470213-412

Forensic Analysis of Glass Lab Activity

Aligned With All Published National Standards

ward's science

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overview

This lab provides students with knowledge of how intrinsic properties of glass can be used to separate common types of glass. Students will distinguish between radial and concentric patterns in the glass and how each type gives information on the direction of the force that impacted the glass. Students' understanding of this exercise will allow them to gain experience sequencing multiple trauma patterns on glass, aiding in reconstruction of crime scene events.

materials included:

- 12 dissecting forceps
- 10 glass plate, 5" x 5"
- 10 glass plate, 8" x 8"
- 1 tempered glass plate, 4" x 10"
- 1 Pyrex beaker, 50-mL
- 1 laser pointer
- 12 protractors
- 12 rulers
- 1 pkg. nails
- 1 spool thread
- 1 pkg. plastic zipper bags
- 8 hand lenses
- 1 roll masking tape
- 1 roll clear tape
- 3 glass vials
- 5 plastic vials
- 3 half circle Petri dishes
- 1 bottle vegetable oil
- 1 bottle clove oil
- 50 sheets black construction paper
- 20 pieces of chipboard
- 8 foam sheets

materials not provided:

- Fume hood
- Distilled water
- Goggles, gloves and apron
- Stereoscope (optional)
- Lead crystal (wine) glass
- Electronic balance (0.001 g)
- Scalpel
- Beaker, 50 mL
- Scissors
- Calculator
- Hammer
- Paper towels
- White paper
- Lab marker

number of uses:

This activity can be performed once by 8 groups of students.

Visit wardsci.com for replacement materials.

framework for K-12 science education © 2012

* The Dimension I practices listed below are called out as **bold** words throughout the activity.

DIMENSION 1 Science and Engineering Practices

×	Asking questions (for science) and defining problems (for engineering)	×	Use mathematics and computational thinking
×	Developing and using models	×	Constructing explanations (for science) and designing solutions (for engineering)
×	Planning and carrying out investigations	×	Engaging in argument from evidence
×	Analyzing and interpreting data	×	Obtaining, evaluating, and communicating information

DIMENSION 2 Cross Cutting Concepts

×	Patterns		Energy and matter: Flows, cycles, and conservation
×	Cause and effect: Mechanism and explanation		Structure and function
×	Scale, proportion, and quantity		Stability and change
	Systems and system models		

DIMENSION 3 Core Concepts

Discipline	Core Idea Focus
Physical Science	PS1: Matter and Its Interactions
	PS3: Energy

× Indicates standards covered in activity

next generation science standards © 2013

Middle School Standards Covered	High School Standards Covered
MS.PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.	HS.PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
MS.PS1-2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	
MS.PS3-1: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	
MS.PS3-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	

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standards alignment

national science education standards © 1996

Content Standards (K-12)			
	Systems, order, and organization		Evolution and equilibrium
×	Evidence, models, and explanation	×	Form and Function
×	Constancy, change, and measurement		

Physical Science Standards Middle School		Physical Science Standards High School	
×	Properties and Changes of Properties in Matter	×	Structure and Properties of Matter
×	Motion and Forces	×	Motion and Forces
×	Transfer of Energy	×	Interactions of Energy and Matter

× Indicates standards covered in activity

benchmarks for science literacy (AAAS, © 1993)

1. The Nature of Science	1B: Scientific Inquiry
2. The Nature of Mathematics	2A: Patterns and Relationships
4. The Physical Setting	4D: Structure of Matter
	4E: Energy Transformations
	4F: Motion
9. The Mathematical World	9C: Shapes
11. Common Themes	11B: Models

activity objectives:

- Differentiate between various types of glass by sorting samples based on physical appearance.
- Differentiate between various types of glass by testing the density of glass samples and comparing them to known densities of glass.
- Differentiate between various types of glass by comparing the refractive indices of glass samples to the refractive indices of known liquids.
- Recognize fracture patterns in glass and classify them as radial or concentric.
- Determine the direction of impact on glass by analyzing the conchoidal fracture patterns in a piece of broken glass.
- Determine the breakage sequence in a multiple fracture pattern in a glass sample.
- Utilize mathematical skills such as taking angle measurements with a protractor and applying basic trigonometry.

time requirement:

Part I:	Visual Comparison of Glass Types	10 min.
Part II:	Fracture Patterns in Broken Glass	15 min.
A:	Single impact	10 min.
B:	Multiple impacts	15 min.
C:	Difference between radial and concentric cracks	10 min.
D:	Fracture patterns in various types of glass	20 min.
Part III:	Determining the Density of Glass	30 min.
Part IV:	Determining the Refractive Index of Liquids	15 min.
Part V:	Refractive Index Comparison for Glass Types	15 min.
Part VI:	Putting it All Together: Case Files	30 min.

safety precautions

teacher notes

lab specific safety:

- Safety goggles and gloves should be worn at all times when working with the glass fragments. Care should be taken when handling any of the glass sheets or fragments. Care is recommended while working with the glass samples to prevent cuts.
- A laser pointer is used in this activity. NEVER point the laser beam directly at a person or at an angle where it could be reflected into a person's eyes.

general safety:

- The teacher should 1) be familiar with safety practices and regulations in his/her school (district and state) and 2) know what needs to be treated as hazardous waste and how to properly dispose of non-hazardous chemicals or biological material.
- Consider establishing a safety contract that students and their parents must read and sign. This is a good way to identify students with allergies (e.g., latex) so that you (and they) will be reminded of specific lab materials that may pose risks to individuals.
- Students should know where all emergency equipment (safety shower, eyewash station, fire extinguisher, fire blanket, first aid kit etc.) is located.
- Require students to remove all dangling jewelry and tie back long hair before they begin.
- Remind students to read all instructions, Safety Data Sheets (SDSs) before starting the lab activities, and to ask questions about safety and safe laboratory procedures.
- As general laboratory practice, it is recommended that students wear proper protective equipment, such as gloves, safety goggles, and a lab apron.

at the end of the lab:

- Remind students to wash their hands thoroughly with soap and water before leaving the laboratory.
- Make sure that the lab area is carefully swept and/or vacuumed, to remove any remaining glass pieces.

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