

**Objective:**

This activity is designed to support the study of thermodynamics and the flow of energy. This activity will follow an experiment where the student designs and manufactures a cold pack.

**Target student audience:**

Honors or AP level chemistry student

**ChemSense User Level:**

Intermediate, prior experience is necessary

**ChemSense Tools used:**

Animation

**Specialized Tools needed:**

None

**Classroom Implementation**

Time: Pre-laboratory discussion: 1/2 hour

Independent study and manufacture of the cold pack: Varies, 2 - 4 hours

ChemSense animation: 1 hour

Student Grouping: Pairs

Activity Type: Reinforcement of laboratory concept

**Chemistry Concepts in Activity:**

California State Standards in Chemistry 7. The student understands energy is exchanged or transformed in all chemical and physical changes of matter. 7.a The student knows how to describe temperature and heat flow in terms of the motion of molecules (or atoms).

ChemSense Theme: State. State can be defined as the full inventory of the energy relationships that exist within a set of molecules or individual atom elements. When molecules absorb or emit energy in the form of heat or light, the molecules undergo a process that involves a change in state.

**Pre-requisite Chemistry Concepts:**

The lesson begins with a discussion of chemical thermodynamics. The concept of heat flow in and out of a system is taught, and the students design and build a cold pack at home.

**ACTIVITY**

**Thermodynamics of a Heat Pack**

**Purpose:**

The student will visualize and represent the flow of energy when a homemade cold pack is activated.

**Goal:**

The student will be able to represent the flow of energy into the cold pack from the surrounding environment.

**California State Standard:**

*7.b Knows chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.*

**Procedure:**

1. Record your observations and data in your laboratory notebook as you activate your cold pack.
2. Using your observations and data, sketch a 3-frame storyboard into your laboratory notebook. It should represent the initial, intermediate, and final energy states of the cold pack.
3. Use the ChemSense animation tool to create an animation that describes the flow of energy into the cold pack from the surrounding environment. Include narrative that describes the data and observations you collected. Use color to enhance your animation.
4. Show your work to your instructor, and include any necessary changes.
5. Save your work to your account folder.
6. Log out and record your work time in your laboratory notebook.

Rubric for scoring:

**Grading Rubric:**

Rubric Score	Level of Competence	Expectation Level
4	Mastery	The energy flow of the system is accurately represented. Narration is accurate and describes the data collected during the experiment. Animation has smooth transitions between frames.
3	Skilled	The energy flow of the system is accurately represented. . Narration is accurate but may not describe the data collected during the experiment. Animation may not be smooth.
2	Proficient	The energy flow of the system is accurately represented. Narration is incomplete or may not describe the data collected during the experiment. Animation is not smooth.
1	Introductory	The energy flow of the system is not accurately represented. Narration is incomplete or may not describe the data collected during the experiment. Animation may not be smooth.
0	Incomplete	The energy flow of the system is not accurate. Narration is incomplete or may not describe the data collected during the experiment. Animation may have smooth transitions between frames, but the artwork does not accurately represent the experiment.

**Links:**

None

**Integrated Uses:**

None