

Small Group Activities with Surfaces for Thermodynamics

Jonathan W. Alfson

He/Him/His

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Paul J. Emigh, Reese R. Siegel, Aaron Wangberg,
Robyn Wangberg, & Elizabeth Gire



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Raising Physics to the Surface

- Collaboration
- Physical systems
- Discovery
- Fluency
- Geometry — Algebra



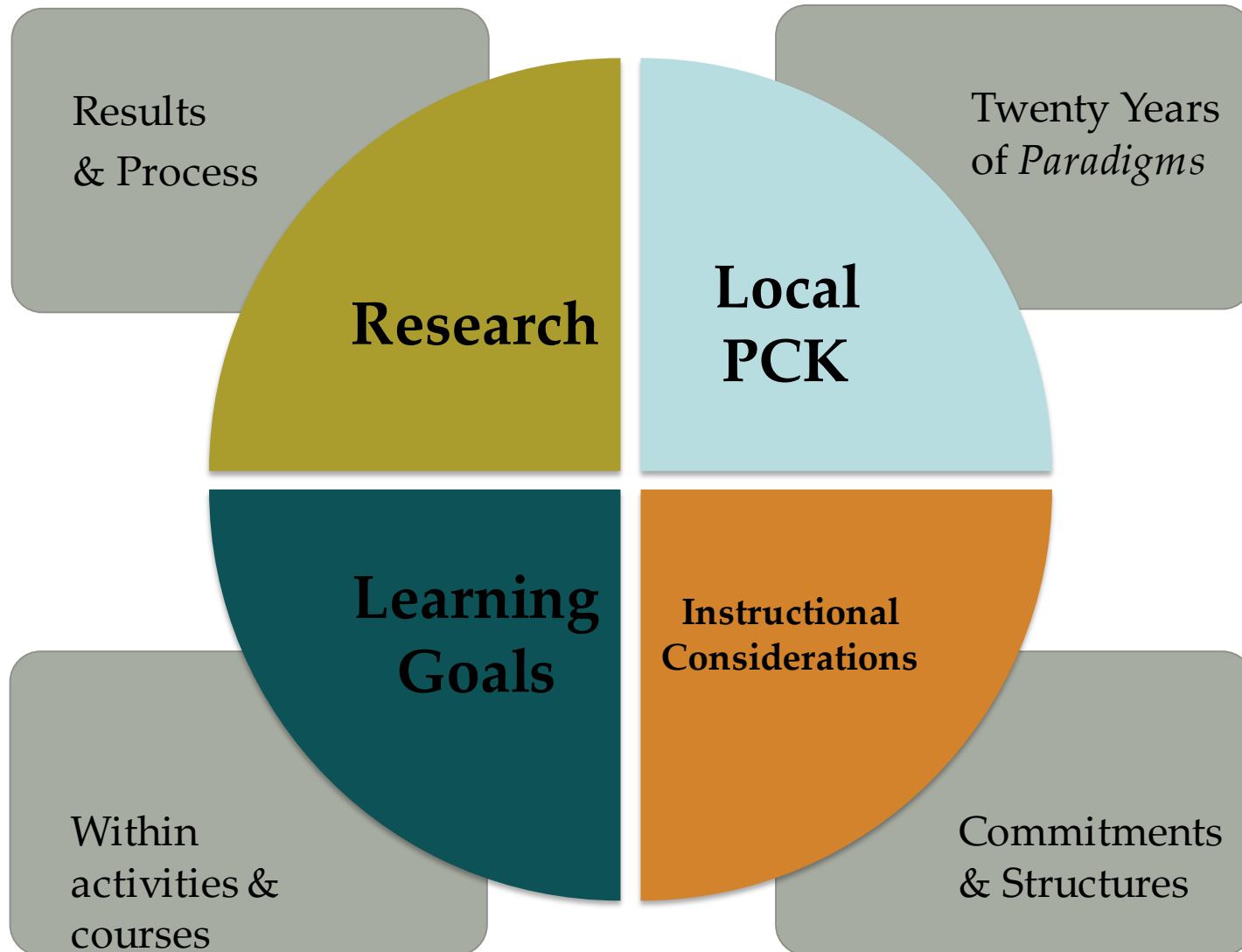
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Activity Design



Activities!

- Thermodynamics
 - Changes in Internal Energy
 - Thermodynamic States
- Mechanics
 - Gravitational Potential Energy
 - Gravitational Force
- Electrostatics
 - Electric Potential of a Parallel Plate Capacitor
 - Electric Field of a Parallel Plate Capacitor
 - Drawing Equipotential Surfaces
 - Vector Integrals
 - Number of Paths
 - Work by an Electric Field

Activity Details: Learning Goals

- Interpret a contour map
- Connect geometric and algebraic representations
- Understand thermodynamic derivatives
- Relate to physical systems and experiments

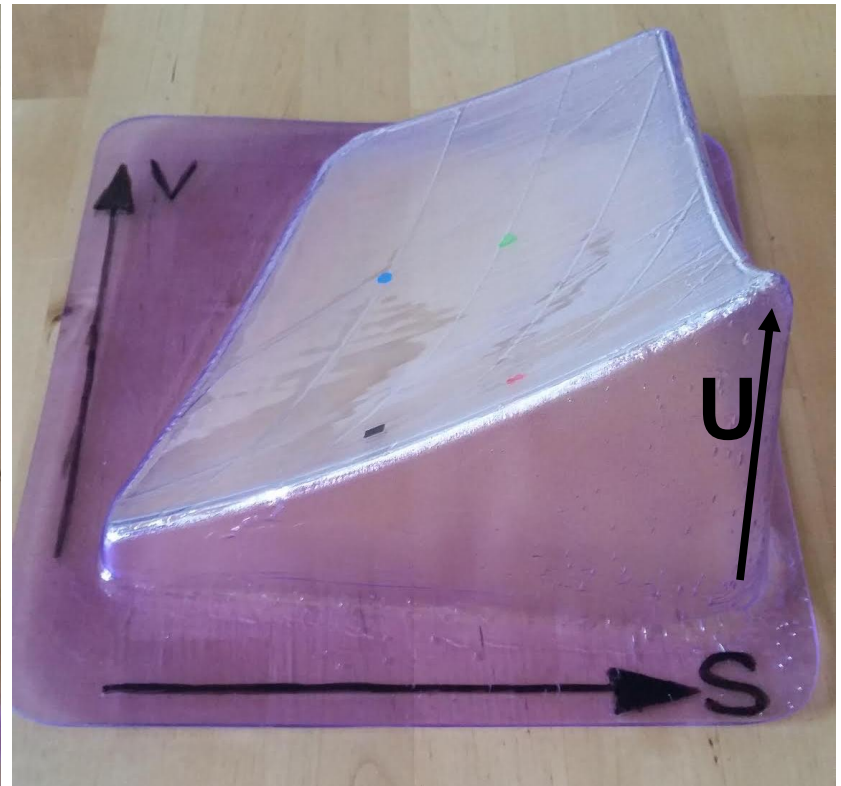
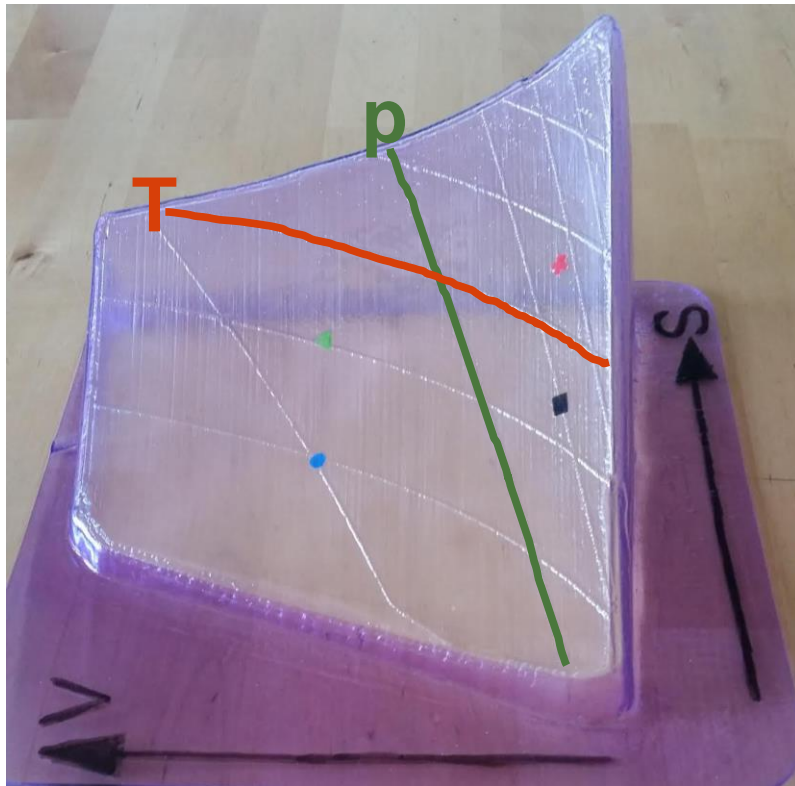
Activity Details:

Prompt 1

Imagine you fill a **lidded metal pot** with water vapor and put it on a hot stove.

How would you expect the internal energy of the water vapor to change (increase, decrease, or stay the same)?

Activity Details: Equipment



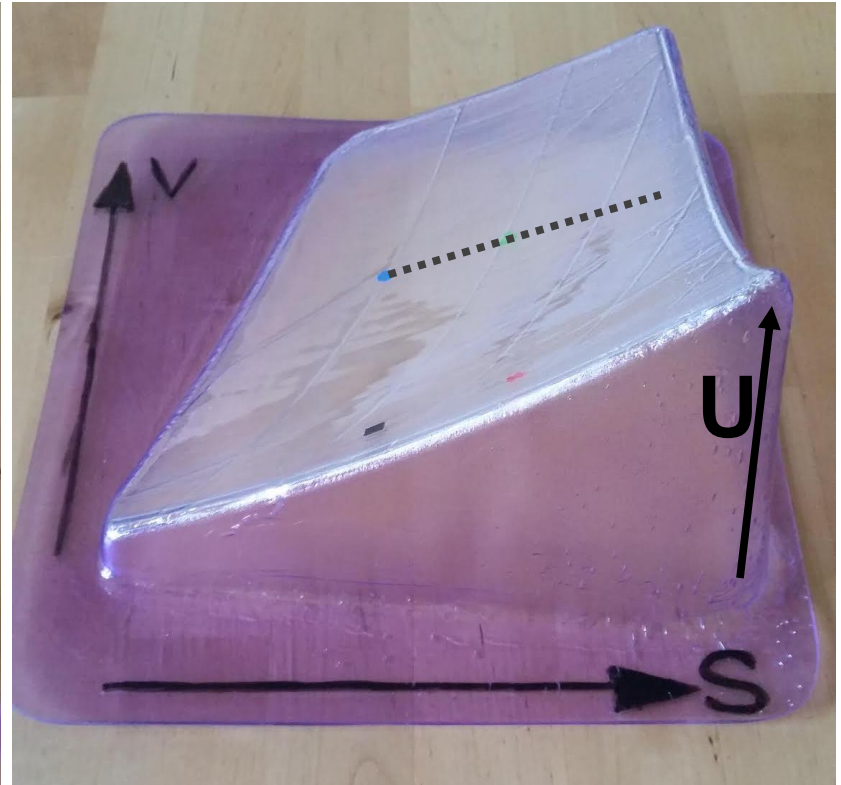
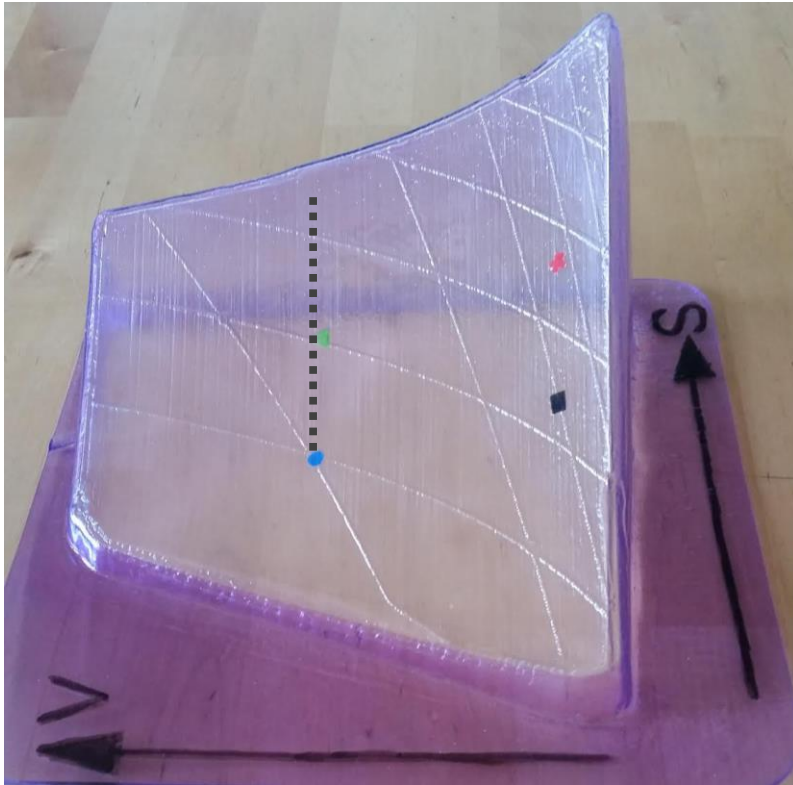
Activity Details:

Prompt 2

Suppose that the water vapor starts with values of volume and entropy that correspond to the **blue dot**.

What does the surface tell you about the change in internal energy? Is this consistent with your intuition?

Activity Details: Possible Response



Thank You!

Student/Instructor Participants, OSU PER Group. NSF-DUE 1612480



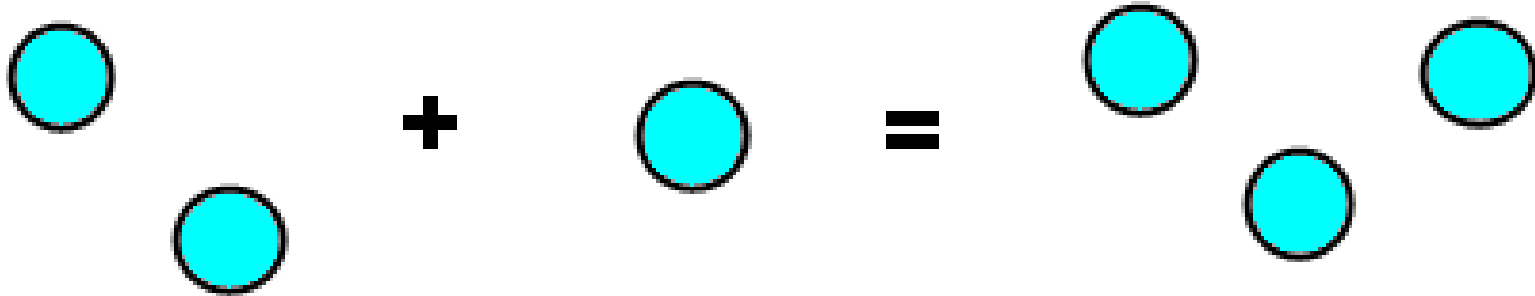
PERC Posters



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Pedagogical Representations...



$$2 + 1 = 3$$