

SALOL LAB

Growing Crystals From a Melt!

Name _____

Period _____ Date _____

In nature there are two basic processes used to form the crystals we all observe in our everyday world. The simplest is to reproduce is the growth of crystals from a solution. As the solvent evaporates, it leaves behind the solute (dissolved mineral material) in solid crystalline form). You have probably seen the growth of crystals from solution before and may have even grown some rock candy sugar crystals at home. Today, you are going to perform a slightly more difficult crystal growth experiment, growing crystals from a melt. You will actually take a solid crystalline substance, melt it under very controlled conditions, and then allow it to cool and re-crystallize under three different sets of conditions.

Problem: What is the relationship of crystal formation to cooling rate?

Materials: (Per lab group of 4 to 6 students)

3 Pyrex watch glasses

1 student hot plate with temperature control

1 sheet of clean wax paper

the top or bottom from a Petrie dish filled with ice cubes

crucible tongs

a watch with a second hand

1 magnifying hand lens per student

about one teaspoon of Salol (chemical name – Phenyl Salicylate)

Optional: Portable Digital Video Camera and tripod

Part 1: Rapid cooling.

1. Obtain all of your supplies from your instructor. Plug in the hot plate and set it at 45 ° C or 110° F. Do not turn the hot plate any higher or it will take too long for your melt to cool and reform the crystals.
2. Tear the piece of wax paper into three parts and evenly divide your Salol sample on the pieces. Place the Salol from one sheet in the center of one of your clean watch glasses. Be careful to keep the solid in a nice central pile on the watch glass. You want it to melt into one puddle. Do this for each of the three watch glasses.
3. Place your Petrie dish of ice cubes off to one side of your work area. Set up your camera and tripod to focus in on the area just on top of the ice cubes. Use the largest zoom factor you can to see the most detail.
4. Place one of your watch glasses with the Salol on it just on the surface of the hot plate. Do not push it in toward the center. You need to be able to remove it with the tongs as soon as the solid melts completely. Watch the glass and solid carefully, as soon as the material is completely melted start your stop watch or clock.

5. Use the crucible tongs to remove the watch glass by gently placing one side of the tongs under the side of the watch glass and the other on top. Carefully close the tongs to get a firm grip and lift the watch glass off the hot plate. Move the glass with the melted material over to the ice cubes and carefully place the watch glass on top of the ice. Hold it there to keep it from sliding off. Focus your camera on the liquid in the center of the watch glass. Keep careful track of when the first crystal appears and when the last of the liquid solidifies, so that you can calculate total elapsed time from liquid to solid.

Part 2: Intermediate cooling.

1. Place one of your watch glasses with the Salol on it just on the surface of the hot plate. Do not push it in toward the center. You need to be able to remove it with the tongs as soon as the solid melts completely. Watch the glass and solid carefully, as soon as the material is completely melted start your stop watch or clock.
2. Use the crucible tongs to remove the watch glass by gently placing one side of the tongs under the side of the watch glass and the other on top. Carefully close the tongs to get a firm grip and lift the watch glass off the hot plate. Move the glass with the melted material over to the lab table top and carefully place the watch glass on the tabletop.
3. Have another student or pair keep track of the second watch glass. As soon as the first set of crystals has completely formed, refocus the camera on the new melt and follow the crystallization process for this sample.
4. Be sure to record the end time for crystallization so that you can calculate the total elapsed time for this sample.

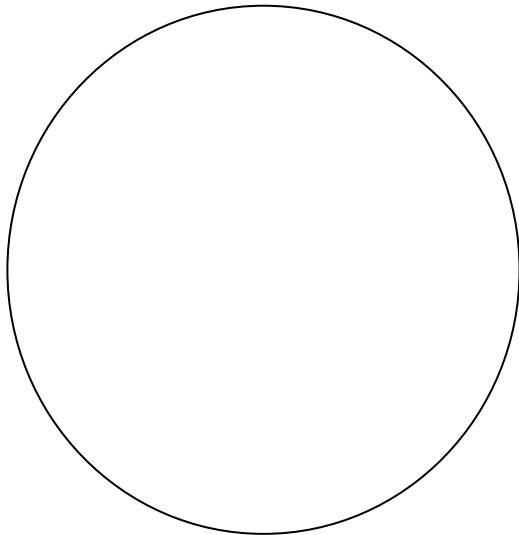
Part 3 : Slow Cooling

5. 1. Place one of your watch glasses with the Salol on it just on the surface of the hot plate. Do not push it in toward the center. You need to be able to remove it with the tongs as soon as the solid melts completely. Watch the glass and solid carefully, as soon as the material is completely melted start your stop watch or clock. **IMMEDIATELY UNPLUG THE HOTPLATE!!!**
6. Do not remove the sample from the hotplate. Your sample will cool at the same rate as the hot plate!
7. When the second sample has completely crystallized, refocus your camera on the sample left on the hot plate. While waiting for the final sample to cool, you may proceed to the analysis and conclusion section to start completing the Part 1 and 2 data collection.

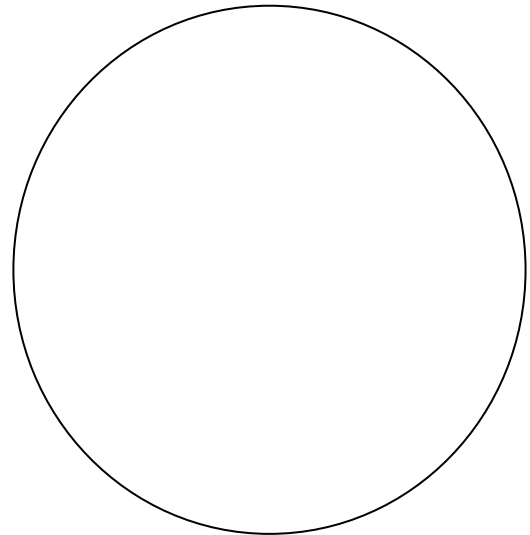
Data Collection Table

Sample	Start Time	End Time	End time – Start Time
1			
2			
3			

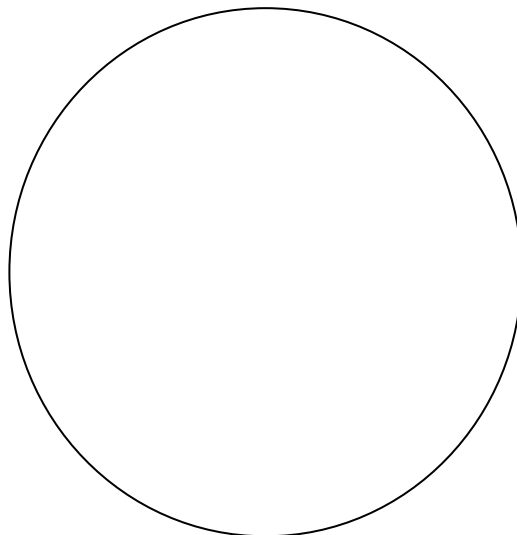
Use the circles below to sketch the relative size and shapes of the crystals formed in each sample.



Sample 1



Sample 2



Sample 3

Analysis and Conclusions:

- 1. What similarities if any can you list between the samples after they have recrystallized? (You may wish to compare # 1 to # 2, then # 1 to # 3, then #2 to #3)**
- 2. What differences, if any, are there between the three samples after they have recrystallized?**
- 3. What factor is the only one varied in this experiment?**
- 4. Write a simple statement of the relationship between cooling rate and crystal size.**
- 5. Use the video taken from your samples to make a PowerPoint presentation explaining the relationship between cooling rate and crystal formation. Draw a parallel to the crystals in three rocks you find outside. Explain what this tells you about where the rocks formed, deep under ground, near the surface, above the surface. This portion of your lab will be counted as 50% of the lab group grade. If you do not have access to the video camera, use the computer to create your own graphics of the end results of the 3 parts of your experiment.**