

# Survival Science: How Evaporation and Condensation Can Save Your Life!

**Resident:** Nathan Frank

**Grade:** 8

**Physical Science**

## OBJECTIVE, BACKGROUND INFORMATION, & REFERENCES

### Objectives:

- 1) To reinforce concepts presented thus far in class regarding state changes in matter and the conditions necessary to induce those changes.
- 2) To make practical applications of these concepts that will help to make these concepts more relevant.
- 3) To demonstrate that knowledge of scientific principles can be used to provide necessary resources in an emergency situation.

### Science Standard 2:

Physical Science: Students know and understand common properties, forms, and changes in matter and energy.

(Focus: *Physics and Chemistry*)

### Background:

Students have so far demonstrated an experiential familiarity with some states of matter and their related phase changes. Melting, freezing, and evaporation are some terms and ideas with which students are familiar. Condensation, sublimation, and deposition are less familiar ideas. Sublimation and deposition were addressed when the classes were allowed to play with dry ice. When asked about condensation, some students have heard the term before in very specific contexts but what condensation is and how it occurs is not common knowledge.

Condensation occurs when a difference in temperature is present between the air and an object with which it is in contact. Molecules of water in the warm air contact a cool surface and are rapidly cooled causing them to precipitate out of the air and aggregate together. The principles of condensation and evaporation can be applied in a survival situation to obtain water that was previously unavailable or to purify contaminated water.

The primary objective of this lesson is to demonstrate that not only is knowledge of these principles necessary to understand the physical world in scientific terms, but this knowledge can be vital to survival in extraordinary situations. It is hoped that after this demonstration, students will see the pragmatic side of scientific knowledge. As Creighton Middle School is located close to the foothills of the Front Range in Colorado, it is likely that many students have or will go camping at some point in their lives. If a student finds themselves lost in unfriendly territory, then having the understanding of these physical principles could help them to acquire enough water to survive for an extended period of time in adverse conditions.

### References:

U.S. Army Field Manual 3-05.70: *Survival*

<http://www.survivalebooks.com/survivalfm3-0570.html>

## VOCABULARY, MATERIALS, PREPARATION, SAFETY

### Vocabulary:

Condensation, evaporation, distillation, kinetic energy, temperature, liquid, solid, gas, phase

### Materials:

- 2 buckets- one for prepared solar still and one to cut away and use a cross section for demonstration
- Clear plastic sheeting
- A small cup
- Several rocks
- A heat lamp
- Several large Ziploc bags filled with fresh vegetation
- Blank Green papers stapled in a tabloid format for the students to begin construction of their own 'survival-science manuals'

### Preparation:

I will construct a demonstration version of the solar still so that students can see the apparatus in cross section. I will also do a brief PowerPoint presentation to communicate facts related to phase changes of matter and human hydration

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needs.

### **Safety:**

The heat lamp is not to be touched and plastic sheeting is not to be placed in a fashion that might obstruct airways. Also, contaminated water is not to be consumed.

## 5 E'S

### **Describe how each of the 5 E's will be accomplished:**

#### **Engage:**

The Resident will pass around a container of dirty water for the students' inspection and ask them how they could make the water pure enough to drink. If it is not suggested by a student, the Resident will recommend filtering it through a paper towel or a piece of cloth. The Resident will perform the filtration and ask them if they would be willing to drink the filtered fluid which will be visibly contaminated. At this point, the concepts of evaporation and condensation will be reintroduced and the class will discuss how these physical processes can be applied to filter water.

A clip from a popular show such as "Survivor Man" wherein the title character uses an apparatus similar to a solar still to obtain or purify potable water will be shown.

#### **Explore:**

The class will be constructing a 'solar still' to extract and purify water. In addition, the Resident will demonstrate two other similar ways to use the concepts of evaporation and condensation to obtain potable water. This apparatus is relatively easy to construct and requires very little in the way of materials (multiple ways located online). The same apparatus can be used to extract potable water from live plant material via evaporation.

A simplified method of extracting water from vegetation is simply to place it in a plastic bag and place the bag in the sun until moisture has evaporated from the plants. This water can be safely consumed providing that the plants used do not contain any toxic compounds. The Resident will have several bags of vegetation under a heat lamp that brave students can consume at the end of the presentation.

#### **Explain:**

The solar still uses the heat of the sun (a heat lamp in this case) to extract pure water from a solution while leaving pathogens and contaminants behind. The students will be asked to explain how the apparatus works and the class will discuss how the environmental conditions present would affect the workings of their still. Students will be expected to note that condensation occurs as a function of the temperature difference between each side of the plastic sheet, hot air rises and that's is why steam rises up to reach the plastic, that it is only the water that is evaporating and not any other substance, etc.

#### **Elaborate:**

Students will be asked to point out potential flaws in construction and how they might affect the efficiency of the apparatus. At this point, student volunteers will be asked if they want to drink the water that has been evaporated from plants over the duration of the class. If no one volunteers then the Resident will drink the water himself.

#### **Evaluate:**

This will be the first of several "survival-science" type activities in our classroom. Students will be asked to create a science survival manual describing the techniques they will use and the principles behind them. Students will draw their own diagrams and label the processes such as evaporation and condensation that occur to produce the desired effect. Vocabulary words will be kept on an adjacent sheet. By the end of the year, students will have a mini-survival manual that will actually contain relevant information and techniques for wilderness survival.