

## 5<sup>th</sup> Grade - Lesson 5.1

### Engineering a Cell Phone Flotation Device

#### Student Reading

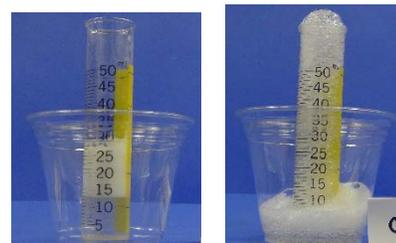
Engineers work in teams to come up with creative ways to solve problems. When your class designed a device to save a cell phone from sinking, you used a lot of the same processes that engineers use to solve other problems. Here are the basic steps of the engineering process:

#### 1. Identify the Problem

The class first identified the problem: A cell phone can sink and be lost if it accidentally falls into deep water.

#### 2. Develop Possible Solutions

You thought of ways, including a chemical reaction, that could be used in a device to make a cell phone float. You tested two different acids to see which one reacted with baking soda to make more gas.



Cream of Tartar

Citric Acid

#### 3. Make and Test a Prototype



You used citric acid and baking soda to inflate a plastic zip-closing plastic bag and attached the bag to a clay cell phone to see whether it would float. Then you tested different amounts of citric acid and

baking soda to see the minimum amount needed to float a model cell phone.



Floating Model Cell Phone

#### 4. Optimize or Improve the Design

Then you may have thought about how the device could actually work when the cell phone hit the water. How would the cell phone “know” when it fell into water? What could start the chemical reaction? Could some kind of sensor somehow detect the impact or pressure of the water and start the reaction? Or could some other technology be used to start the reaction?

### Engineers Design Solutions to Problems

There are big problems in the world that scientists and engineers are working to solve. One example is the shortage of fresh water in certain parts of the world. This is a problem on a small scale if you are in a situation where you need a quick way to make a small amount of fresh water from salt water. But it is also a big problem for some areas of the world where it almost never rains and people need to convert sea water into drinkable fresh water on a large scale.

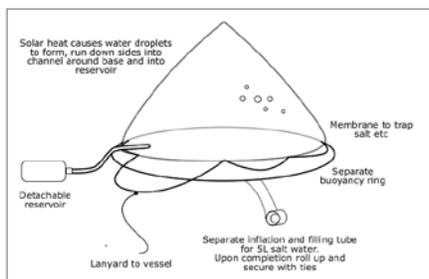
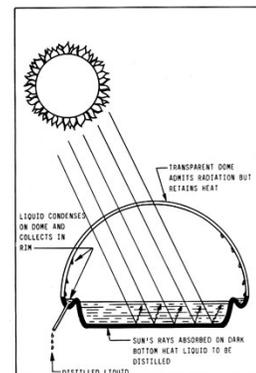
Here is a way the engineering design process might be used to solve the problem on a small scale:

### 1. Identify the Problem

In an emergency, people on or near the ocean need fresh water to drink, but might only have salt water.

### 2. Develop Possible Solutions

Engineers might begin designing a solution by drawing a simple model of a solar still. This is a closed container with salt water in the bottom and a transparent top. Heat from the sun causes only the water to evaporate—the salt stays behind. This water vapor condenses on the inside surface as fresh water.



### 3. Make and Test a Prototype

Engineers develop and test different models called *prototypes* to see what works best. They might try different cone-shaped tops to see which works best to make the fresh water run down into a collecting area.



### 4. Optimize or Improve the Design

After testing the prototypes, they refine the design until they have a device that works.

### Salt Water to Fresh Water on a HUGE Scale

On a huge scale, engineers have designed and built a system in the United Arab Emirates, a country near Saudi Arabia, which can convert over 500 million gallons of salt water into fresh water every day! Believe it or not, they use evaporation and condensation to make it happen.

