5th Grade - Lesson 5.1
Engineering a Cell Phone Flotation Device
NGSS Alignment

Performance Expectations

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- The success of a designed solution is determined by considering the desired features of the solution (criteria).

  Possible solutions to a problem are limited by available materials and resources (constraints).

  Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

  As a class, students discuss how a chemical reaction might be used as the basis for a cell phone floatation device. Students consider what substances and container should be used in order for the device to be successful. Students also consider what problems they might have with the substances and the container which might prevent the device from being successful.

ETS1.B: Developing Possible Solutions

- Tests are often designed to identify failure points or difficulties, which suggest the elements of a design that need to be improved. (3-5-ETS1-3)

  Students compare solutions of citric acid and cream of tartar to see which produces the most gas when reacted with baking soda. Students then test the reaction in a snack-size zip-closing plastic bag to see if the bag inflates enough to float a model cell phone.

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and constraints. (3-5 ETS1-3)

  Students reduce the amounts of reactants to see if enough gas is produced to make the model cell phone float. Students are also shown a video of an actual floatation device and given the opportunity to discuss other features their cell phone floatation device would need.

Science and Engineering Practices

Asking Questions and Defining Problems

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5 ETS1-1)

  Students read a story and have a class discussion to define the problem of creating a device that can make a cell phone float if it falls into deep water. They discuss the criteria that the device should have to make it successful and the constraints that could become barriers to a successful design.

Planning and Carrying Out Investigations

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered. (3-5 ETS1-3)

  Students conduct an investigation to determine whether citric acid or cream of tartar should be used as the acid to react with baking soda in their cell phone floatation device. Students identify and control variables for a fair test.

Constructing Explanations and Designing Solutions

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5 ETS1-2)

  Students try decreasing the amounts of citric acid and baking soda because using less will cost less and be lighter and contribute to a better design.

Crosscutting Concepts

Influence of Engineering, Technology, and Science on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5 ETS-2)

  Even though many cell phones will work after getting wet, if they are lost in deep water, it is a total loss. Students work on a new invention which could rescue a cell phone from deep water so that it could be recovered. If it floats to the surface quickly enough, it may still work when recovered.