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| <p>Description In this method-based lesson, learners will work in teams to brainstorm and conceptualize a device.</p> | | |
| <p>Grade Levels 4-12</p> | <p>The Tech Challenge Connections</p> <ul style="list-style-type: none"> Utilize the brainstorming process to gather and evaluate ideas to determine which is the most appropriate for the specified task. Practice the Engineering Design Process as it relies on continuous testing, evaluation and revision of possible challenge solutions. | <p>Objectives</p> <ul style="list-style-type: none"> Learn what brainstorming is and how it can be used to solve problems. Practice brainstorming solutions. Participate in group discussions regarding tests, modifications and outcomes of scenarios. |
| <p>Duration 60 minutes</p> | | <p>Standards Connections</p> <ul style="list-style-type: none"> <i>3-5-ETS1-2</i> 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. <i>3-5-ETS1-3</i> 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. <i>MS-ETS1-2</i> Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. <i>HS-ETS1-2</i> Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. |
| <p>Tech Tip Brainstorming</p> | | |



Materials

- Dry erase markers
- Erasers
- Notebook for journaling
- Pencils/pens
- Post-it® notes
- Printer paper
- Whiteboards*

*Only one whiteboard per team. There should be enough for each student to have at least two of all the additional materials.

Prep

- Make all necessary brainstorming supplies available for groups to use.
- Familiarize yourself with the selected brainstorming method. See Tech Tip: [Brainstorming](#) and [video](#).
- Create groups of 4-6 students

Lesson

1. Introduction to brainstorming (5 minutes)
 - a. *When faced with a challenging problem, it is easy to become overwhelmed or stuck on how to begin. Brainstorming is a way to spur creativity and generate many ideas that can be incorporated into a solution. During today's lesson, we will complete a few rounds of brainstorming to generate many ideas, decide which ideas to turn into designs, and share these design ideas with other teams.*
 - b. Tell students which method they will be using (allow older/more experienced students to choose):
 - i. **Freewriting** allows thoughts and ideas to flow freely while writing them down. Each team member will have a sheet of paper to write thoughts on as they think of them.
 - ii. **Mind maps** show how ideas and concepts can be divided, connected, or expanded upon. Each team member will create their own mind map.
 - iii. During **Post-it® note brainstorming**, each idea is written down on a Post-it® note. Ideas are then shared with the group and can be analyzed, organized and combined.

Brainstorming Challenge

Brainstorm designs that will expand due to impact or after a trigger mechanism is engaged. (examples: umbrella, airbag, parachute)

2. Brainstorming a device that expands
 - a. *Now that we've gone over the different types of ways to brainstorm, you are going to brainstorm a design for a device that will expand due to impact or after a trigger mechanism is engaged.*
 - i. Consider allowing extra time for younger learners to complete the brainstorming phase and the design illustration phase of the challenge.



- b. Individual brainstorm (5 minutes)
 - i. Tell learners that for a few minutes they will be using freewriting or mind maps individually to brainstorm objects that expand (younger) or mechanisms for expansion (older). Have them think of as many different things as possible.
 - c. Group brainstorm (25 minutes)
 - i. *Now that we all have a few ideas down, let's go back to the bigger design challenge question, "Can you design a device that expands upon impact?" As a team, you will use Post-it® notes for brainstorming.*
 - ii. Ask guiding questions to encourage deeper, more focused thinking during the brainstorming process:
 1. *What is the idea behind your design?*
 2. *Which elements of your individual brainstorm designs do you think will produce a successful solution?*
 - d. Combine and decide
 - i. Have teams review their individual ideas and narrow them down by identifying two designs the team would like to create and build on.
 - ii. As teams deliberate, ask facilitative questions:
 1. *What concerns might you have about building and testing your design? (for 5th grade and up)*
 2. *Which designs are you leaning towards? Why?*
 - e. Device sketch
 - i. Have learners work with their team to create two designs in a sketch/diagram that shows the following:
 1. It illustrates how the designs are envisioned to work.
 2. It has the individual parts of the device labeled.
 3. It lists the materials needed.
3. Share out (10 minutes)
 - a. Allow each group to share their design illustrations with the entire class or 1-2 other groups.
 - b. Teams should explain how their design meets the criteria outlined for this challenge and discuss any problems they anticipate this design having if it were built.
 - i. *Why did you choose the designs that you did?*
 - ii. *What types of materials do you think you would need if you were to build your device?*
4. Reflection (5 minutes)
 - a. Reflecting on the brainstorming process
 - i. In their teams or individually, have students reflect on the brainstorming process and record their thoughts in their individual notebook or team journal.
 - ii. Suggested questions:
 1. *What did you like about the brainstorming process?*
 2. *Explain how your group continued to use the brainstorming process as you developed the illustration of your design idea.*
 3. *Think about other brainstorming methods besides the one you tried. Which method would you like to try next? How do you think it might help you solve the problem?*