

5th Grade - Lesson 5.1

Engineering a Cell Phone Flotation Device

Teacher Background

The engineering design process is often described as a series of steps or as a cycle:

1. Define the problem in terms of *criteria* and *constraints*

First, a problem is identified, analyzed, and described. If a device is needed to solve a problem, an important part of the description is to identify exactly what the device needs to do. This set of necessary abilities or requirements of the device are called the *criteria*.

In the example of the cell phone floatation device, the criteria are that:

1. The floatation device must use a chemical reaction
2. The device must be small and light-weight
3. The device materials must be common and inexpensive

Part of defining the problem also includes identifying challenges that might interfere with accomplishing the criteria. These hurdles are called the *constraints*. Common constraints are the availability of specialized materials, difficulty of making certain parts, available technology, and limited budget.

In the example of the cell phone floatation device, a constraint might be that too much substance is required to generate enough gas to float the cell phone. This could make the device too large, too heavy, or too expensive.

2. Develop possible solutions

Next, taking the criteria and constraints into consideration, engineers develop a design to solve the problem. They usually make a prototype or model and test it.

In the example of the cell phone flotation device, first the appropriate acid was identified. Then it was tested with baking soda in a plastic bag to see how much gas was produced. Then it was tested to see if it could make the cell phone float.

3. Optimize the design solution

After testing prototypes and models, the most promising designs are modified to make them even better. They are adjusted to more successfully achieve the criteria or to overcome constraints such as using less material or a less expensive or time-consuming production process.

In the example of the cell phone flotation device, the amounts of citric acid and baking soda were reduced to make the device smaller, lighter, and cost less. The amounts were tested to be sure enough gas was produced to make the model cell phone float.

