height h in this expansion?*
- Work done in the surrounding against gravity is w = mgh
- g = acceleration due to gravity = 9.8 m/s^2
- In expansion $w = -P_f(V_f - V_i)$
- → $mgh = -P_f(V_f - V_i)$

- *Part B. The system is restored to its initial state in a single-state compression. What is the smallest mass m' that must fall through the height h to restore the system to its initial state?*
- In compression, work $w = -P_i(V_i - V_f)$
- → $mgh = -P_i(V_i - V_f)$

- Part C and D: apply the formulas

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- **Question 5.**
- Check the hints on Pearson if needed.
- **Question 6.** why burns caused by steam at 100°C can be more severe than those caused by water at 100°C
- Compare the heat released from the condensation of steam and the heat released from boiling water.