Penny Crystal Structure

Overview: Crystals are defined by their set, repeating patterns. Scientists have names for the types of patterns a mineral's crystals have, and they are used to classify them accordingly.

What to Learn: The way minerals break has to do with their crystal structure.

Materials

- 50 pennies
- ruler

Lab Time

1. Lay about 20-50 pennies on the table so that they are all sitting flat on the table. Now, use the ruler (or your hand) to push the pennies toward one another so that you have one big glob of pennies on the table all touching one another. Don't push so hard that they pile on top of one another. Just get one nice, big, flat blob of pennies.
2. Take a look at the pennies, do you notice anything? You may notice that the pennies form patterns. How could that happen? You just shoved them together you didn't lay them out in any order. Taa daa! That's what often happens when solids form.
3. The molecules are pulled so close to one another that they will form patterns, also known as matrices. These patterns are very dependent on the shape of the molecule so different molecules have a tendency to form different shaped crystals. Salt has a tendency to be "cubey." Go take a look … and you'll find that they are like little blocks!
4. Water has a tendency to from triangle or hexagon shapes, which is why snowflakes have six sides. Your pennies also form a hexagon shape. Solids don't always form crystals, but they are more common than you might think. A solid that's not in a crystalline form is called amorphous. Before you put your pennies away, I want you to notice one more thing.
5. Take your pennies and lay them flat on the table.
6. Push them together so they all touch without overlapping.
7. Place your ruler on the right-hand side of your pennies so that it's touching the bottom half of your pennies.
8. Slowly push the ruler to the left and watch the pennies. You may have noticed that the penny "crystal" split in quite a straight line. This is called cleavage. Since crystals form patterns the way they do, they will tend to break in pretty much the same way you saw your pennies break.
9. Break an ice cube and take a look. You may see many straight sections. This is because the ice molecules "cleave" according to how they formed. The reason you can write with a pencil is due to this concept. The pencil is formed of graphite crystal. The graphite crystal cleaves fairly easily and allows you to write down your amazing physics discoveries!

Penny Crystal Observations

Draw your penny crystal structure in the space on the left, and after it was "cleaved" on the right.

Reading

The atoms in a solid, as we mentioned before, are usually held close to one another and tightly together. Imagine a bunch of folks all stuck to one another with glue. Each person can wiggle and jiggle but they can't really move anywhere. Atoms in a solid are the same way. Each atom can wiggle and jiggle but they are stuck together. In science, we say that the molecules have strong bonds between them. Bonds are a way of describing how atoms and molecules are stuck together.

There's nothing physical that actually holds them together (like a tiny rope or something). Like the Earth and Moon are stuck together by gravity forces, atoms and molecules are held together by nuclear and electromagnetic forces. Since the atoms and molecules come so close together they will often form crystals.

Exercises

1. Draw an arrangement of atoms in a crystal:

2. How are atoms stuck together?
    a. They have bonds between them.
    b. Gravity

    c. None of these
3. What is a crystal pattern called?
    a. Revelation
    b. Matrix
    c. Lattice
    d. Mineral
4. Circle a few other crystalline substances that you could find nearby:
    a. Chalk
    b. Paper
    c. Soap
    d. Graphite in pencil
    e. Ice cube
    f. Paper towel

Answers to Exercises: Penny Crystal Structure

1. Draw an arrangement of atoms in a crystal: (should show the atoms close together)
2. How are atoms stuck together? (bonds between them)
3. What is a crystal pattern called? (matrix)
4. Circle the examples of other crystal-like substances: (Graphite in a pencil, ice cube, chalk, etc.)