let's talk science
UBC Partnership Program

Classroom activities: Making Movie Glass

Description: Ever wondered how people can jump through a plate glass window, or smash a beer bottle over someone's head, in the movies and not get hurt? This activity shows you how to make fake "movie glass" out of sugar -- and describes the similarities of movie glass and real glass.

Concept: Glass is an amorphous solid (as opposed to a crystalline solid), which is why it shatters in irregular patterns. Movie glass, made from sugar, is also an amorphous solid, so it shatters like real glass, but isn't as dangerous.

Materials: Measure Carefully.

- 1/2 cup water 4oz
- 1 3/4 cup granulated sugar
- 1 tbsp light corn syrup
- candy thermometer
- pot
- stove
- baking sheet (if you want to make "windows")
- balloon (if you want to make a "glass bowl")

Method: Boil the water in the pot and stir in sugar and corn syrup. Continue to boil the mixture, stirring constantly, until it reaches 300 degrees.

To make a **glass window**, pour the glass mixture on the lightly oiled baking sheet. The thinner you make it, the easier it will be to break it, so don't make it too thin or it will be too delicate (but don't make it too thick, or it won't break!). Let the glass cool to harden (about an hour) and then gently pop it out of the pan.

To make a **glass bowl**, first you need to fill a balloon about 1/4 full of water, then blow the balloon up the rest of the way. (You need some water in the balloon so that it won't break under the heat of the 300 degree sugar mixture... for a scientific explanation of why this works, see the activity "Fire Proof Balloon"). Then, dip the balloon into the sugar mixture to coat the bottom of the balloon, forming your bowl. Hold the balloon until the sugar mixture has cooled enough to harden a bit. You can then place the balloon on a baking sheet (with the "glass" side up, not touching the baking sheet) to cool completely. Once it is hardened, you can peel the balloon out of the glass bowl. (Don't pop the balloon, because the water might melt your glass!)

Now you can smash your glass, just like in the movies! Note how it shatters just like real glass!

You can also eat this glass!

Clean Up: You can clean any hardened glass out of the pot (and off the candy thermometer) but boiling water in the pot to dissolve the sugar.

Note: *300 degrees is really, really hot! Don't touch the sugar mixture when it is this hot, as it will burn you!*

Background:

- **Crystalline solid**
  - molecules arranged in an orderly fashion
  - e.g., salt, ice
- **Amorphous solid**
  - molecules arranged in a random fashion
  - e.g., glass, sugar glass
- Although it shatters like glass, the fragments aren't nearly as sharp, so it's much safer to smash a candy glass bottle over someone's head or jump through a candy glass window
- Both candy glass and real glass are made by combining a base material (glass-former) with an additive.
- Glass is primarily made from silica--a mineral found in most rocks and in sand on beaches.
- It takes a very high temperature of 2876° F (1580° C) to melt silica
- To lower the melting temperature of silica, lime (CaO) and soda ash (Na_2CO_3) are added (when 75% sand (silica), 15% soda ash, and 10% lime, are melted at 1292° F (700°C))
- Sugar (or sucrose) is a good glass former and water serves as the additive.
- Sucrose has a melting temperature of 367° F (186° C), and water has a melting temperature at 32° F (0° C). The lower melting temperature makes candy glass easier to produce.

Source:Recipe from: http://www.recipesource.com/desserts/candy/01/rec0170.html

Further Reading: Read more about the thermodynamic and material properties of glass at: http://www.math.ucr.edu/home/baez/physics/General/Glass/glass.html

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ACTIVITY 14-2
GLASS DENSITY

Objectives:

By the end of this activity, you will be able to:

1. Describe how density is determined using a water displacement method.
2. Calculate the density of various samples of glass.
3. Determine if any of the glass evidence obtained from the four suspects has the same density as the glass found at the crime scene.
4. Maintain the proper chain of evidence when collecting and examining glass evidence.

Time Required to Complete Activity: 45 minutes

Materials:

(per group of three students)
evidence bags containing glass labeled Suspects 1, 2, 3, and 4
evidence bag containing crime-scene evidence labeled CS
displacement containers *or* 10 mL graduated cylinders
beaker (250 mL)
water
dropper bottle of water containing 50 mL of water
balance (accurate to at least .01 gram)
forceps
newspaper or construction paper
labeling tape
permanent marker pen

Safety Precautions:

Wear gloves and goggles while handling glass. Spread newspaper or construction paper in your work area. Dispose of all materials as directed by your teacher. Immediately report any accidents with glass to the teacher.

Background:

The density of glass fragments found at a crime scene can be compared to the glass fragments found on suspects. Keep in mind that if the densities do match, this does not prove that the suspect is guilty, because glass would be considered class evidence.

Glass fragments from a crime scene need to be matched with any glass fragments associated with the four suspects.

In this activity, you will be asked to determine the density of glass fragments found at the crime scene and the densities of glass fragments found on any of the suspects. If the densities do not match, you may be able to disqualify a suspect. If you find that the densities do match, then you will need to collect further evidence to help prove that a particular suspect was at the crime scene.

Procedure:

1. Obtain the evidence envelopes labeled:
   Suspect 1
   Suspect 2
   Suspect 3
   Suspect 4
   Crime Scene
2. Using Suspect #1 evidence bag, record your name, date, and time on the Chain of Possession form.
3. Open the envelope labeled Suspect #1. Do not disturb the signatures on the evidence envelope. Open it from a different side.
4. Remove two pieces of glass fragments from suspect's evidence bag #1. Using a balance, determine the combined mass of both pieces. Record the mass on Table 1. Leave the two pieces of glass on the balance for further testing.
5. Reseal the evidence bag. Place a piece of tape over the opened edge. Write your signature or initials across the interface of the tape and the bag to maintain chain of custody. At this point, there should be two taped areas on the bag, both containing signatures or initials on top of the tape. Refer to proper chain of command described in Chapter 2.
6. Set up a 250 mL beaker of water filled to overflowing. You may need to add the last few drops with a dropper.
7. Position a clean, dry, 10 mL graduated cylinder to receive overflow water. Several books may have to be placed under the beaker to adjust the height of the beaker.
8. Slowly add your two glass fragments of glass Sample 1 into the beaker one at a time. Water will spill over into your graduated cylinder.
9. Measure the volume of water displaced by the addition of the two glass fragments. This is determined by reading the amount of water that has overflowed into the graduated cylinder.
10. Record the combined volume for the two glass fragments in Data Table 1.
11. Calculate the density of the glass fragments from Suspect 1 evidence bag and record your answer on the data table.

$D = \frac{m}{V}$

12. Remove the two glass fragments from the beaker and handle as described by your teacher.
13. Refill the beaker to just overflowing.
14. Repeat the process with glass from (Suspect) 2. Be sure to properly open and reseal the evidence bag. Record your name, date, and time on the Chain of Possession form. Record all information for Suspect 2 in the Data Table.
15. Repeat the process until you have recorded all the information for the glass found on suspects 3 and 4, and the crime-scene evidence envelope.