Lesson Title	Don't be a Fool: Know Gold from Fool's Gold!
Length of Lesson	90 minutes
Created By	Erin Anderson
Subject	Chemistry
Grade Level	10-12
State Standards	2. c, 2.e.
DOK Level	2 & 3
DOK Application	Distinguish, Make Observations/Investigate, Differentiate
National Standards	B: Physical Science
Graduate Research Element	Pyritization is the formation of pyrite (FeS_2), which usually occurs within bays and marshes. Measuring sulfide and iron within sediments can indicate bay health over time, recording oxygen fluctuations that occurred within the sediments. Measuring the degree of pyritization of the 10 cm within the soil can indicate current bay/marsh health. I am comparing the degree of pyritization within Weeks Bay, AL and Tampa Bay, FL.

Student Learning Goal:

Students will understand that bond type affects bond strength (e.g. hardness and tenacity). Atom size and the length of the bond affect mineral density. Different atomic bonds can form the same shape.

State Standards:

2. Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.

c. Apply the definition of mass, length, volume, time, density, temperature and pressure.

e. Compare the properties of compounds according to their type of bonding.

- Covalent, ionic, and metallic bonding
- Valence electrons and bonding atoms

National Standards:

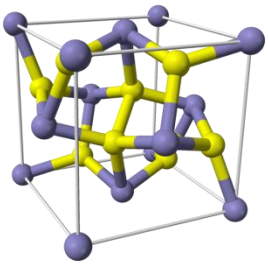
B: Physical Science: Structure and Properties of Matter:

- Atoms interact with one another by transferring or sharing electrons that are furthest from the nucleus. These outer electrons govern the chemical properties of the element.
- Bonds between atoms are created when electrons are paired up by being transferred or shared. A substance composed of a single kind of atom is called an element. The atoms may be bonded together into molecules or crystalline solids. A compound is formed when two or more kinds of atoms bind together

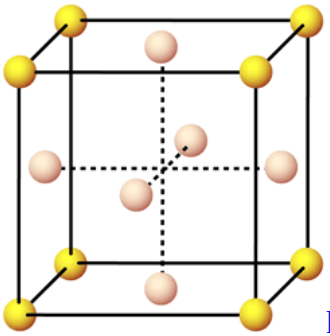
chemically.

Materials Needed (supplies, hand-outs, resources):
Large and small Styrofoam balls (colored balls preferred), straws, glue and markers.

Lesson Performance Task/Assessment:
Students will construct a straw and Styrofoam ball model of the pyrite unit cell and the gold unit cell (pictured below).



http://en.wikipedia.org/wiki/File:Pyrite-unit-cell-3D-balls.png



http://gold.yabz.com/images/gold_atom_illust.gif

Questions will be asked after the students have completed their task:

- Both pyrite and gold crystallize in the isometric crystal class (forming cubes or octagons). How will you determine whether or not a gold-colored cube is gold?
- Why are the Styrofoam balls different sizes? What does size represent? Why are the gold Styrofoam balls so much larger than iron and sulfur?
- How do the bond types and size of the atoms affect density?
- Does bond type affect the shape of a mineral's crystal? Do gold and pyrite have the same chemical bonds?

Lesson Relevance to Performance Task and Students:
Recollection and application of solid chemistry, chemical bonds and density.

Anticipatory Set/Capture Interest:

Display a PowerPoint slide discussing the "pyrite rush" in Singapore. Show slides of gold and pyrite and ask students to identify. The pictures of the gold and pyrite will both have crystal and amorphorous forms. Most likely the students will misidentify the minerals. Explain key differences between minerals and pass around pyrite samples and gold flakes.

Guided Practice:
Students will have key differences between gold and pyrite explained to them. Students will pass around pyrite samples and gold flakes. The model of the pyrite unit cell will be displayed on the SmartBoard for students to refer to while constructing their own models.

Independent Practice:
Students will compare their models to the model on the board.

Remediation and/or Enrichment:
IEP's will be supported. Students can work hands-on with drawing models of crystal structure if they need more practice.
For enrichment, details of formation of gold and pyrite minerals will be discussed. The environmental parameters required for each mineral are different.

Check(s) for Understanding:
- Is color a good way to identify gold?
- You have found a gold-colored mineral. How will you determine whether or not it is gold?
- Why are the Styrofoam balls different sizes? What does size represent? What size Styrofoam balls would you use if you were modeling gold?
- How do the bond types and size of the atoms affect density?

Closure:
Students will now know how to properly identify gold versus pyrite in case the economy goes bust. They are ready with a back-up plan.

Possible Alternate Subject Integrations:
Earth Science, Social Studies, Physical Science, Geography

Teacher Notes:
Make sure students understand that not all crystals are euhedral (perfectly shaped).
Best indicators for difference between pyrite and gold:
- Density
- Location

http://webmineral.com/java/Gold.shtml
http://webmineral.com/data/Pyrite.shtml