Heat Transfer

from last time

- Heat transfer from ↑T to ↓T irreversible
- Only reversible if infinitismally small difference in T
- Reversible process is an ideal case. Real processes are irreversible

Work

- Recall that $w = -P\Delta V$
- Irreversible work:
  - If a gas expands freely into a vacuum, no work done ($w_1 = 0$)
  - If the gas is then compressed, work done on system ($w_2 > 0$)
  - Since $w_1 \neq w_2$, the process is irreversible
- Reversible work:
  - If $P_{sur} = P_{sys}$ and only infinitesimal changes made, process is reversible
  - A reversible process produces the maximum amount of work by the system

$$E = q + w$$
$$= q_{rev} + w_{rev}$$

q_{rev}: min, w_{rev}: max

q_{rev}: least amt of heat you can lose when going from state 1 → 2

Spontaneous Processes

- Heat flow from high T to low T and gas expansion into a vacuum are both spontaneous processes. They are also irreversible
- All spontaneous processes are irreversible

Entropy Change

- It takes 6.01×10^3 J heat to melt 1.00 mol of ice at 0°C. What is ΔS for this process?

$$\Delta H_{fus} = 6.01 \times 10^3 \text{ J/mol} \qquad T = 0°C$$

Solid → liquid fusion

$$\Delta S_{fus} = \frac{\Delta H_{fus}}{T} = \frac{(6.01 \times 10^3 \text{ J/mol}) \times (1.00 \text{ mol})}{273 \text{ K}}$$

$$= 22.0 \text{ J/K}$$