#### **Chemical Thermodynamics**

#### Chemical Thermodynamics

- Study of system and surroundings
- Three main goals



Based on four laws

# Iclicker

- If the internal energy of a thermodynamic system is increased by 300 J while 75 J of expansion work is done by the system, how much heat was transferred and in which direction?
  - A 375 J
  - B 300 J
  - C − 225 J
  - D − 75 J
  - o E 225 N/m<sup>2</sup>

## Systems

Will focus on simple systems defined by five conditions.

Look at a simple system.



# Simple System

Simple system with diathermal walls.

Two ways to exchange energy with surroundings



# First Law

First law of thermodynamics

#### Sign conventions

### First Law

Mechanical Equilibrium

Sign conventions



- PV work an integral over path
- Couple of types of non-PV work

Unfortunately, expression is path dependent



Two paths with two different constant external pressures



Third path with infinitesimal pressure changes



# Iclicker

- One mole of N<sub>2</sub> at 25 °C and 1 bar expands reversibly and isothermally to a pressure of 0.132 bar. What is the sign of w?
  - A positive
  - B negative
  - o C-zero
- What is the work done?
  - A +326 J
  - B -3.26 J
  - C − -50.18 J
  - D− -326 J
  - E -5018 J

Chemical Thermodynamics

- Isothermal reversible expansions are not limited to ideal gases.
- van der Waals gas