ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.

A Wild Ride! Week 2: Grades 3-5

Day	Topics	Related Standards
1	Are You Up For a Challenge?	**Define problems and design solutions** pertaining to force and motion.
2	I Push, You Pull!	**Obtain, analyze, and communicate evidence** of the effects that balanced and unbalanced forces have on the motion of objects. **Define problems and design solutions** pertaining to force and motion.
3	Don't Look Down!	**Construct an explanation** using evidence to demonstrate that objects can affect other objects even when they are not touching. **Obtain, analyze, and communicate evidence** of the effects that balanced and unbalanced forces have on the motion of objects. **Define problems and design solutions** pertaining to force and motion.
4	Challenge Accepted!	**Define problems and design solutions** pertaining to force and motion.
5	How Can We Make It *Even* Better?	

A Wild Ride! Week 2

Day 1: Are You Up For a Challenge?

Teacher/Parent Background:

Scientists and engineers are always faced with challenging questions and problems. In order to best explain the world around them or propose valuable solutions, scientists and engineers follow steps to accomplish these goals. In engineering fields, engineers use the Engineering Design Process to propose solutions to problems in order to make the world a better place.

Overview:

What do scientists and engineers do when they are faced with a challenge? In this activity, students will be introduced to the strategies of scientists and engineers by learning about the steps of the Engineering Design Process in order to begin defining their own, week-long challenge: *How can we design a roller coaster using force and motion concepts?*

Related Standards:

- Define problems and design solutions pertaining to force and motion.

Key Terms:

- Scientists: people who ask questions, experiment and explain the world around them
- Engineers: people who design and build things to solve specific problems
- Engineering Design Process: a set of steps engineers use to propose solutions to problems
- Constraints: limitations or restrictions

Materials List:

- Internet access
- Journal
- Pen/pencil
- Computer/phone with audio
- *Student Resources - Pages 5-6*
    - *Scientist Pictures*
    - *The Engineering Design Process Image*
    - *Step 1: Ask Table*

Activity Description:

- Ask students to share a recent problem or challenge they were faced with and how they went about solving the problem. For example:
    - Problem:
        - My bike tires became flat.
    - Steps:
        - I asked questions about what caused the tires to go flat.
        - I asked my family and friends what they have done when their bike tires have become flat.
        - I learned about how to repair flat bike tires by listening to the advice/past experiences of family/friends and by watching a video.
        - I used the appropriate tools to fill the tires with air and then tested the bike out by riding it around the neighborhood.
        - I asked questions about how the bike tires are riding now and if any changes need to be made to make them ride even better.
- Tell students that scientists and engineers are also often faced with challenges. Ask students to describe what they think a scientist and an engineer are and what they do. Then, show students examples of different kinds of scientists and engineers, using the *Scientist Pictures* and *What is an Engineer? Video*.
- Explain to students that scientists and engineers are people just like us; people who are curious and want to know more about the world, including how to make it a better place for all!
        - *Scientists* are people who ask questions, experiment and explain the world around them.
        - *Engineers* are people who design and build things to solve specific problems.
    - Facilitate the following discussion with students:
        - Have you ever been a scientist or engineer? Indeed, you have!
        - When you ask questions and investigate/perform an experiment in order to explain something about the world around you, you are a scientist!
        - When you ask questions about a problem and design/build things to test out possible solutions, you are an engineer!
    - Show students the *Engineering Design Process Image* and explain each step of the process, encouraging them to record main ideas.
        - **Step 1: Ask** -
            - Ask questions about the problem.
            - Consider what you need to know to solve the problem.
            - Ask about what others have done to solve the problem/similar problems.

- Consider the *constraints* or limits you have to stay within while solving the problem.
    - Example: time, materials, etc.

- **Step 2: Imagine** -
    - Now that the problem has been clearly explained/defined, brainstorm more than one possible solution to the problem.
    - Draw and label diagrams, write-out words/phrases to help you brainstorm!
    - Pick your best solution to share with others.
- **Step 3: Plan** -
    - Share your best solution with others on your design team. Listen to the solutions of your peers, as well.
    - Work together to decide on one best solution to be built by the team. This solution should include ideas from the team; not just one member's ideas!
    - Draw and label a design of your solution and create a materials list with types and amounts of materials needed.
- **Step 4: Create** -
    - Build your design with your team!
    - Stick to your plan, including only using the types and amounts of materials you asked for.
    - Test it out! How did your solution work?
- **Step 5: Improve** -
    - Reflect on the results of your testing experience. What worked well? What didn't work so well?
    - Consider/discuss what your team can do to make your design better.
    - Re-plan, re-create and re-test your improved design. How did your solution work this time?

- Explain to students that they will be using the Engineering Design Process to address this week's challenge: *How can we design a roller coaster using force and motion concepts?*
- Guide students through the "Ask" step of the Engineering Design Process by asking students to record ideas/questions in the *Step 1: Ask Table*. See example below:

What is the problem?	What do you need to know to solve the problem?	What have others done when solving a similar problem?

- Possible student responses may include:
    - I need to know...
        - What is force and motion?
        - How does a roller coaster work?
        - What materials do we have to build the roller coaster?
        - How much time will we have to build the roller coaster?
    - Others have...
        - Used an app. or game to build online roller coasters.
        - Used metals, bolts, screws, plastics and wood to build roller coasters, like at *Disneyland* or *Castles N' Coasters*.
        - Built tracks and carts so that passengers can ride in roller coasters.
- Tell students that although we may not have the answers to these questions or "need to knows" at this time, we will find them out together in order to build our own roller coaster at home, just like an engineer!

Closure:

- Ask students to think back to how they described what a scientist and an engineer are and what they do. Engage in a discussion with students:
    - How would you now describe what a scientist and engineer are and what they do, based on what you learned today?
    - Thinking about what engineers do, what are you most looking forward to as we begin the roller coaster challenge?

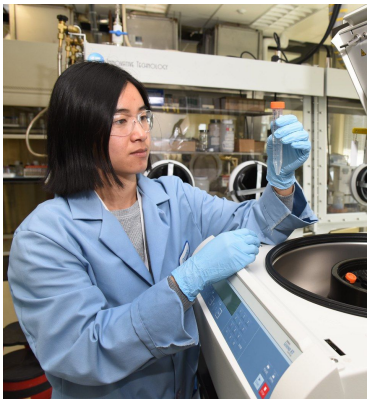
Extensions:

Watch: Crash Course Kids: *The Engineering Process*

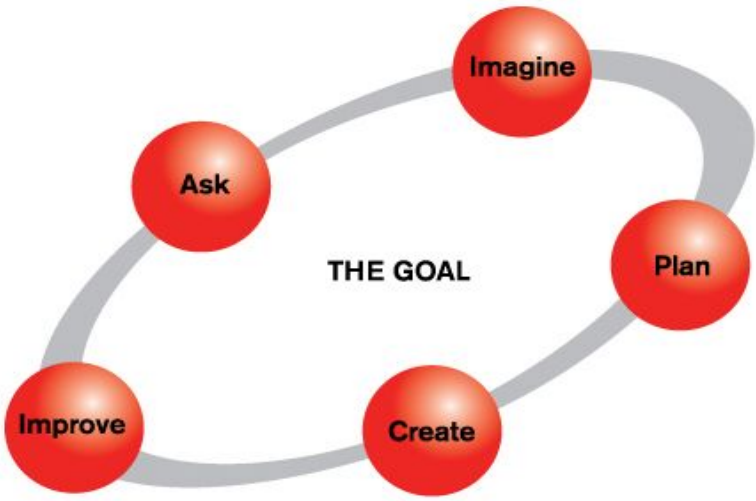
Research: Science Buddies: *Careers in Science*

Student Resources

Scientist Pictures

Zoologist	Environmental Scientist	Chemist
Studies animals	Studies environmental/health hazards	Studies the substances that make up the world around us
	 *Scientist Image: U.S. News, What to Do With an Environmental Science Degree?, 2019.*	

Engineering Design Process Image



The Engineering Design Process, EiE, Museum of Science, Boston.

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Step 1: Ask Table

What is the problem?	What do you need to know to solve the problem?	What have others done when solving a similar problem?