

Chapter 1

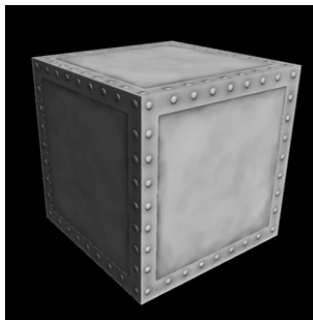
Introduction to Matter

Mrs. Valentine
Physical Science
4th and 6th Periods

Section 1

Describing Matter

- **Definition:** Matter – anything that has mass and takes up space.
- Matter has a variety of properties. Each specific substance has its own combination of properties that can be used to identify the substance.



Properties and Kinds of Matter

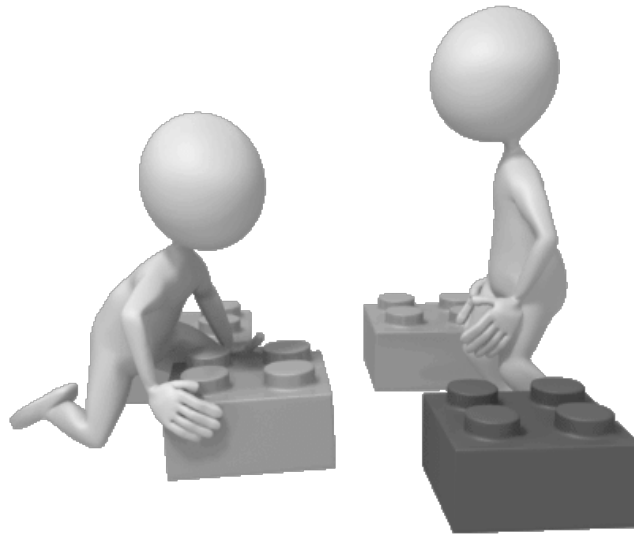
- Example – Water is a clear, colorless liquid at room temperature. Water freezes at 0°C and boils at 100°C .



- **Definition:** Chemistry – the study of the properties of matter and how matter changes.

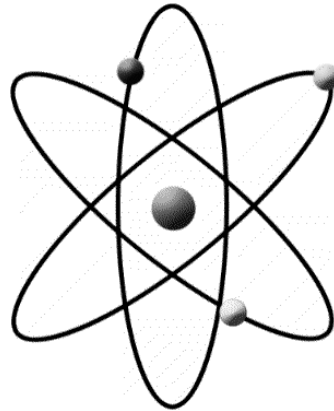
Kinds of Matter

- **Definition:** Element – a substance that cannot be broken down into any substances by chemical or physical means.
- Elements are called the building blocks of matter because all matter is composed of elements.



Kinds of Matter

- **Definition:** Atom – the smallest particle of an element.

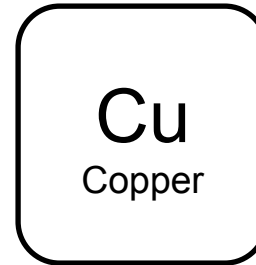
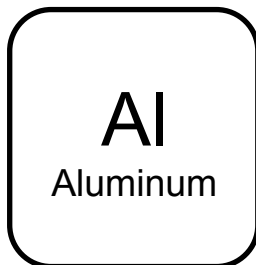
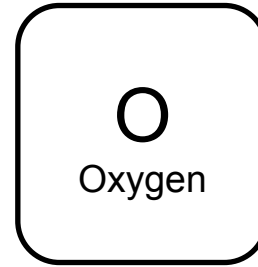
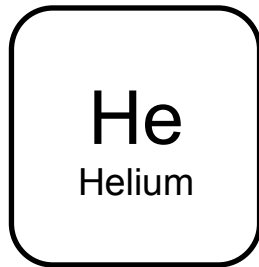


- Examples of elements – Aluminum, Zinc, Oxygen, Copper, Helium, Gold, Silver, etc.



Kinds of Matter

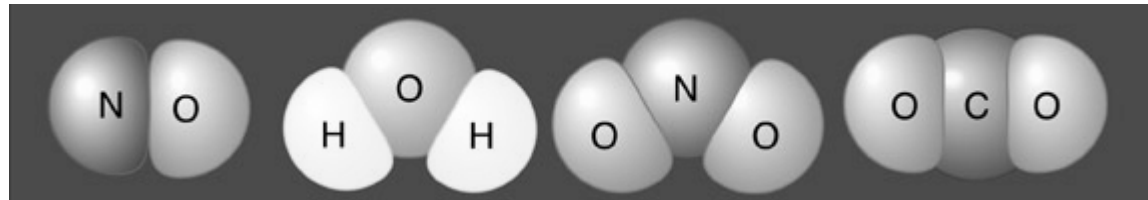
- Each element is represented by its own symbol, which is usually one or two letters.



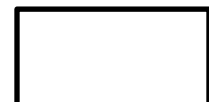
- Capitalization Counts! Incorrect capitalization can cause miscommunications.

Compounds

- **Definition:** Compound – a substance made of two or more elements chemically combined in a specific ratio.

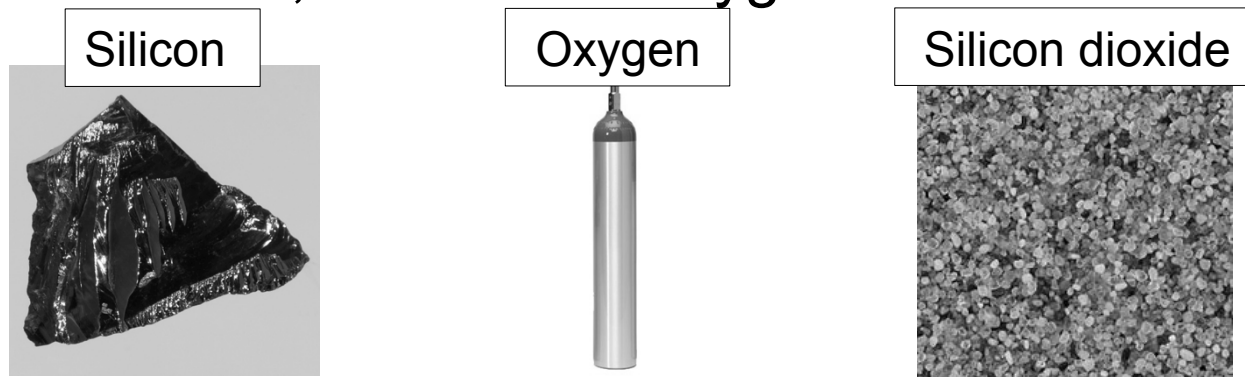


- Each compound is represented by a formula to identify which elements are present in the compound, and what ratio they are in.
- **Definition:** Formula – shows the ratio of elements in the compound.

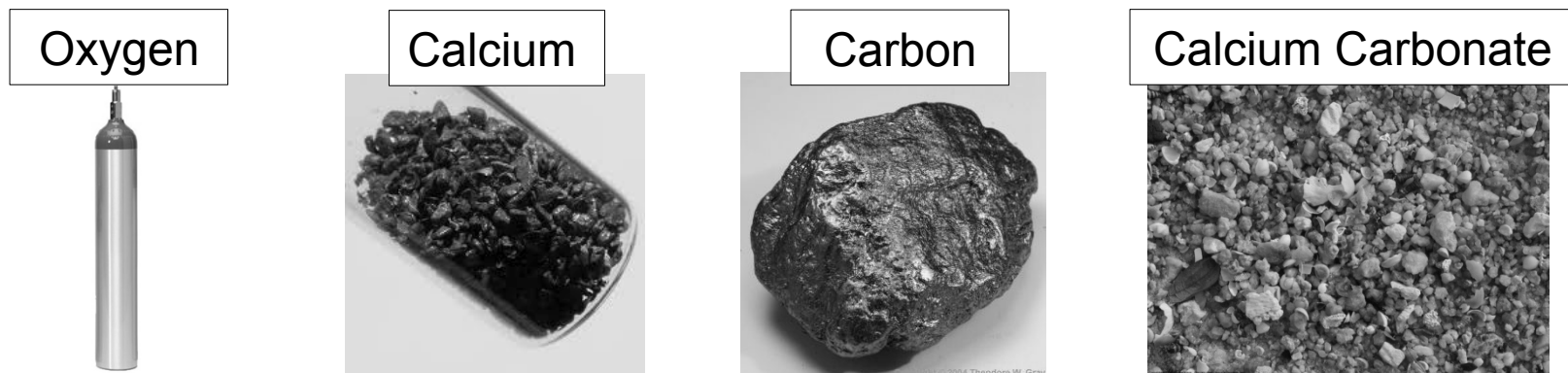


Exploring Matter at the Beach – p. 21 (on p.1 in packet)

- Discussion: What is the difference between silicon dioxide and its elements, silicon and oxygen?

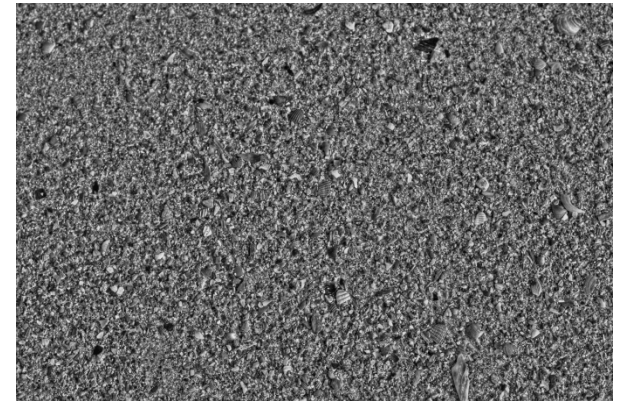
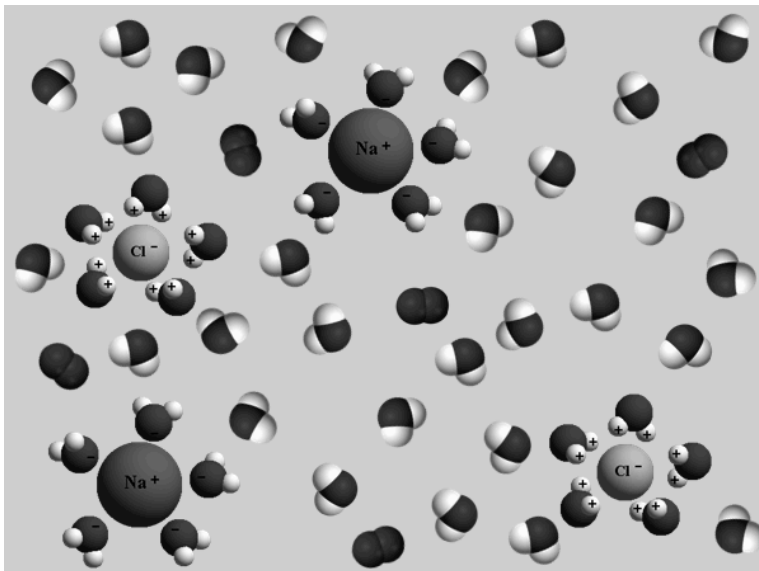


- Discussion: What is the difference between calcium carbonate and its elements, calcium, carbon and oxygen?



Mixtures

- **Definition:** Mixture – made from two or more substances that are together in the same place but are not chemically combined into a new substance.



- Example – Water, in nature, is a mixture of water, oxygen, salts, and other substances.

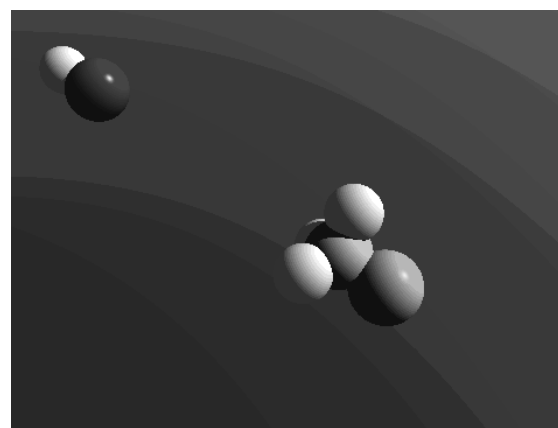
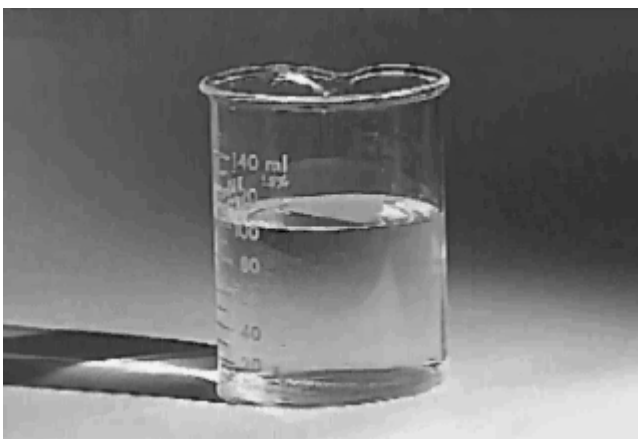
Changes in Matter

- **Definition:** Physical Change – a change that alters the form or appearance of a material but does not make the material into another substance.
- The three major states of matter: solid, liquid, and gas.
- When a substance freezes or boils, it undergoes a physical change.



Changes in Matter

- **Definition:** Chemical Change – a change in matter that produces a new substance. The new substance is made of the same elements as the old ones.
- **Definition:** Chemical Reaction – a process in which substances undergo chemical changes.



An Analogy of Physical and Chemical Changes

- A physical change –

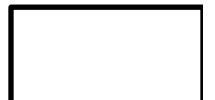
adventure → *adventure*

- The original word is still the same, just in a different form.

- A chemical change –

adventure → raven + duet

- The original word has been broken down into two, not necessarily similar, words.



Activity

- I will separate you into groups.
- There are three cards: Element, Mixture, and Compound.
- Using the knowledge we have just discussed, ask yes or no questions to try to figure out what is on the other groups cards.
- Ask questions that will be revealing. You may NOT ask “Is it an element?” “Is it a mixture?” or “Is it a compound?” Spelling questions are also prohibited.

Section 2

Measuring Matter

- **Definition:** Weight – a measure of the force of gravity on you.
- The weight of an object changes from that on Earth when moved to the moon or another planet.



Weight



Measuring Mass

- **Definition:** Mass – a measure of how much matter an object contains.
- The mass of an object does not change from that on Earth when moved to the moon or another planet.



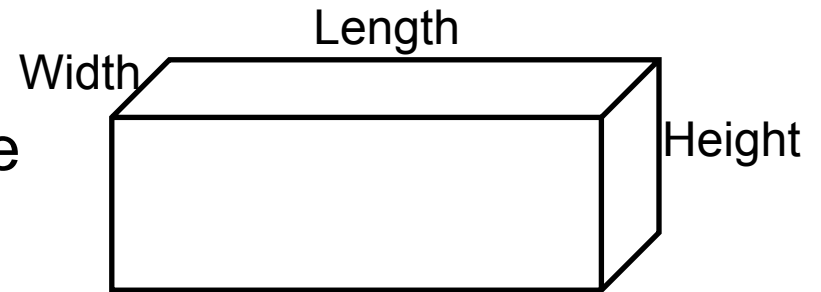
Mass



Volume

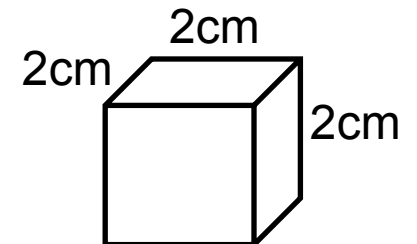
- **Definition:** Volume – the amount of space that matter occupies.

- For a rectangular object, the volume is found by multiplying the length, width, and height.



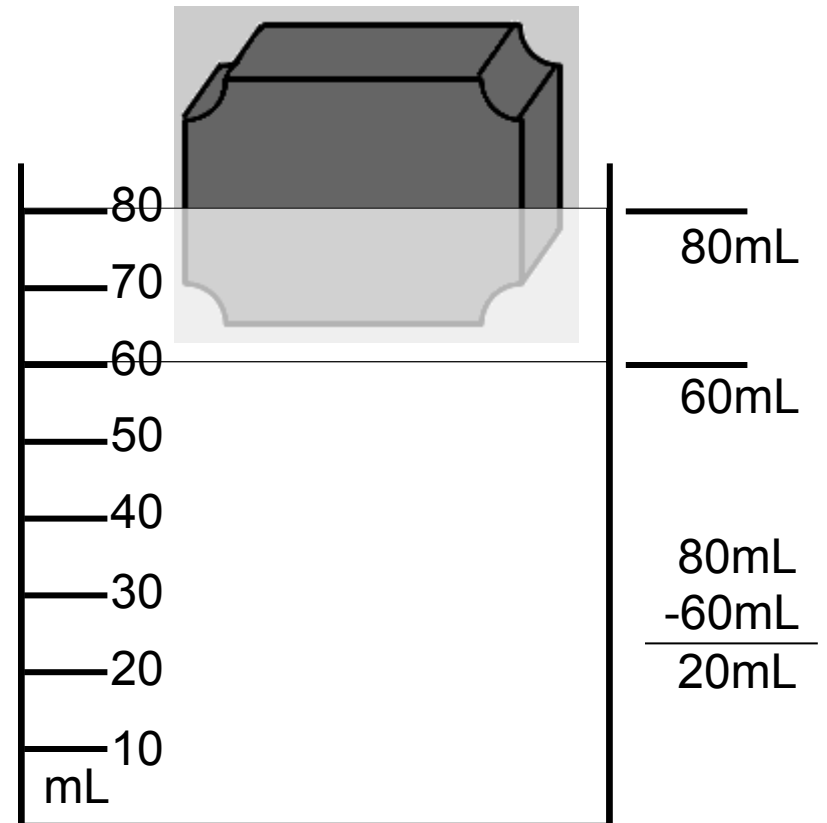
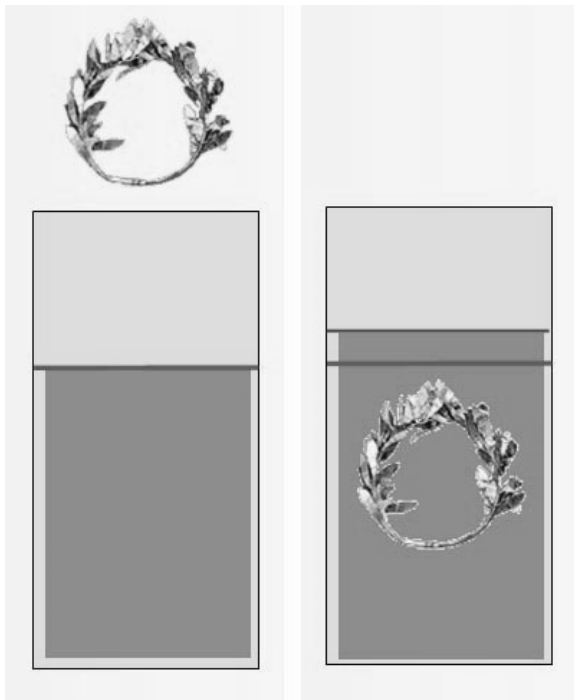
- When you multiply the measurements, you multiply the units as well.
- For example, if a block has the measurements of 2cm high by 2cm wide by 2cm long, then

$$2\text{cm} \times 2\text{cm} \times 2\text{cm} = 8\text{cm}^3 \text{ or } 8\text{mL}$$



Volume

- In order to measure the volume of an object with an irregular shape, one way to measure the volume is to put it in a graduated cylinder with water, and measure the difference in the volume of water.



Density

- **Definition:** Density – the measurement of how much mass is contained in a given volume.
- To determine the density of an object, divide its mass by its volume.

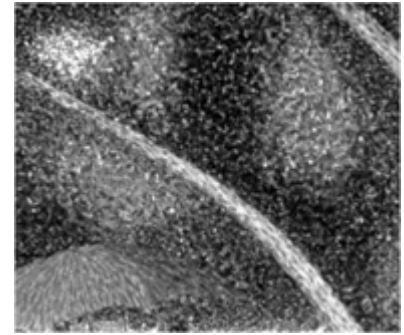
$$D = \frac{m}{V}$$

$$D = \frac{\text{heart}}{\text{heart}}$$

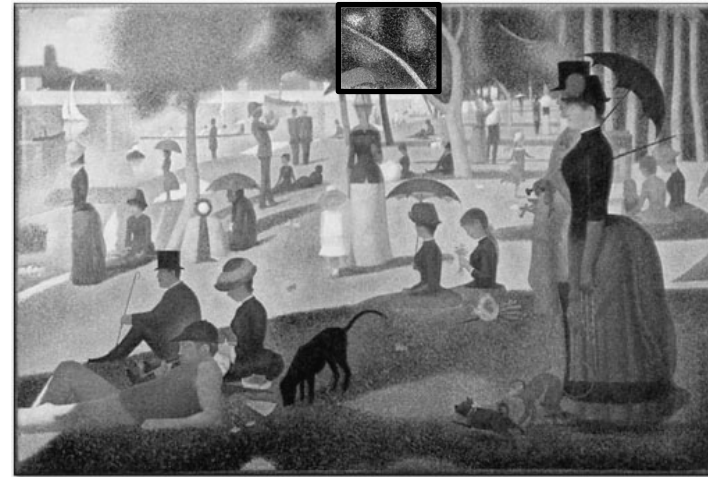
- Recall that when two units are divided and they are not the same, they do not cancel.
- The SI unit for density is kg/m^3

Section 3

Particles of Matter

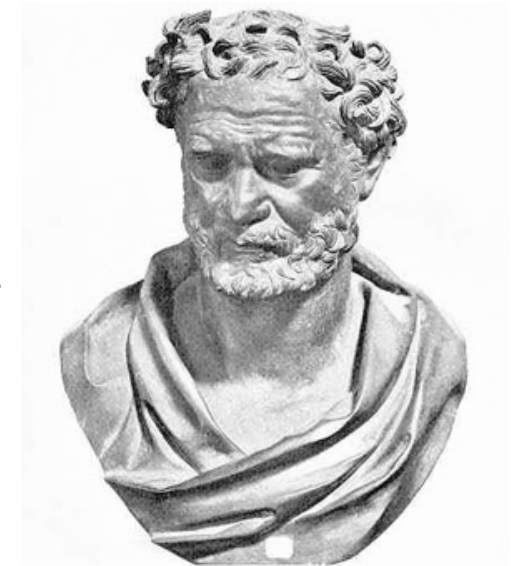


- Look at the painting on pg. 31 in your text books.
- Matter is a lot like this painting.
- From a distance, you see the whole picture with your eyes.
- When you look more closely (usually through a microscope of some kind), you can see the smaller parts that make up the matter.

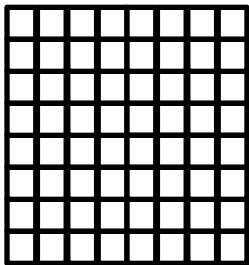


Early Ideas About Atoms

- Democritus, a Greek philosopher from about 440B.C., was one of the first philosophers to suggest that matter was made of small pieces.

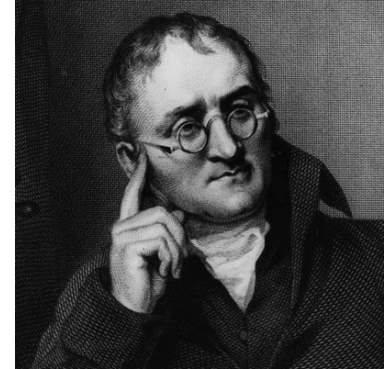


- He thought that matter could be cut into smaller and smaller pieces until the smallest piece was left.

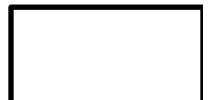


- He called this “atomos” which is Greek for “uncuttable.”

Dalton's Idea About Atoms



- John Dalton took a large step in 1802 towards our understanding the atom.
- His main conclusions:
 - Atoms can't be broken into smaller pieces.
 - In any element, all atoms are exactly alike.
 - Atoms of different elements are different.
 - Atoms of two or more elements can combine to form compounds.
 - Atoms of each element have a unique mass.
 - The masses of the elements in a compound are always in a constant ratio.



Demonstration

- On my desk there are two glasses of water.
- I'm going to shine a light through each of them.

- Write down your observations.

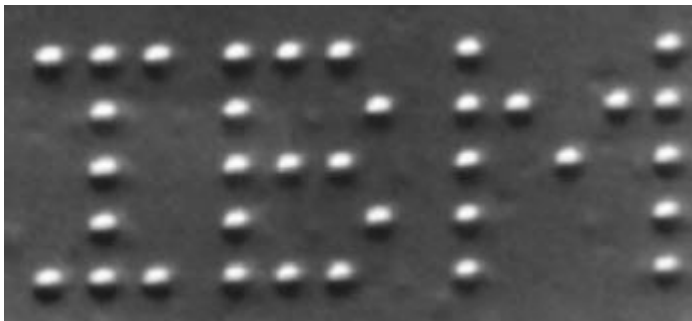
- One of these glasses has milk in it.
Which one?



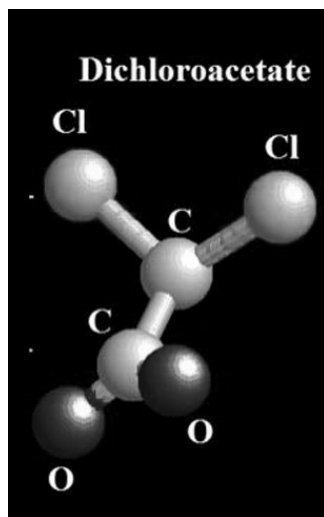
- This process is one way to detect particles that cannot be seen under normal conditions.

Ideas About Atoms Today

- Atoms used to be thought to be unable to be seen.
- Atoms are extremely small. For example, the diameter of one atom of hydrogen is $1.1 \times 10^{-10} \text{m}$.
- A piece of paper like the one you are writing on is about $1.0 \times 10^{-4} \text{m}$ thick, or approximately 1 million times as thick as one atom.

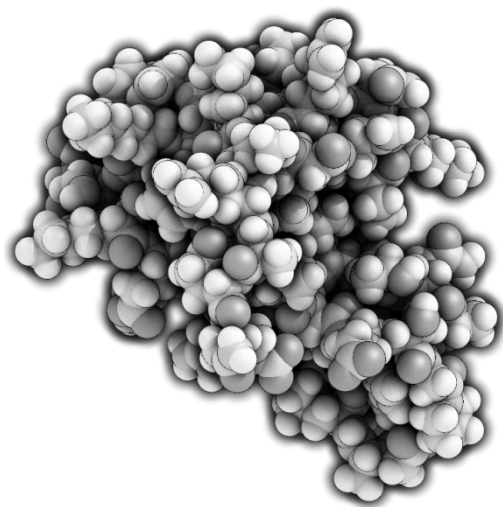


- A scanning tunneling microscope can be used to see atoms.



Atoms and Molecules

- **Definition:** Chemical Bond – the force that holds two atoms together.
- **Definition:** Molecule – a combination of two or more atoms that are bonded together.
- Molecules can be either small or large.
- The small molecule here is composed of six atoms.
- The large molecule is composed of hundreds of atoms.

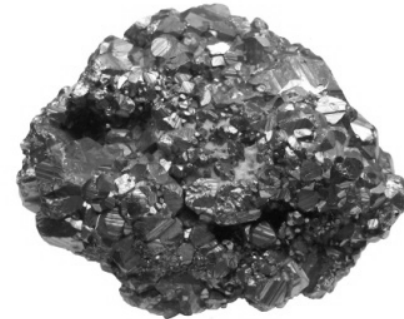


Section 4

Elements From Earth: Gold



- Gold was found in 1848 in California.
- Some people got rich, some people left empty-handed, and some found pyrite, or “fools gold.”



- Pyrite is made of iron and sulfur.
- Gold can be separated from other materials in a mixture because of its density.

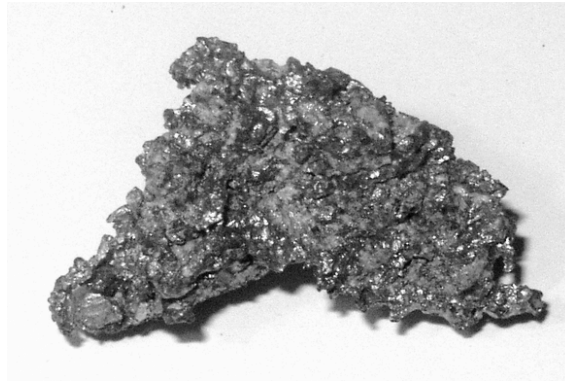
Gold and Density

- To separate the gold from its surroundings, miners use a technique called panning.
- The gold and dirt are put in a pan with water and are swirled around.
- Then the water is poured off, which takes the dirt with it.
- Since the gold is so much more dense than the dirt and water, it stays behind in the pan.



Copper and Electrolysis

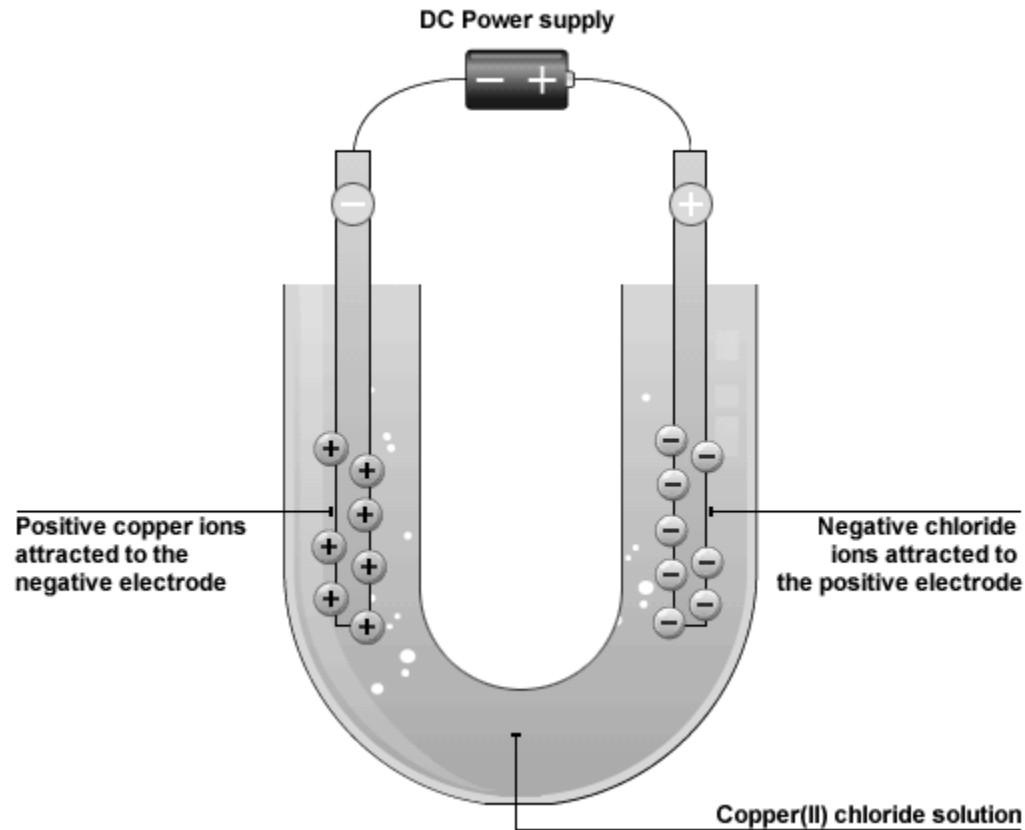
- Many elements are found in nature as part of a compound, such as ore.



- In order to obtain the element, it may be necessary to cause a chemical reaction.
- A method commonly used to break down copper compounds is electrolysis.
- **Definition:** Electrolysis – electric cutting.

Electrolysis

- **Definition:** Electrodes – metal strips attached to wires, which are attached to a source of electric current, such as a battery.



Iron and the Blast Furnace

- Iron is use a lot in industry, including as a major component of steel.



- It is separated from its ore in a blast furnace.
- The iron ore is mixed with coke (which contains carbon) and is then heated to a very high temperature.
- The carbon from the coke reacts with the oxygen in the ore to leave behind elemental iron.

Chapter 1 Review

Answer questions
1-14, 16, 20-22
on pages 42-43.

Frank, D. V., Little, J. G., Miller, S., Pasachoff, J. M., &
Wainwright, C. L. (2001). *Physical science*.
Needham, Mass.: Prentice Hall.

