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Course 565/665 Lecture Number ____ Date 2/28/03

Lecturer Dr. Silvia Cavagnero Note Taker Eric Fulmer

Last Time

1st Principle of Thermodynamics

$$dU = \delta w + \delta q$$

$q > 0$ heat transfered to systems from surroundings

$q < 0$ heat transfered from systems to surroundings.

$W > 0$ work done on the system by surr.

$W < 0$ work done on the surrounds by the system.

2nd Principle of Thermodynamics

$$dS = \frac{\delta q}{T}$$

Midterm

March 14, F 5:30 - 7:30pm

Chapter 1-9

T March 11 Workshop

W March 12 TA Discussion

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M. March 10

Instr. Review Lecture

- Concepts to Review
- Send email
- Questions?

Format of Exams

15 questions

(7) Multiple Choice	6 pts.
(4) Concept Questions	6 pts
(4) Complex Thinking	10 pts
	106 pts (+6 bonus pts.)

Special Case

Applications of 1st Principle

- adiabatic system (no heat transfer – $\delta q = 0$)

$$dU = \delta w + \cancel{\delta q}^{\,0} = dw$$

Work is a state function in this case.

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Proving the 2nd Principle of Thermodynamics

For closed systems (no mass transfer),

$$dU = TdS - pdV = \delta q + \delta w$$

In the case of Pressure/Volume (PV) work,

$$\delta w = -pdV$$

$$TdS - pdV = \delta q - pdV$$

$$TdS = \delta q$$

$$\boxed{dS = \frac{\delta q}{T}}$$ 2nd Law.

<u>Reversible Process</u> - Occurs by infintesimal changes.

Revert back to original conditions.

$$A \longrightarrow B$$

$$A \rightleftarrows B$$

Under reversible conditions, the maximum amount of work is being produced.

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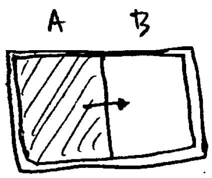

$S(U, V, N)$

Given a Y (extensive variables) and holding V, N const.

$$dS = \frac{\partial S_A}{\partial U_A} dU_A + \frac{\partial S_B}{\partial U_B} dU_B + \frac{\partial S_A}{\partial Y_A} dY_A + \frac{\partial S_B}{\partial Y_B} dY_B \geq 0$$

$$dS = \underbrace{\left(\frac{1}{T_A} - \frac{1}{T_B}\right) dU_A}_{\text{I}} + \underbrace{\left(\frac{\partial S_A}{\partial Y_A}\right) dY_A + \left(\frac{\partial S_B}{\partial Y_B}\right) dY_B}_{\text{II}} \geq 0$$

Want Heat flow to go from B to A: (cold to hot)

This can be done as long as I and II balance in a way that I + II ≥ 0.

Chapter 8

In chemical / biological systems → deal with condensed phase → work is not easy to define.