

Matter exists in different physical states

Solids and liquids and gases...oh my

States of Matter

States of matter are the different forms in which matter can exist.

There are 5 states of matter

1. Solid
2. Liquid
3. Gas
4. Plasma
5. Bose- Einstein Condensate (BEC)

Solids are like Soldiers

A solid is a substance that has a fixed volume and a fixed shape.

Solids:

- 1) Are rigid- they hold their own shape
- 2) atoms are arranged in distinct patterns
- 3) solids have definite volume and hold shape

Two types of solids

There are two types of solids:

1. Crystalline solids
2. Amorphous solids

Crystalline Solids

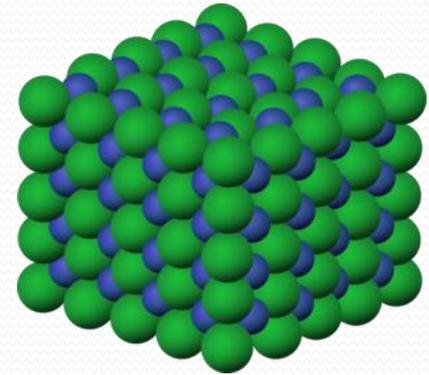
Crystalline solids: solids has a very orderly and 3D arrangement of molecules

(That's why solids are like soldiers- they are all lined up in a row)



Examples of Crystalline Solids

- Iron
- Diamonds
- Ice
- Salt



- A crystal is a solid that was slowly formed from one type of atom.



Amorphous solids

Amorphous solids are made of atoms that are in no particular order.

- There is no order or pattern
- Think of people on a crowded beach or at a concert



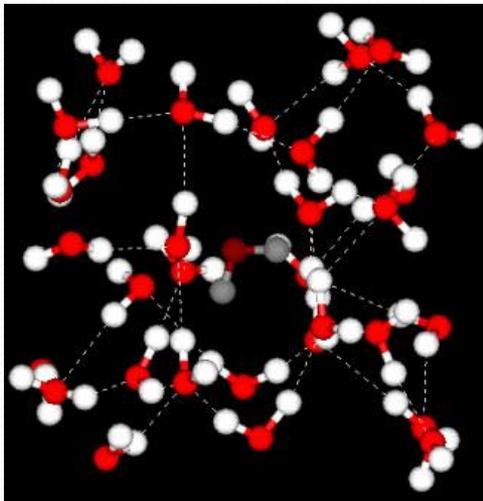
Examples of amorphous solids

- Exist in two different states:
 - A “rubbery” state
 - A “glassy” state

Examples:

- Butter
- Rubber
- Glass
- Wax

Liquids



A liquid has a fixed volume, but does not have a fixed shape

- 1) Liquids take the shape of the container
- 2) Atoms are attracted to one another and close together, but they are not in a fixed structure
- 3) Liquids have volume and mass, but no definite shape

Two properties of liquids

- **Surface tension**- the molecules on the surface of a liquid are strongly attracted to one another and form a sheet across the top.



- **Viscosity**- The resistance of a liquid to flow.
 - Honey = high viscosity
 - Water = low viscosity



A short exploration of behavior of liquids

- How do liquids behave

- Procedure:

1. Using the graduated cylinder, measure 5 ml of colored water and add it to the test tube
2. Measure 5 ml of vegetable oil, pour the oil into the test tube. Record your results
3. Pour a small amount of corn syrup directly into the test tube. Record what happens to all three liquids
4. Add 10 more ml of colored water to the test tube see what happens
5. Add 5 more ml of vegetable oil and record what happens

Questions

- 1) How did the layers change as more liquid was added?
- 2) What are some behavior of each of the liquids in this experiment to tell them apart?
- 3) What would happen if you changed the order in which you added the liquids
- 4) Challenge: Think of a liquid you are familiar with that was not used in this experiment. What do you think would happen if you added that liquid to your test tube. Explain.

Mini activity

- Run in place very fast for a minute
- Do you notice how hard you are breathing
- What are you breathing?
- Can you see the oxygen you are breathing?
 - ITS INVISIBLE AND IT'S A GAS

Giddy Gases

A gas has no fixed volume or shape

- 1) Random grouping of atoms
- 2) Really spread out and full of energy
- 3) Takes on both the shape and volume of the container

The are bounding around constantly and that's why they are giddy- just like you in my classroom



Plasmas

- Plasma is matter that does not have a definite shape or volume and whose particles have broken apart.
- Plasma is a gas that has electricity running through it.



Plasmas are the most common state of matter in the universe

- Plasma occurs naturally and makes up the stuff of our sun and the core of stars.
- On earth, plasma is naturally occurring in flames, lightning and the northern and southern lights.
- Artificial plasma include fluorescent lights

Bose-Einstein Condensation

- A BEC is a microscopic blob of atoms that lose their individual identities and shape at extremely low temperatures.
- At low temperatures, the particles lose energy and slow down and clump together to form a little drop.
- Its not longer a bunch of separate little atoms but one large dense lump. Think of a drop of water condensing out of damp air onto a cold bowl.