Safety Demonstrations

Start with Safety—Safety Demonstrations

Introduction

This simple demonstration will teach your students the importance of wearing safety goggles any time heat, glassware or chemicals are used in a science laboratory. Show the immediate and irreversible destructive action of strong acids using egg whites as simulated eyes, and demonstrate the effectiveness of goggles for protecting the eyes.

Concepts

- Goggle safety
- Reactivity of strong acids and bases

Materials

Hydrochloric, sulfuric or nitric acid, 6 *M* or stronger
Sodium bicarbonate solution, 1 *M* (optional)
Sodium hydroxide, 6 *M* or stronger (optional)
Chemical splash goggles or visor gogs
Permanent marker
Petri dish or pie tin
Pie tin, aluminum (a paper plate will also work)
Pipets, Beral-type
Overhead projector
Raw eggs or egg whites
Shaving cream
Towel (for cleanup)
Willing participant

Demonstration 1. Acid in the Eye

Safety Precautions

Hydrochloric, nitric, and sulfuric acids as well as sodium hydroxide are all highly toxic by ingestion or inhalation, and severely corrosive to skin and eyes. Remember that any food items brought into a laboratory setting are considered chemicals and should not be ingested thereafter. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Draw a large eye on the bottom of a Petri dish using a permanent marker.
2. Gently crack open an egg and separate the egg white from the egg yolk. Place the egg white in the Petri dish.
3. Place the Petri dish on the overhead projector stage.

Demonstration

1. Briefly discuss the similarities between an egg white and a human eye (see *Discussion* section).
2. Using a Beral-type pipet, place several drops of acid on the egg white. It will immediately become opaque.
3. Try to "undo" the damage by gently rinsing the egg white with water or dilute sodium bicarbonate solution. The egg white cannot be made transparent again.

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4. Place the cover on the Petri dish and pass it around for the students to see that the egg white/human eye is permanently damaged. Ask the students what effect this would have on their vision. Before passing the egg white around, make sure there is no unreacted acid and caution the students against touching the egg white.
5. Repeat the experiment with other acids or sodium hydroxide solution. Concentrated nitric acid turns the egg white brilliant yellow, almost like an egg yolk. Strong solutions of sodium hydroxide do not discolor the egg whites but do solidify them. Acid solutions less than 6 M will work, but the effects are not as dramatic.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The egg whites should be rinsed with water and then disposed of in the trash. Any excess acid should be stored in an acid cabinet for future demonstrations.

Discussion

Egg whites and human eyes contain an abundance of proteins. Proteins are natural polymers (also called polypeptides) formed by linking amino acids together. Proteins, when subjected to strong acids, first undergo a process called denaturation, in which they lose their native three-dimensional structures. The acid can further break down proteins to amino acids via hydrolysis reactions. Proteins need very specific three-dimensional structures to perform their biochemical functions—denaturing or destruction of the protein structure changes the properties of a protein and is frequently irreversible.

This demonstration should convince your students of the importance of wearing chemical splash goggles anytime chemicals, heat or glassware are used. During the school year, a gentle reminder of "remember the egg white" should bring back vivid memories of this safety demonstration and the importance of wearing goggles.

Demonstration 2. Pie in the Face

Safety Precautions

Wear chemical splash goggles and be certain the goggles fit the volunteer properly. Wear an apron or old clothes. Have the volunteer keep his mouth closed during the demonstration.

Preparation

Prepare a shaving cream pie using a pie tin and shaving cream. A metal pie tin, disposable aluminum pie tin, or paper plate all work well. Fill the pie tin with shaving cream until it is about 2 inches thick.

Find a willing "victim." Some teachers have used other science teachers, the department chair, the assistant principal or the principal. Having an administrator participate in the demonstration shows their interest in science and their commitment to laboratory safety. Other teachers have a colleague perform the demonstration on themselves. Always ask for permission; never let this demonstration be a surprise to the participant. Our recommendation is not to involve students in the demonstration.

Procedure

1. Explain the importance of wearing safety goggles in the laboratory any time heat, glassware or chemicals are used.
2. Place a towel around the shoulder of the volunteer or have them wear a lab coat to protect against falling shaving cream.
3. Have the volunteer put safety goggles on. Check to make sure they fit securely.
4. Gently smash the shaving cream pie in the face of the volunteer. Try to hit the volunteer squarely in the face so the eyes (goggles) are fully covered.
5. Remove the pie tin from the face leaving a thick layer of shaving cream on the face of the volunteer.
6. The volunteer should now remove the shaving cream from around his mouth in order to breathe.
7. The volunteer should now remove his safety goggles straight out from his face, demonstrating that his eyes are completely

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protected from the shaving cream accident.

8. The volunteer should clean off his or her face at the end of the demonstration.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The shaving cream may be disposed of according to Flinn Suggested Disposal Method #26b.

Tips

- Have fun! Safety is a serious topic and rules must be followed. However, many teachers use humor and fun to capture their students' attention. This demo is sure to be one of your students' favorite and if you catch your students not wearing their goggles, you can just say "remember the pie."
- Shaving cream is preferred over whipping cream because it is a thicker foam, easier to clean off a face, and not as sticky.
- This demonstration can also be performed as a "surprise." Have a colleague sneak up on you when you are lecturing about safety goggles (and wearing your goggles) and "surprise" you and your class with the shaving cream accident. Remember, the volunteer must always be a willing volunteer.

Discussion

Before students perform their first laboratory experiment, laboratory safety rules should be explained and a safety contract provided describing all the rules. One of rules must be to wear safety goggles whenever heat, glassware or chemicals are used. Simple demonstrations such as this one will help students understand the reasons behind the rules and, hopefully, remember and respect the rules at all times.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation
Form and function
Content Standards: Grades 5–8
Content Standard F: Science in Personal and Social Perspectives, personal health
Content Standard G: History and Nature of Science, history of science
Content Standards: Grades 9–12
Content Standard F: Science in Personal and Social Perspectives, personal and community health
Content Standard G: History and Nature of Science, nature of scientific knowledge

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Safety Demonstrations* activity, presented by Jamie Benigna, is available in *Start with Safety—Safety Demonstrations*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

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Materials for *Safety Demonstrations* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP5947	*Make Your Own Colorful Goggles Kit*
H0006	*Hydrochloric Acid, 12 M, 2.37 L*
N0055	*Nitric Acid, 15.8 M, 2.37 L*
S0145	*Sulfuric Acid, 18 M, 2.37 L*
AP3306	*Standard Vented Chemical Splash Goggles*
AP8739	*Instructor's Chemical Splash Goggles*
AP8955	*Economy Choice Chemical Splash Goggles*
AP3309	*Standard Vented Goggle with fog-free lens*
AP1362	*Visorgog®*
AP1557	*Citation, Safety Violation*

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

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