

SNC1D/1P/2D/2P Scientific Investigation Skills

Teacher Demo: The Importance of Safety Goggles

Topics	Timing
introduction to the Chemical Reactions strand general laboratory safety	preparation: 5 min demonstration: 5-15 min

Specific Expectations

SNC1D, SNC1P, SNC2D, SNC2P

A1.4 apply knowledge and understanding of safe practices and procedures when planning investigations (e.g., appropriate techniques for handling, storing, and disposing of laboratory materials [following the Workplace Hazardous Materials Information System–WHMIS]; safe operation of electrical/optical equipment; safe handling and disposal of biological materials), with the aid of appropriate support materials (e.g., the Reference Manual on the WHMIS website; the Live Safe! Work Smart! website)

Introduction

Although all students know that it is essential to wear safety goggles during many science investigations, it can be helpful to provide a powerful demonstration showing why this is so important. This quick and easy demonstration can illustrate the necessity of appropriate safety eye wear without anyone actually getting hurt (Fig.1).

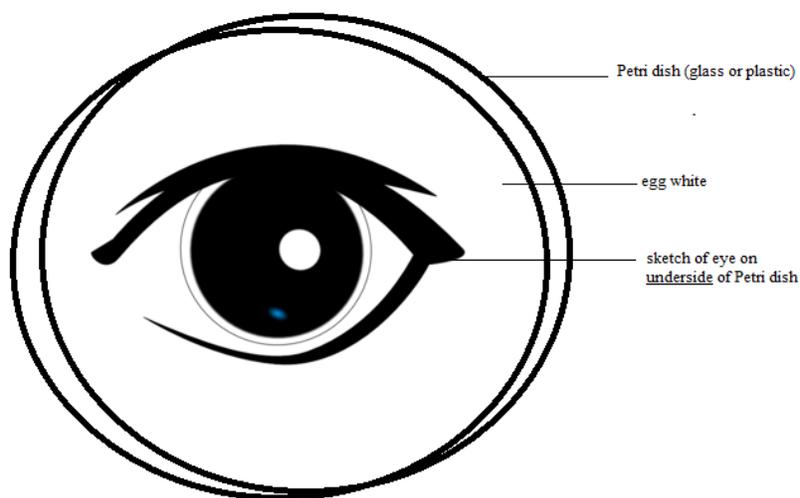


Fig.1 Place a sketch of the eye underneath the Petri dish containing egg white.

Materials

chemical safety goggles	1 permanent or washable thin marker
protective gloves	1 glass or plastic Petri dish
lab coat or apron	1 overhead projector
1 egg	1 glass stirring rod
1 dropper bottle of 2.0 mol/L hydrochloric acid, HCl(aq)	

Safety Considerations

- Provide MSDS sheets for all chemicals used.
- 2.0 mol/L hydrochloric acid is corrosive and poisonous. Avoid skin or eye contact. Safety goggles, protective gloves, and lab coats or aprons should be worn when handling hydrochloric acid. Wash your hands and flush your eyes immediately if you come into contact with it. Students should not handle 2.0 mol/L hydrochloric acid.
- There is a small chance that raw eggs may be contaminated with *Salmonella* bacteria. After handling the egg, wash hands thoroughly with warm water and soap.
- Ensure a buffer zone around the overhead projector to protect students from any spills.

Hazardous Materials Identification System Rating

(0-minimal 1-slight 2-moderate 3-serious 4-severe)

2.0 mol/L hydrochloric acid

HMIS (0 to 4)

Health	2
Fire Hazard	0
Reactivity	1

Procedure

Ensure that the demonstrator is wearing appropriate PPE: chemical safety goggles, lab coat or apron, and protective gloves.

1. Using a marker, draw an image of an eye on the underside of the bottom of a Petri dish before class.
2. Introduce the demonstration by indicating that you want to show students why we need to wear safety goggles during experiments with chemicals. Since you don't want to risk injuring anyone, egg white is used to simulate the fluid of an eye.
3. **Predict/Explain**
Ask students to predict what will happen to the egg white when hydrochloric acid is added. Have them explain their predictions.
4. Crack an egg and separate the egg yolk from the egg white, pouring the egg white into the Petri dish.
5. Place the Petri dish on an overhead projector which is turned on.
6. Using the dropper bottle, carefully add hydrochloric acid dropwise into the Petri dish until the reaction products are observable (a volume of acid approximately equal to the volume of egg white).
7. **Observe**

Provide time for students to record their observations (ensuring that they include observations both before and after the acid is added).

8. Stir the acid–egg white mixture with the stirring rod, until it turns white.

9. **Explain**

Ask students to revise their explanations, if necessary.

Disposal

Sodium hydrogen carbonate (baking soda) or sodium carbonate may be used to neutralize any excess acid in the final mixture prior to disposal. Follow procedures that are consistent with school board protocol and appropriate for your municipality.

What happens?

The clear egg white turns a milky white with a thicker consistency within about one minute of adding the acid and mixing.

How does it work?

The egg white (albumen) consists of proteins (albumins, globulins, and mucoproteins) dissolved in water. The egg white's purpose is to protect for the yolk and provide nutrients for embryo growth when the egg is fertilized. These proteins are long chains of amino acids attached together with peptide (amide) linkages. The proteins are globular in structure, so the long protein chains are bent around each other due to a variety of attractive forces between amino acid side chains. One of these interactions that helps create the tertiary structure of proteins is the salt bridges formed between acidic and basic side chains. The addition of acid disrupts these salt bridges, therefore disrupting the entire structure of the protein with the effect of straightening portions of the protein out. When the structure of a protein is altered or “denatured,” it can no longer function. The change from a transparent, colourless solution to an opaque, white mixture is due to the denatured proteins precipitating out of solution and coagulating. For more information, refer to the Additional Resources provided.

Teaching Suggestions/Hints

- This demonstration can be used as an introduction to any Grade 9, Grade 10, or senior level science course. It could also be used to introduce or reinforce acid–base chemistry or the chemistry of proteins in senior biology courses.
- Although this demonstration works well with a plastic Petri dish, using a deeper dish minimizes spillage.

Additional Resources

1. This animation about protein denaturation provides a visible model. http://highered.mcgraw-hill.com/sites/0072943696/student_view0/chapter2/animation_protein_denaturation.html
2. More information about protein structure and denaturation <http://www.elmhurst.edu/~chm/vchembook/568denaturation.html>
3. This video demonstrates and explains this same reaction. <http://www.youtube.com/watch?v=DedE68fjKRM>