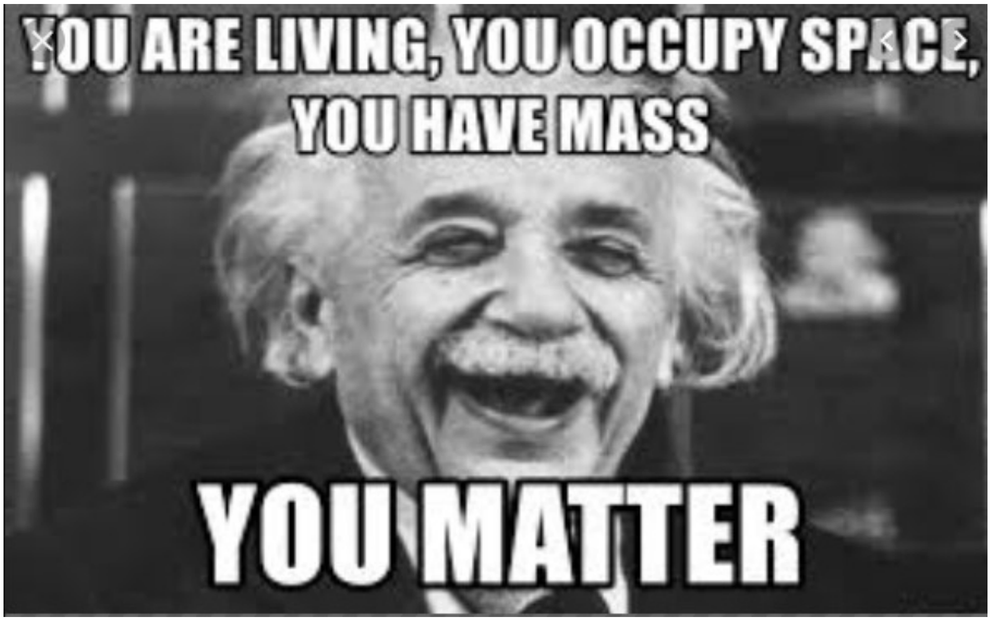
Unit 1: Matter and Measurement



Monday	Tuesday	Wednesday	Thursday	Friday

Read/Write

Read/Write: Read the article about the 5 states of matter and Write 3 facts you learned from the article, 2 things you found interesting and 1 question you have.

Matter: Definition & the Five States of Matter
By Mary Bagley, Live Science Contributor | April 11, 2016
Five phases

There are five known phases, or states, of matter: solids, liquids, gases, plasma and Bose-Einstein condensates. The main difference in the structures of each state is in the densities of the particles.

Solids - In a solid, particles are packed tightly together so they are unable to move about very much. Particles of a solid have very low kinetic energy. The electrons of each atom are in motion, so the atoms have a small vibration, but they are fixed in their position. Solids have a definite shape. They do not conform to the shape of the container in which they are placed. They also have a definite volume. The particles of a solid are already so tightly packed together that increasing pressure will not compress the solid to a smaller volume.

Liquids - In the liquid phase, the particles of a substance have more kinetic energy than those in a solid. The liquid particles are not held in a regular arrangement, but are still very close to each other so liquids have a definite volume. Liquids, like solids, cannot be compressed. Particles of a liquid have just enough room to flow around each other, so liquids have an indefinite shape. A liquid will change shape to conform to its container. Force is spread evenly throughout the liquid, so when an object is placed in a liquid, the liquid particles are displaced by the object.

The magnitude of the upward buoyant force is equal to the weight of the fluid displaced by the object. When the buoyant force is equal to the force of gravity pulling down on the object's mass, the object will float. This principle of buoyancy was discovered by the Greek mathematician Archimedes who, according to legend, sprang from his bath and ran naked through the streets shouting "Eureka!"

Particles of a liquid tend to be held by weak intermolecular attraction rather than moving freely as the particles of a gas will. This cohesive force pulls the particles together to form drops or streams.

Scientists reported in April 2016 they had created a bizarre state of matter, one that had been predicted to exist but never seen in real life. Though this type of matter could be held in one's hand as if it were a solid, a zoom-in on the material would reveal the disorderly interactions of its electrons, more characteristic of a liquid. In the new matter, called a Kitaev quantum spin liquid, the electrons enter into a sort of quantum dance in which they interact or "talk" to one another. Usually when matter cools down the spin of its electrons tends to line up. But in this quantum spin liquid, the electrons interact so that they affect how the others are spinning and never align no matter how cool the material gets. The material would behave as if its electrons, considered indivisible, had broken apart, the researchers reported April 4, 2016, in the journal Nature Materials.

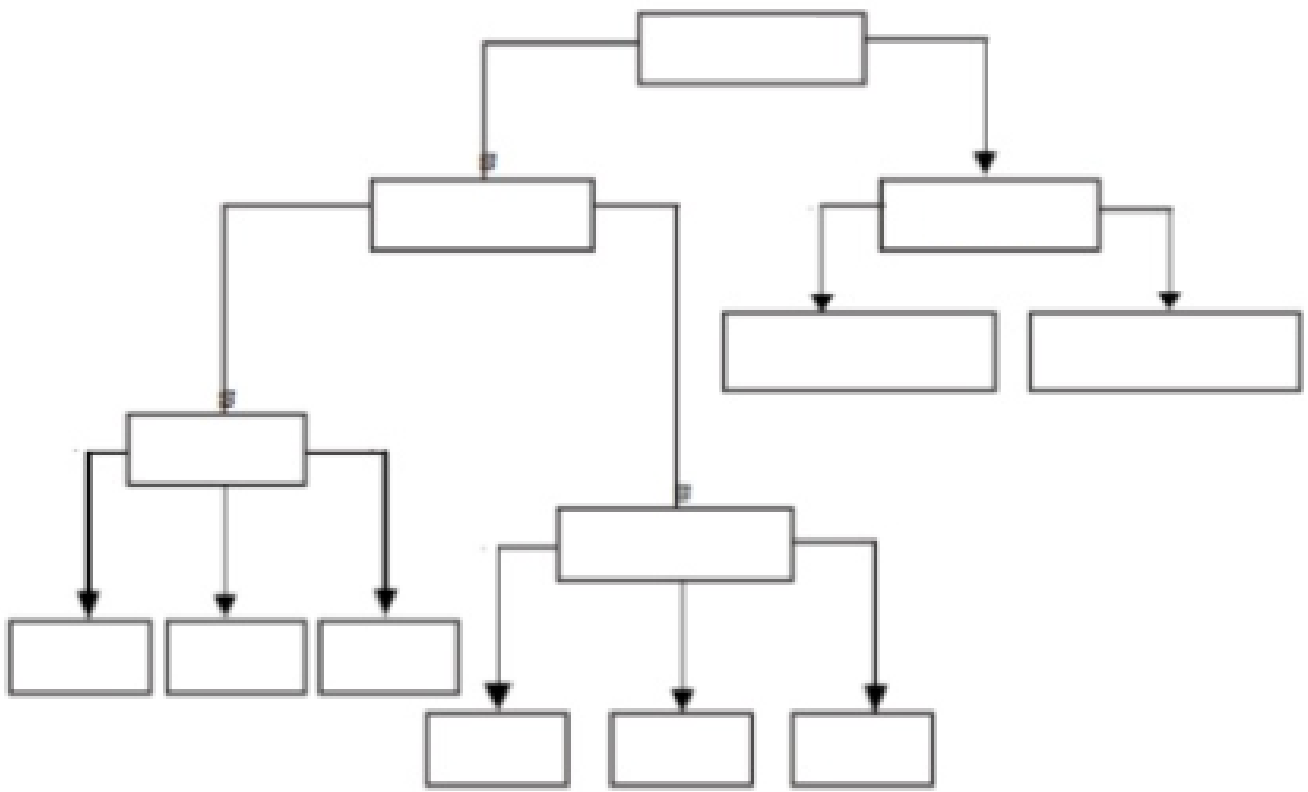
Gases - Gas particles have a great deal of space between them and have high kinetic energy. If unconfined, the particles of a gas will spread out indefinitely; if confined, the gas will expand to fill its container. When a gas is put under pressure by reducing the volume of the container, the space between particles is reduced, and the pressure exerted by their collisions increases. If the volume of the container is held constant, but the temperature of the gas increases, then the pressure will also increase. Gas particles have enough kinetic energy to overcome intermolecular forces that hold solids and liquids together, thus a gas has no definite volume and no definite shape.

Plasma - Plasma is not a common state of matter here on Earth, but may be the most common state of matter in the universe. Plasma consists of highly charged particles with extremely high kinetic energy. The noble gases(helium, neon, argon, krypton, xenon and radon) are often used to make glowing signs by using electricity to ionize them to the plasma state. Stars are essentially superheated balls of plasma.

Bose-Einstein condensates - In 1995, technology enabled scientists to create a new state of matter, the Bose-Einstein condensate (BEC). Using a combination of lasers and magnets, Eric Cornell and Carl Weiman cooled a sample of rubidium to within a few degrees of absolute zero. At this extremely low temperature, molecular motion comes very close to stopping altogether. Since there is almost no kinetic energy being transferred from one atom to another, the atoms begin to clump together. There are no longer thousands of separate atoms, just one "super atom." A BEC is used to study quantum mechanics on a macroscopic level. Light appears to slow down as it passes through a BEC, allowing study of the particle/wave paradox. A BEC also has many of the properties of a superfluid — flowing without friction. BECs are also used to simulate conditions that might apply in black holes.

Matter

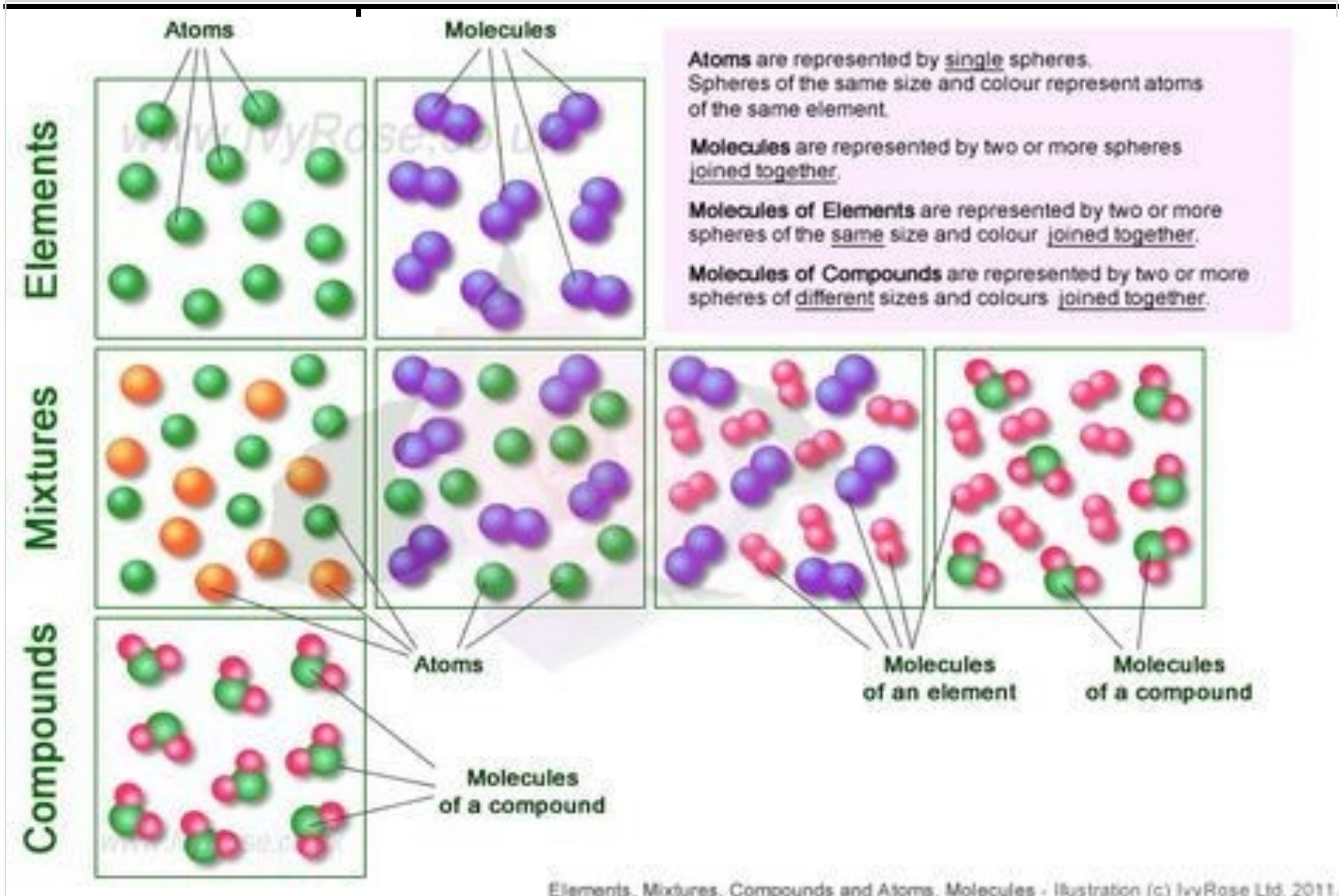
Matter —



Separating Mixtures

Filtering **Decanting** **Distillation** **Chromatography**	**Separation Techniques**

Particulate Level Diagrams



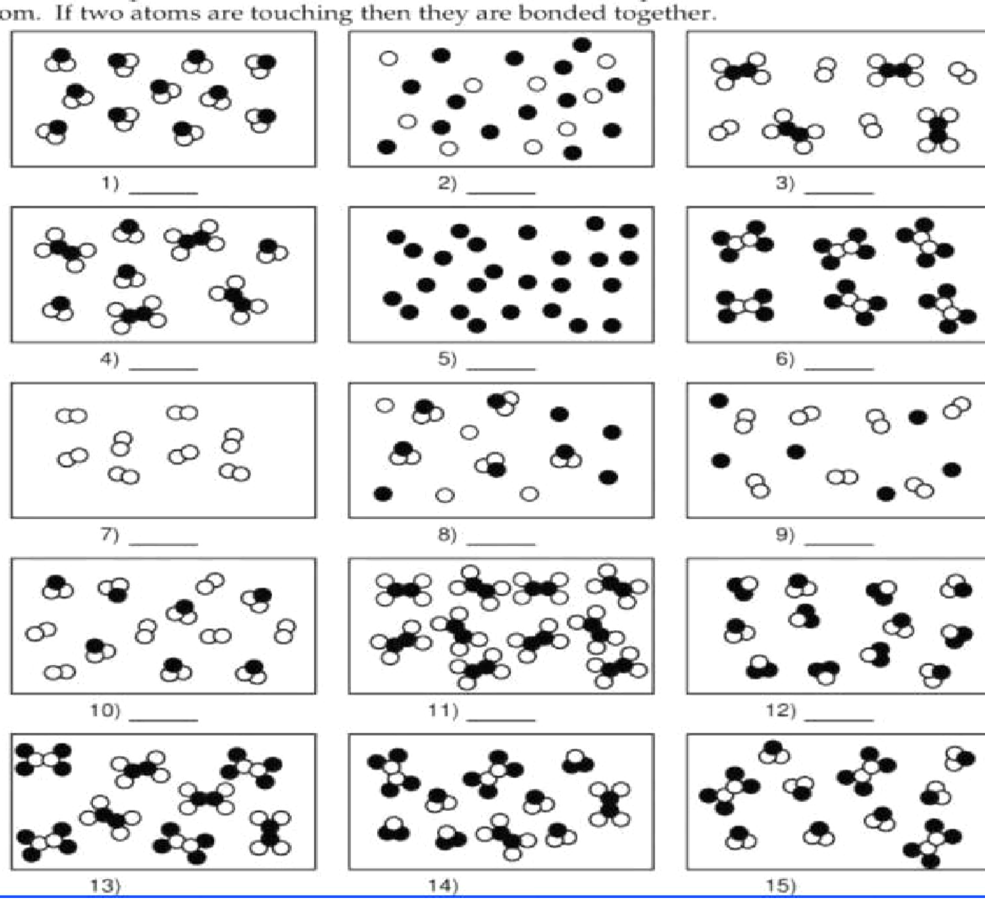
Particle Level Practice

Elements, Compounds, and Mixtures

Classify each of the pictures below by placing the correct label in the blanks below:

- A= Element
- B= Compound
- C= Mixture of elements
- D= Mixture of compounds
- E= Mixture of elements and compounds

Each circle represents an atom and each different color represents a different kind of atom. If two atoms are touching then they are bonded together.



Physical and Chemical Properties and Changes

Physical changes involve changes in attractive forces BETWEEN molecules.

Chemical changes involve a change in attractive forces WITHIN molecules.

Lab: Chemical and Physical Changes

Purpose: To determine whether certain changes in matter are chemical or physical, and to describe the changes in detail using observational skills.

Procedure:

Change 1:

1. Fill a test tube about ½ full of water, and place it in the test tube rack.
2. Add a small scoop of sodium bicarbonate (baking soda) to the test tube.
3. Stopper the tube, and shake it carefully to dissolve the sodium bicarbonate.
4. Add about 2 mL of acetic acid solution (vinegar). Write down your observations.

Discard your solution into the SOLUTIONS waste container

Change 2:

1. Get about a 2.5 cm piece of calcium carbonate (chalk).
2. Use a mortar and pastel to crush the chalk, Write down your observations.

Discard the remains into the garbage can.

Change 3:

1. Add about 1 mL of acetic acid to a test tube, and place it in the test tube rack
2. Add 1 drop of phenolphthalein (FEEN-ALL-THAL-EEN).

Write down your observations and save this solution for Change 4.

Change 4:

1. Add sodium hydroxide 1 drop at a time to your solution from Change 3.
2. Once a noticeable change occurs, write down your observations.

Discard your solution into the SOLUTION waste container.

Change 5:

1. Get a test tube and fill it ¼ full of tap water.
2. Add a small scoop of sucrose (sugar) to the test tube.
3. Stopper the test tube and shake it gently to dissolve the sucrose. Write down your observations.

Pour the solution down the drain, and rinse the test tube out.

Change 6:

1. Get a DRY petri dish and add a small scoop of Sodium Polyacrylate to it.
2. With a pipette put one drop of water in at a time and write down your observations.
3. Make sure you put plenty of drops in.

Scientific Measurement

POGIL

Key Points and Extension Questions.

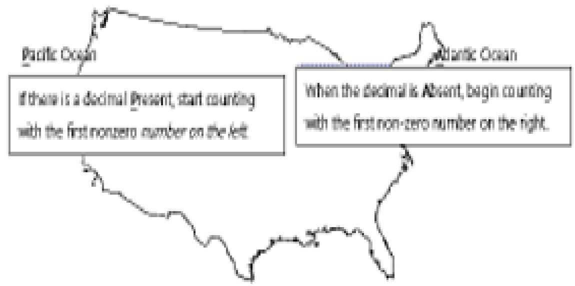
Accuracy and Precision

Density

How to count significant figures

Pg 10 Rules for Significant Figures

1. Exact numbers and conversions don't have sig figs.
2. All non-zero digits are significant, regardless of whether they occur before or after a decimal point.
3. Zeroes at the beginning of numbers are never significant.
4. Zeroes between non-zero digits are always significant.
5. Zeroes at the end of numbers are significant *only if a decimal is present*.



Calculations with Measurements