Activity: Super Safety Scientists

FOR THE TEACHER

Summary
In this activity, students will brainstorm ideas for keeping people safe during lab activities and design personal protective equipment (PPE) suitable for a given situation.

Grade Level
Elementary and Middle School

NGSS Alignment
This activity will help prepare your students to meet the performance expectations in the following standards:

- **K-2-ETS1-1**: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- **3-5-ETS1-1**: Define a simple design problem reflecting a need or 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.
- **Scientific and Engineering Practices**:
  - Developing and Using Models
  - Engaging in Argument from Evidence

Objectives
By the end of this activity, students should be able to:

- Explain the importance of personal protective equipment (PPE) and lab safety procedures.
- Generate and design ideas for creating personal protective equipment (PPE).

Chemistry Topics
This activity supports students’ understanding of
- Lab Safety

Time
**Teacher Preparation**: 20 minutes
**Lesson**: 150-200 minutes

Materials
- Chart paper
- Markers/crayons/colored pencils
- Engineering Design Journals
- Safety Hazard Scenario Cards
- Computers/devices with internet access
- Projector
- Recycled materials for physical models (optional)
- Super hero mask/cape (optional)

Safety
- No specific safety precautions need to be observed for this activity.
Teacher Notes

- In this activity, students will develop an understanding of the importance of lab safety practices. Using the Engineering Design Process, students will work in small to groups to develop and create models of innovative personal protective equipment (PPE) that would help to keep them safe in a hazardous situation.
- The scenarios may be printed on cardstock. Each scenario presents several different possible outcomes. For example, Scenario 2 could result in the need for fire resistant material, sprinklers, or fire extinguishers. Students should be allowed creative freedom during the design process.
- Creating and using a Driving Question Board allows students to guide and take ownership of their learning throughout the lesson.
- It may be beneficial to utilize reading comprehension strategies, i.e. jigsaw, partner reading, text codes, highlighting, or note-taking, while reading informational texts.
- Superhero masks and capes are a fun option to make the lesson more interactive.
- Due to time constraints and access to materials, having students create physical models of their designs is only a suggestion. Illustrations/drawings of student design models can be just as impactful.
- Suggested websites for student research:
  - ACS Safety in the Elementary Classroom
  - United Federation of Teachers
  - Safety in the Science Classroom
  - OSHA
- Note that the Engineering Design Process Journal is available for download. It is set-up to be printed double-sided, and folded into a small booklet for student use.
- All images used in this classroom are from Pixabay, which are free for commercial use and requires no attributes.

Implementation Instructions:

1. As a class, view this Superhero Gadget video (~8 minutes). Other options are available listed in the Resources section below. Each video highlights a piece of equipment that the superhero uses. Instruct students to identify and discuss those “contraptions” or tools that allow the heroes to stay safe, with their tables. Have groups briefly share their thoughts and ideas with the class.
2. Create and fill in a t-chart with equipment and uses. The students will fill in their own while the teacher makes one on chart paper/whiteboard or the like.
3. Next, view When Things Go Wrong in the Lab video (~1 minute). Discuss with the students how the hazard could have been prevented or how the scientists could have better protected themselves, encouraging students to provide specific examples.
4. Pose the driving question to the class, “How can we stay safe in the lab?” and ask students what they need to know in order to figure out the answer to that question. Students should only be generating more questions that may lead to a solution or explanation, not answering the actual driving question.
   - For example, students should be asking questions like:
     - What types of activities/experiments will we do in the lab?
     - How could they potentially go wrong?
     - What types of PPE do we already have?
     - Are they safe enough or can they be improved?
   - Student responses should not include suggestions of how to be safe or simply reiterating lab safety rules.
5. Create a Driving Question Board and/or notebook page, using the questions that students have generated regarding lab safety and personal protective equipment by grouping the questions into categories for display on the board based on similarities or topics. All questions should be honored and displayed on the board and if they are “off topic” or “outliers”, they can be placed in a “parking lot” to be answered/addressed at a later date.
6. Introduce the idea of “Personal Protective Equipment (PPE)” to students by reading and discussing the following news articles (utilizing a reading comprehension strategy such as jigsaw or partner reading):
   - What is PPE?
   - Hoverboard Fires
   - Radiation Shield

7. Present the assignment to the class by assuming the superhero stance (hands on hips) and asking, “Are you ready to save the day?”

8. Divide students into small groups (4-5 max) and distribute one lab safety hazard scenario card (there are 8 scenario cards available) and one Engineering Design Journal to each group. Explain that they have been charged with saving the students in the scenario by creating a new and innovative PPE or updating an existing one.

9. Inform students that they will collaborate with their team to brainstorm, design, create models (physical or illustrated), and present their designs to the class. Allow students to research PPE and school lab safety online and access any necessary art supplies and materials.

10. Revisit the Driving Question Board to discuss what students have learned about how and why it is important to stay safe in the lab and award students with Super Safety Scientist award certificates (optional).

Additional Superhero Video Options:
   - Wonder Woman’s Lasso (5:08)
   - 5 Batman gadgets that are really used! (5:29)
   - Best superhero gadgets (8:28)
   - Green Lantern’s Ring (0:34)

Lab Safety Disaster Videos:
   - When Things Go Wrong in the Lab (1:18)
   - Mr. Bean Chemistry Experiment (2:01)

Picture Books
   - Papa’s Mechanical Fish by Candace Fleming
   - Ada Twist, Scientist by Andrea Beaty

Safety Articles
   - Hoverboard fires, injuries prompt U.S. to begin working on safety standards
   - Science of art: NASA seeks origami-inspired ideas for new radiation shield
FOR THE STUDENT

Lesson

Super Safety Scientists: Vanquishing Danger One Disaster at a Time

Background
Your safety and the safety of every individual in this classroom, and building are the most important considerations when conducting a lab. This week we are going to be Super Safety Scientists and work to keep everyone safe!

Prelab Questions
1. What does *vanquish* mean?
2. How do you feel about safety? Why?
3. Is there an activity that you do that you need special equipment to keep you safe? Explain the activity and the equipment needed.

Objective
How can we stay safe during a lab?

Procedure
1. Watch a superhero video with your class.
2. After watching the video with your teacher fill in the t-chart with your group.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: <em>Shield</em></td>
<td><em>A shield protects you from any object that might hit you</em></td>
</tr>
</tbody>
</table>

3. Watch a lab disaster video with your class.
4. List three questions below that we need to ask to stay safe in a lab setting.

   a.

   b.

   c.
5. Read the safety article provided by your teacher. Summarize the article below.

6. Read the scenario your group has been given and look over the Engineering Design Journal. Discuss them both with your group.
7. Review the rubric for the project.
8. Begin planning your project by filling out the *Engineering Design Journal.*
9. Create a drawing of your PPE to present to the class. You may use whatever materials you want: magazines, stickers, fabric, etc.!

**Analysis Questions** (complete after all student groups have presented to the class)

1. When should you use a PPE?

2. How would you determine what type of PPE to use?

3. Has your view on safety changed? Why or why not?