

A crystal is a chemical solid with flat faces that meet at precise angles. Each crystal shape represents a unique pattern of the internal arrangements and bonding of atoms. Natural minerals can often be identified by their characteristic crystal forms. Crystals have been called “the flowers of the physical world” because of their rare beauty, and mathematical symmetry.

Each mineral has its own distinctive crystal shape, or habit.



MATERIALS: (For the Class:
 Two, 1000 mL beakers, or saucepans, 2/3 full of tap water
 Hot Plate or Burner Apparatus to boil water
 1 Box of Moth Flakes (Naphthalene/P Dichlorobenzine)
 4 Jars of Particles (Sand, Soap Flakes, Sugar, Salt)
 2 Igneous Rocks & 1 Edge of a Rock Intrusion
 Atomic Crystal Model (from chemistry)

For each Lab Group:
 Test Tube Wire Test Tube Holder
 Watch Glass Magnifying Lens
 Balance Scale 6 Inch Ruler

1. Measure approximately 0.5 to 1 gram of moth flakes. Use a small piece of paper to hold the flakes so the chemical does not touch the top of the scale. If you use an electronic balance, tare the balance with the paper. If you use a balance scale, add about 0.5 to 1 gram to the mass of the paper.
2. Fold the paper to pour the flakes into a test tube. Then put the test tube into a pan of boiling water until the powder has melted. Be sure that it melts fully and becomes clear.
3. Place your watch glass on the table top, concave (bowl) side up. Quickly pour the molten naphthalene into the watch glass and observe it as it crystallizes (solidifies).

4. Where does the melt crystallize first? _____

5. Compare the size of the crystals at the edge with the crystals at the center. Where are the crystals the largest? _____

Where did the melt cool the slowest? _____

What can you conclude about the formation of large crystals? _____

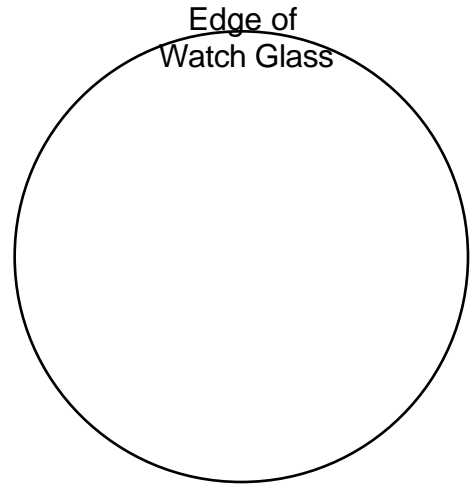
6. Use a hand lense and a small ruler to measure the approximate distance across one of the crystals near the center: _____...and a crystal at the edge: _____

(Continue to the next page.)

7. In the space to the right, make a neat sketch of the circular mass of moth flakes. Your sketch should clearly show the change in crystal size from the center to the edges.

8. What determines how large the crystals grow?

9. Return all equipment. You do not need to clean the watch glasses or test tubes. The test tubes will be left for the next group, and your teacher will clean the watch glasses.



(At this time you can continue to 11, or, if it's crowded, you can come back to step 11 later.)

10. We can usually identify crystals by their angular edges and flat faces. In most crystalline substances, like the moth flakes that you observed, the crystals grow together. So, intergrown crystals may not show the kinds of shapes shown in the diagrams on page 1. However, some crystalline substances cleave (split) evenly along parallel faces. Crystal form and cleavage (splitting along flat surfaces) are two properties that help us to identify crystalline solids.

Use your hand lense to observe the shapes of particles in each the jars solids at the front of the room. A few grains of each have been put on the colored papers next to each bottle. Please don't spill them.

Substance	General Shape of the Particles	Does it Appear Crystalline?
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

11. Which powder appears the most obviously crystalline? _____

Which of these powders does not appear to be crystalline at all? _____

12. Find the two rocks marked with their rock names. (Basalt and gabbro) Which of these rocks probably cooled the fastest? _____

How can you tell? _____

13. A third rock has large crystals just at one side. It's from a xenolith. Describe the change in crystal size. _____

How could it have formed? _____

Wrap-Up:

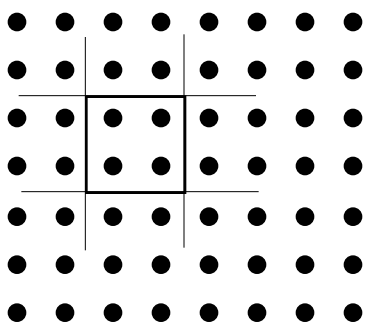
- A. What do crystals look like? That is, how can we recognize a substance as crystalline? _____
- B. Describe how quartz crystals are different from halite (rock salt) crystals. (See the diagrams on page 1.)

- C. What determines the size of the crystals? _____
- D. If we find a rock with larger crystals at one end than at the other, what can we conclude about the formation this rock?

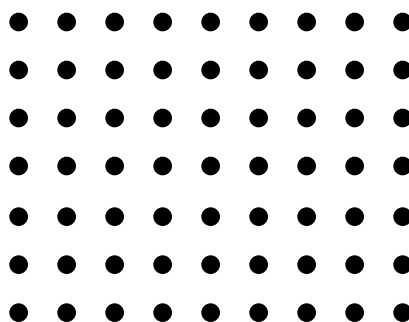
- E. Predict the shapes of crystals that might form in each of the arrangements of atoms below. Draw the crystal shapes so that the edges fall between or along the rows of atoms, but the shapes must be able to fit tightly together to fill the whole space. The first diagram shows you how it works. Draw a different shape of crystals for each of the next five diagrams. 1-3 and 4-6 are identical, but you should show three *different* crystal patterns that could develop within each of these patterns of atoms. Note the diagrams on page 1.

Examples:

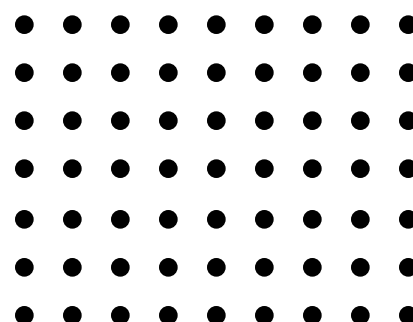
Solid #1 (Halite/Rock Salt)



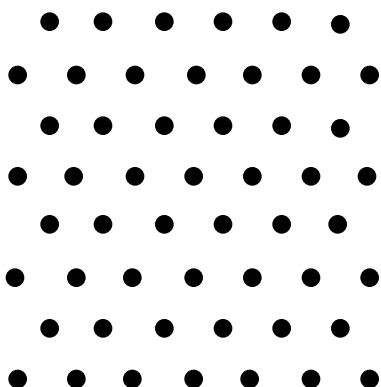
Solid #2



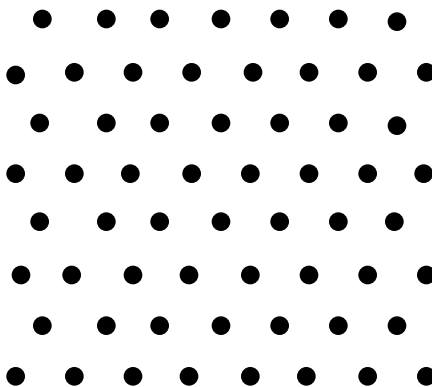
Solid #3



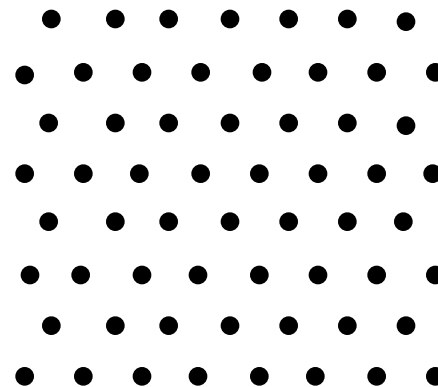
Solid #4 (Quartz)



Solid #5 (Calcite)



Solid #6



- F. What determines the characteristic shape of the crystals in any substance? _____

Extension: Prepare a brief report on the the six crystal systems used by mineralogists and crystallographers.