LABORATORIES

Lab- Carbon Allotropes

Background:
Carbon occurs in several different forms known as allotropes. These allotropes are characterized by differences in bonding patterns which result in substances with distinctly different properties. The three allotropes that will be studied in this lab are: graphite, diamond and fullerene.

Diamonds are a colorless, crystalline solid where each carbon atom is bonded to four others in a network pattern. This bonding structure makes diamond the hardest material known.

Graphite is a soft , black crystalline solid of carbon where the carbon atoms are bonded together in layers. Within each layer, each carbon atom is bonded to 3 other carbon atoms. Because the adjacent layers are held together by weak London dispersion forces graphite is very soft.

The most recently discovered allotrope of carbon is the fullerene. Fullerenes are a cage like spherical structure of bonded carbon atoms. The fullerene bonding pattern resembles a soccer ball. Fullerene particles are also referred to as nanoparticles and are being explored for a variety of applications.

Objective:
Students will be able to:
1. Describe how elements can exist as 2 or more different structures.
2. Distinguish between different allotropes based on structural analysis and properties.
3. Analyze how the bonding structure could influence the properties.
4. Distinguish between crystalline and amorphous structures.
5. Compare and contrast the 3 different carbon allotropes.

Materials:
Molecular model kits   digital camera

Procedure:
1. Students at each lab table will work as a group using 3 model sets.
2. Build two sheets of graphite using 15 carbon atoms for each sheet
3. Take a digital picture of the model created and include it in your report
4. Examine the structure and answer the related questions in the conclusion
5. Take the graphite model apart and build a diamond with the 30 atom.
6. Take a picture of the model and include it in your report.
7. Examine the model and answer the related questions in the conclusion.
8. Examine the model of the fullerene and take its picture for your report

Lab Data Sheet

Analysis & Conclusion

Picures

Graphite	Diamond	Fullerene

Questions:

1. Define allotrope
2. How does the arrangement of atoms differ in the above allotropes?
3. How do the properties of these three allotropes vary?
4. What relationship does the bonding pattern have to an allotrope's properties.
5. Do any of the carbon allotropes conduct electricity? Explain

Lab- Sulfur Allotropes

Background:

Allotropes of sulfur can be formed following specific heat treatments. The allotropes vary in their appearance and crystalline structure. The formation of sulfur allotropes using heat can produce noxious fumes, so the preparation of ther material will bew done by the teacher in the hood

Objective:

Students will be able to:

1. Describe how elements can exist as 2 or more different structures.
2. Distinguish between different allotropes based on structural analysis and properties.
3. Analyze how the bonding structure could influence the properties.
4. Distinguish between crystalline and amorphous structures.
5. Compare and contrast 3 different sulfur allotropes.

Materials

safety goggles	Bunsen burner	test tube	test tube holder
sulfur (powder)	vegetable oil	filter paper	cold distilled water
graduated cylinder	dropper	funnel	3 beakers (50, 100, 250 mL)
microscope	microscope slide	clamp	ring stand
wire gauze	stirring rod		

Procedure

Teacher Preparation of Allotropes

Part 1

Fill a test tube 1/3 full of powered sulfur. Make sure you keep the sulfur off the sides of the test tube. Sewt up the filter so that it can rest inside the 100 mL beaker. Heat the testtube very slowly, passing it back and forth above the flame until the powder is totally melted. Pour the liquid sulfur into the filter. As soon as the crust develops on the surface of the filter, open up the filter paper to its original shape. Have students observe with the microscope the crystals formed. They should see monoclinic sulfur, which appears as small needle shaped crystals.

Part 2

Into the 50 mL beaker, pour a small amount of vegetable oil (0.5 mL). Add a small quantity (pea size) of sulfur to the oil. Set up the ring stand, clamp and wire gauze heating assembly.Heat the mixture over a low flame for a few seconds. Using a dropper, place a few drops onto a microscope slide. Have students observe with the microscope the crystals formed.

Part 3
Fill a test tube 1/3 full with powdered sulfur. Make sure you keep the sulfur off the sides of the test tube/ Nearly fill the 250 mL beaker with cold distilled water, Heat the test tube slowly. It should melt to a yellow liquid, change to a red liquid, turn to a dark reddish brown syrup and finally change to a dark runny liquid. Under the fume hood, quickly pour the hot sulfur into the beaker of water. Leave under the fume hood overnight. Have students observe the sulfur under the microscope. They should see no crystals; a non-crystalline (amorphous) form of sulfur was formed.

Student's Tasks

1. Draw a diagram and describe the appearance for each of the substances formed in Parts 1 to 3.

Part 1 **Part 2** **Part 3**

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2.Look at the crystalline models in the reference chart and select the type that best matches what you observe.

Part 1 ________________ Part 2. __________________ Part 3 ________________

3. Define amorphous. Which sample prep appears amorphous. Give a possible explanation for why this type of structure formed.

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