Chapter 3: States of Matter , Lect 1

2 pts ec

The 5 States of Matter
All matter exists in some sort of physical form or a state of matter. There are 5 states of matter:
1) _____, (2) _____, (3) _____, (4) _____,
(5) Bose-Einstein Condensate (_____)

The Particles are Moving: Matter is made up of little atoms. These are constantly moving and bumping into one another. The state of matter of a substance depends on 2 things: (1) _____ _____ and (2) _____

	SOLID	LIQUID	GAS
You Predict: How do the atoms move in the following states of matter?			
The atoms move very differently.			

Solids are Soldiers
The atoms in a solid are tightly packed together. That's why they feel hard - the closer your molecules are, the harder you are. Solids also can hold their own shape. A rock will always look like a rock unless something happens to it. Solids like their shape and don't want to change. Summary: Solids have a _____ and hold _____.

There are two types of solids: 1. _____solids 2. _____solids

Crystalline Solids
A crystalline solid has a _____ and 3D arrangement of molecules. Think of soldiers when they line up or seats in a movie theater they are all lined up, in rows and columns. That's why solids are like soldiers – they're all lined up in rows.

Examples of Crystalline Solids
- Iron, Diamonds, Ice, Salt
- A crystal is a solid that was slowly formed from one type of atom.
- We call this a _____ substance.

Amorphous solids
Amorphous solids are made of atoms that are in _____order. Think of going to the beach - you sit wherever there's room. Same thing when you go see a concert in a park. Each person has a spot, but there is no order or _____

Examples of Amorphous Solids
Amorphous solids do not have a definite melting point and can exist in two different states: a "rubbery" state, a "glassy" state. Examples: Butter, Rubber, Glass, Wax

Weird Solids
Some substances act like a solid and a liquid. Jello, Peanut Butter, Whole Milk, SLIME! You can spread peanut butter on bread, but peanut butter does not flow, right? It is not a liquid at room temperature. When you make Jello, it is first a liquid. You have to put it in the refrigerator so that it becomes a solid. These yummy forms of matter with properties of a liquid and a solid are called _____.

Flowing Fluids
A fluid is a form of matter that flows when any force is applied, no matter how small. Liquids are one kind of fluid, gases are another. You have seen water flow from a faucet (or overflow a sink) and felt cool air flow through an open window (or carry the aroma of cooking food into your room). Let's talk about liquids first.

Lovely Liquids
A liquid is a substance that has _____ and _____ , but _____ shape. It takes the _____ of its container. Think of what would happen if you knocked this glass of Coke over - It would spread all over the table, onto the floor, all over until it was spread out as far as it could possibly go! But when you pour it into a cup, it fills it up as much as possible.

How do liquid molecules move?
The molecules in liquid water have more _____ and move around much more than do the molecules in ice. In a liquid, molecules can slide over and around each other. This is how liquids flow and change shape. But the atoms do not have enough energy to completely break their bonds with one another. That is why liquids have _____ volume even though the shape may change. Think of the balls in a ball pit - they spread out as much as they can, to fill the shape of the pit

Liquids have a definite volume
In fact, liquids don't like to change their volume, even if they don't mind changing their shape. Example: it doesn't matter whether you pour a soda into a big glass or small glass, you'll still have the same amount and it'll take up the same amount of space (volume). But think of how hard it would be to force a liquid, or compress it, into a small space.

Two Properties of Liquids
_____ --The *resistance* of a liquid to flow. Think of pouring honey (high viscosity) vs. water (low viscosity).

_____ -- The molecules on the surface of a liquid are sometimes so strongly attracted to one another that they form a sheet across the top. This is what lets bugs like water skaters.

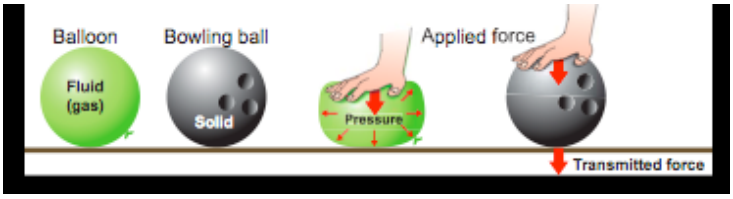
Giddy Gases
Gas is everywhere. Our atmosphere is a big layer of gas that surrounds the Earth. Gases are random groups of atoms. In solids, atoms and molecules are compact and close together. Liquids have atoms a little more spread out. However, gases are really spread out and the atoms and molecules are full of energy. They are bouncing around constantly - that's why they're giddy!

How do gas molecules move?
Remember, gas atoms and molecules move very quickly. They move so quickly, that they can completely break away from one another. When they break away, they collide and bump into one another constantly. This causes them to spread out as much as they can.

Gases _____have a definite volume
Gases can fill a container of any size or shape. Think about a balloon - No matter what shape you make the balloon it will be evenly filled with the gas atoms. The atoms and molecules are spread equally throughout the entire balloon. Liquids can only fill the bottom of the container while gases can fill it entirely.

Speaking of Balloons…
Think of helium, a gas used to blow up balloons. It is stored in metal cylinders, where the gas is packed into (or compressed into) the canister very tightly. As soon as you let the helium out into the balloon, the atoms spread out and fill the balloon. As this happens, the space between the atoms increases too.

Balloons & Pressure
Think about what happens when you push down on an inflated balloon. The downward force you apply creates forces that act sideways as well as down. This is very different from what happens when you push down on a bowling ball. The ball transmits the force directly down. Because fluids change shape, forces in fluids are more complicated than forces in solids.



Let's Talk Pressure

A force applied to a fluid creates _____. Pressure acts in _____, not just the direction of the applied force. When you inflate a basketball, you are increasing the pressure in the ball. A pressure of 30 pounds per square inch means every square inch of the inside of the ball feels a force of 30 pounds. This force acts up, down, and sideways in all directions inside the ball. This is also what makes the basketball feel solid, even though it is filled with air.

Compare the basketball to the beach ball though. Even though they have the same volume, the basketball has much more air particles compressed into it. This causes a higher pressure, which causes the basketball to feel more solid.

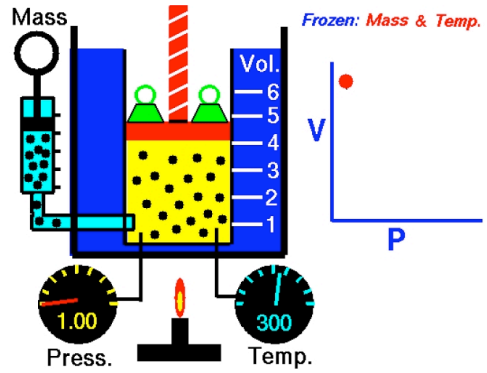
The basketball has a higher pressure than the beach ball because the greater number of particles of gas are closer together. Therefore, they collide with the inside of the ball at a faster rate.

The beach ball has a lower pressure than the basketball because the lesser number of particles of gas are farther apart. Therefore, they collide with the inside of the ball at a slower rate.

Boyle's Law

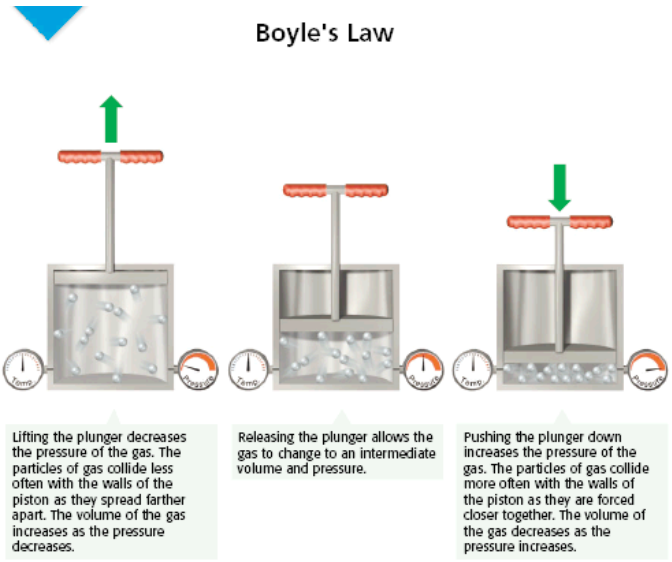
Robert Boyle wrote a law that states:

For a fixed amount of gas at a constant temperature, the volume of the gas increases as its pressure decreases.



_____= constant

↑Pressure then ↓Volume or
↓Pressure then ↑ Volume



Lifting the plunger decreases the pressure of the gas. The particles of gas collide less often with the walls of the piston as they spread farther apart. The volume of the gas increases as the pressure decreases.

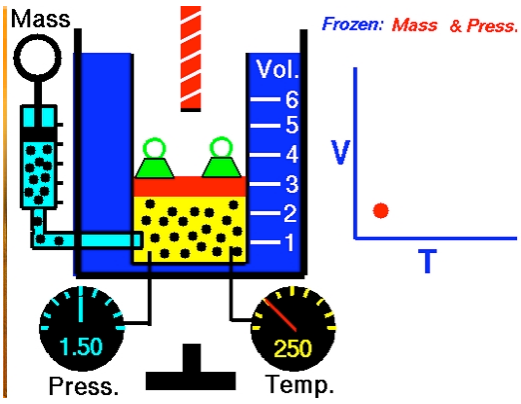
Releasing the plunger allows the gas to change to an intermediate volume and pressure.

Pushing the plunger down increases the pressure of the gas. The particles of gas collide more often with the walls of the piston as they are forced closer together. The volume of the gas decreases as the pressure increases.

Charles's Law

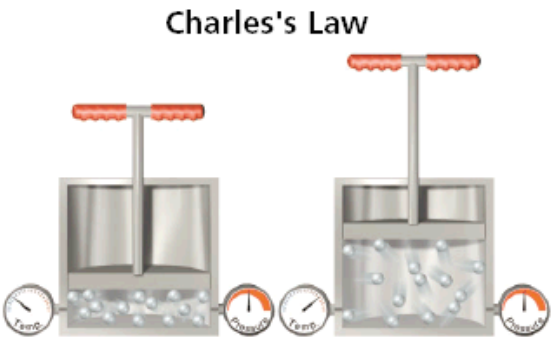
Jacques Charles wrote a law that states:

For a fixed amount of gas at a constant pressure, the volume of the gas increase as its temperature increases.



_____= constant

↑Volume then ↑ Temperature
↓Volume then ↓Temperature



Lowering the temperature of the gas causes the particles to move more slowly. They hit the sides of the piston less often and with less force. As a result, the plunger enters the piston and the volume of the gas decreases.

Raising the temperature of the gas causes the particles to move more quickly. They hit the sides of the piston more often and with greater force. As a result, the plunger is pushed upward and the volume of the gas increases.

Pulsating Plasmas

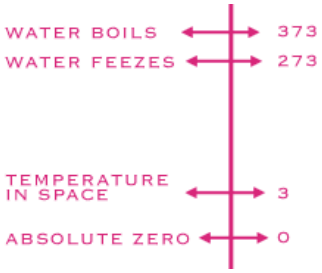
The 4th state of matter, plasma is matter that does not have a definite _____ or _____ and whose particles have broken apart. Plasma is an _____ _____, a gas into which sufficient energy is provided to free electrons from atoms or molecules and to allow both species, ions and electrons, to coexist. In other words, a plasma is a _____ that has _____ running through it.

Plasmas are the _____state of matter in the universe. Plasma occurs naturally and makes up the stuff of our sun, the core of stars and occurs in quasars, x-ray beam emitting pulsars, and supernovas. On Earth, plasma is naturally occurring in _____, _____, and the _____ (northern & southern lights). Artificial plasmas include fluorescent lights.

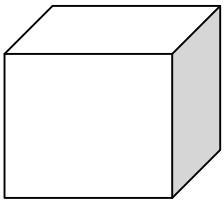
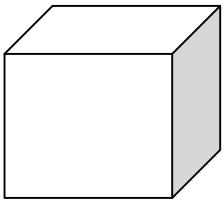
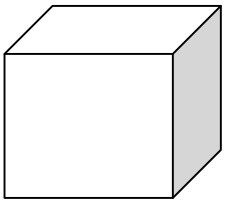
A fifth state of matter?

Scientists have found a fifth state of matter! It is called _____ and was just proven in 1995 by two men at the University of Colorado.This phenomenon was originally predicted in the 1920s by Satyendra Nath Bose and Albert Einstein. At ultra-low temperatures, we're talking cold, like "3 degrees above Absolute Zero, the coldest you can possible get", atoms begin to stop moving. Einstein wondered, what would happen if this occurred in a gas???

Remember, a gas is defined by the fact that its particles move! It took many years for us to figure out how to test this idea, but eventually, Einstein and Bose were proven correct. A BEC is a microscopic blob of atoms that lose their individual identities and shape at these extremely low temperatures. At these low temps, the particles lose energy, slow down and clump together to form a little drop. It is no longer a bunch of separate little atoms, but one large dense lump, or a drop of water condensing out of damp air onto a cold bowl. It is also referred to as a "super atom" and think of it as the opposite of plasma.



For more info: http://www.colorado.edu/physics/2000/index.pl?Type=TOC

	Solid	Liquid	Gas
3D Model			
Shape			
Volume			