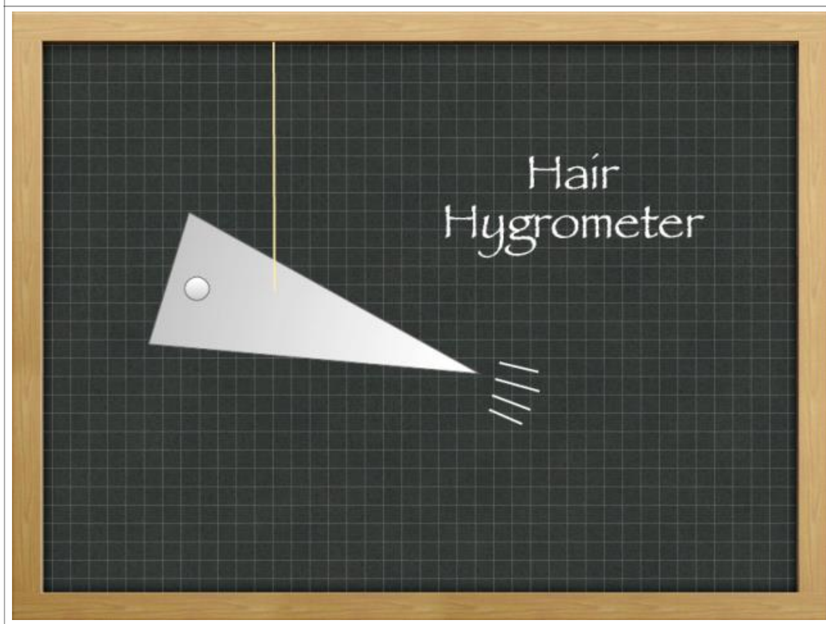
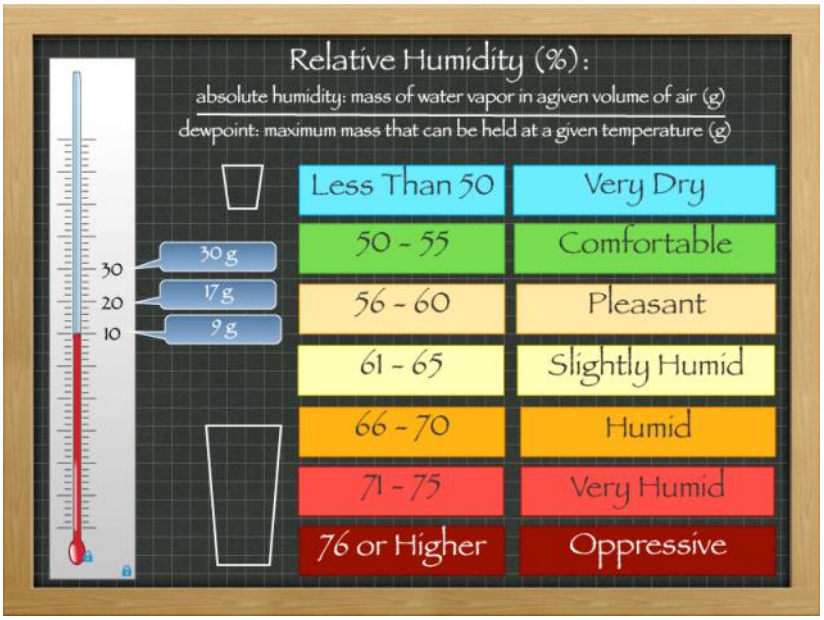
Air

Monday, September 01, 2014
7:45 AM

Slide	Notes
	In this lesson we will talk about air and what is in it. We will start off with one important component of air, water vapor. Water vapor is also known as humidity.
	Hair makes a good tool in creating a makeshift humidity measuring tool. Just cut a triangle out of cardstock, put in a sewing pin to make a pivot, and calibrate your scale to known humidity. Hair changes its length depending on the humidity in the air. You may have noticed how responsive hair is. In the winter when humidity is very low hair tends to shorten and become far more impacted by static. In humid conditions, it lengthens.

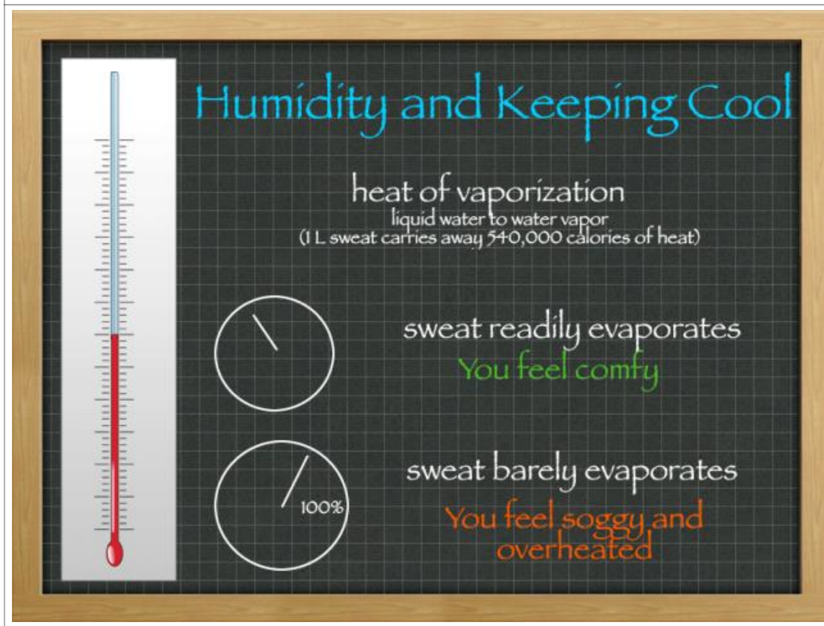


Humidity and temperature are related to each other. The higher the temperature the more water vapor the air can hold.

Compare the number of grams of water vapor there is in a given volume. At 10 degrees Celsius the air can hold a maximum of 9 grams of water vapor, at 20 degrees it can hold 17 grams, and at 30 degrees it can hold 30 grams. Essentially, it is similar to when you go out to eat. You can fill your cup all the way to the brim, but if you have a small cup, you will have less soda than in a big cup.

Look over how the percent humilities in the chart relate to comfort levels.

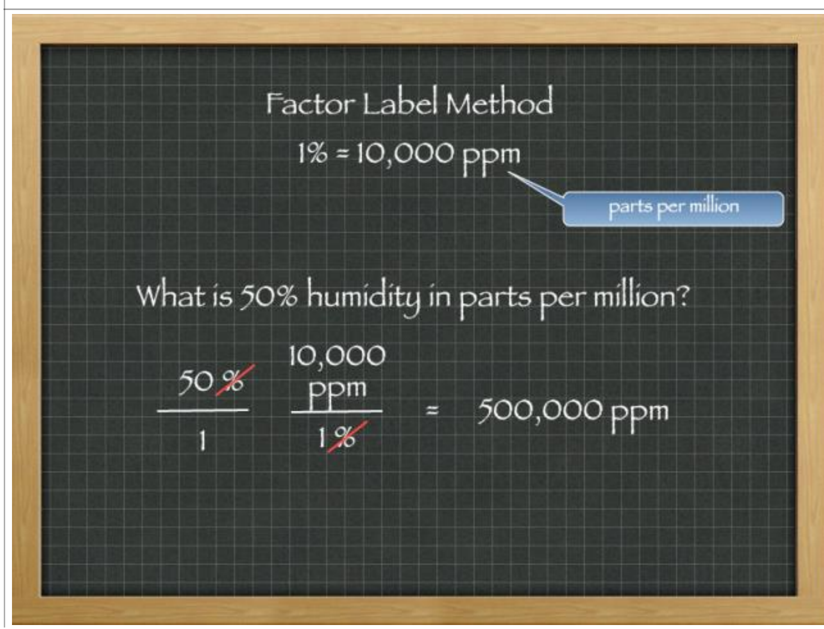
Where do the numbers com from? Relative humidity is what you have any time it is a percent. Just like a percent it is some part of a total. Relative humidity is the actual number or grams of water vapor in a given volume which is absolute humidity divided by the maximum mass of water vapor the air can hold for that volume and temperature. This is related to dew point. Dew will form on the ground when you reach these conditions.



Humidity impacts more than just your hair. It impacts your whole body on a hot day. Your body cools by sweating. The liquid water changes to water vapor at about the temperature where you start feeling too warm. This point is called the heat of vaporization. When the sweat evaporates, it caries away with it 540,000 calories of heat for every liter of sweat.

On a low humidity day, the sweat readily evaporates and you feel nice and comfy.

On a high humidly day, the air is already filling up with water vapor resulting in sweat that barely evaporates. It doesn't carry much heat away. You feel soggy and overheated.

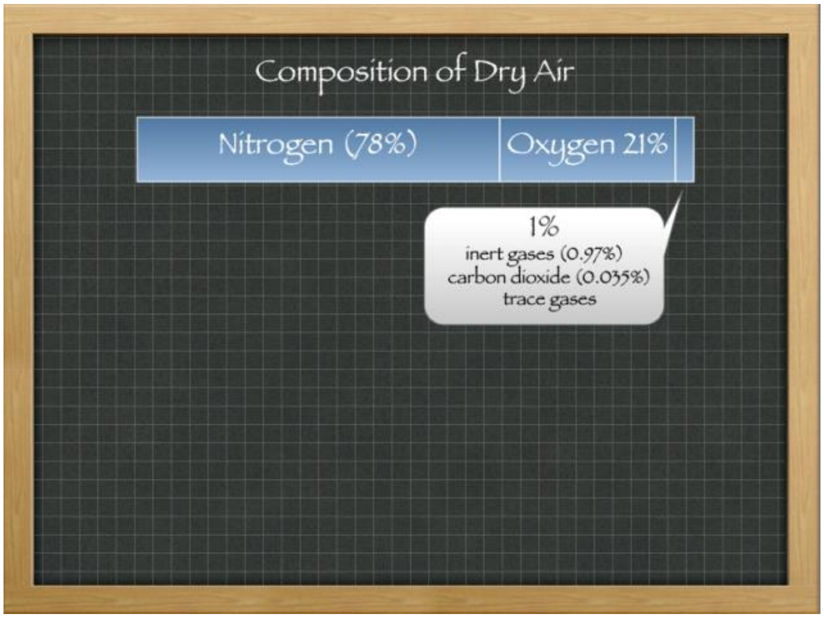
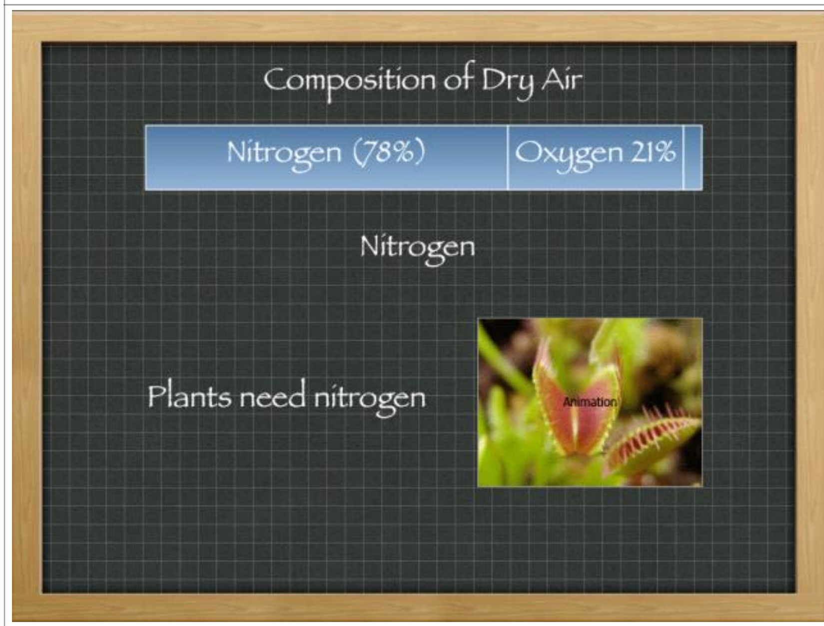


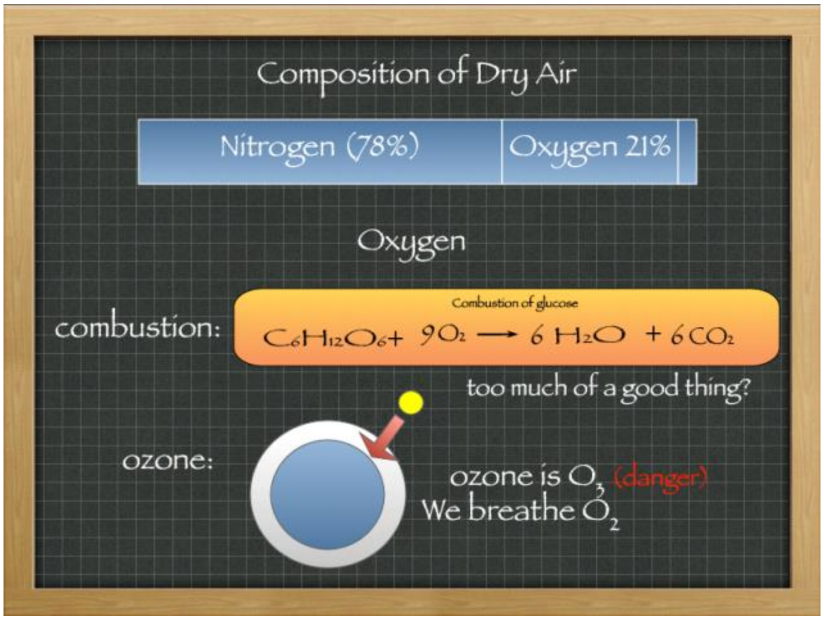
We can talk about anything in the air as a percent or we can use another unit called parts per million, ppm for short.

You need to memorize this conversion ratio: 1% is equal to 10,000 ppm. You can use this conversion fact and the factor label method that you learned in the last module to convert between the two units.

Let's try one:
What is 50% humidity in parts per million?

Take your given and put it over 1. You want your units to cancel, so put the percent in the bottom and cancel. Then plug in the1 percent and the 10,000 ppm. Now compute it. It will 500,000 parts per million. That should make sense to you: 500,000 is half of a million, or 50% of a million.

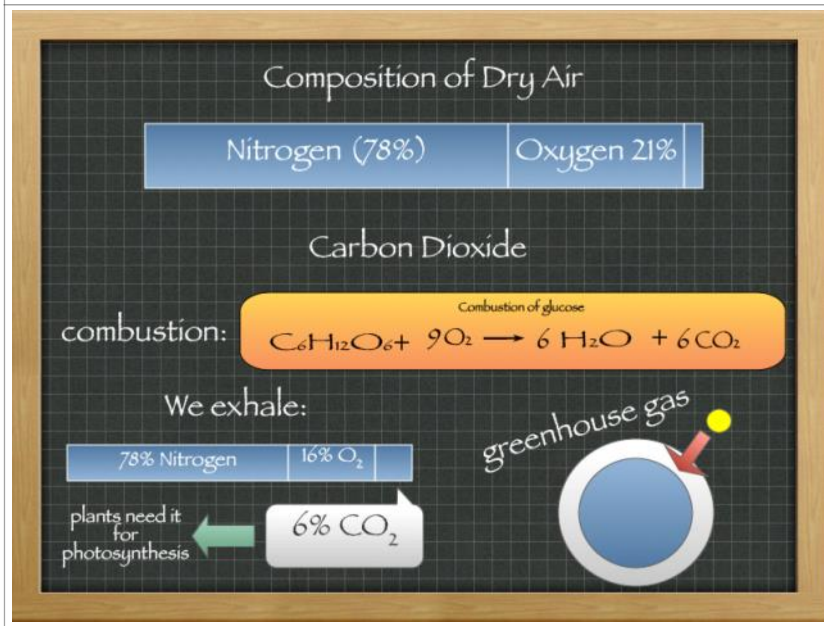
	Now that we have talked about water vapor in the air, let's take that out of our stuff in the air so that it is clean and dry. The composition now is 78% nitrogen 21% oxygen And the last 1% is a mix of inert gasses, carbon dioxide, and trace gases.
	Let's look more closely at nitrogen. Humans and animals have only a very small need for it, but plants have a fairly high need for it. The irony is that plants are surrounded so much by it, but they cannot make use of it when it is in the air. It needs to be combined with other atoms in the ground. Most plants will die in soil that is low in nitrogen, but there is one plant that finds a different source for its nitrogen than the soil. The Venus flytrap captures insects and sometimes frogs and digests them primarily for the nitrogen content. It lets them thrive in places that other plants cannot do well in.



How about oxygen. You probably already know that animals and humans need oxygen to live. This is because our cells perform a combustion reaction that uses glucose which is a type of sugar and oxygen to produce the fuel we need to power our cells.

You can get too much of a good thing though. Too much oxygen makes combustion go a little too well. Blacksmiths could get their flames hot enough to soften metal by working a bellow that increased the oxygen supply to the fire. If we get too much oxygen, we have hyperoxia - better known as hyperventilating. You get light headed and can even pass out.

The planet takes the O2 that we breathe and adds in an extra oxygen to make ozone. This we cannot breathe. It is poisonous to all living things, but high in the atmosphere it does a very important job. It takes the radiation that comes in from the sun and reduces the damage it can do by converting some of that energy into the process of splitting off an oxygen atom from the ozone to drop it back down to breathable O2 and a spare oxygen atom. Oxygen cannot stand to be alone, so it isn't long before it pairs back up to create O2 or O3 again and the whole process starts all over again.



Now, Carbon dioxide's turn.

Carbon dioxide is given off in the combustion reaction. That is why we exhale it. What may surprize you is that we also exhale 78% nitrogen and 16% oxygen. Our lungs don't seem very efficient do they. We breathe in air that has 21% oxygen and breathe out air with 16% oxygen. We only use 5% of the oxygen. That is all we need though.

The CO2 that we exhale is used by plants to produce the fuel they need in photosynthesis.

Carbon dioxide also is a greenhouse gas. It serves a function to stabilize our planet's day and night temperatures. The heat of the sun comes in to our planet. Some of the heat is immediately absorbed. The rest would bounce back out in to space, but instead it bounces off our carbon dioxide blanket of air and stays nestled to the planet. We need that held heat as the planet rotates and we move in to night. We would drop to near absolute zero if it were not for our blanket.

You probably have heard CO2 get a bad rap for causing global warming. It is a hot topic in today's society (pun intended). Do you recall hearing that our planet has gone through an ice age in the past? Our planet has a long cycle of cooling and warming. The last cool cycle was called the little ice age and it happened at about the time that the pilgrims arrived on Plymouth rock. Back in the middle ages, it was about as warm as it is now. We now this through a variety of techniques at calculating temperatures before thermometers were invented and temperature readings began to be tracked. The idea of global warming specifically states that the heating cycle we are in is largely made-made. It isn't. In the middle ages when we had our last warming cycle of about the same temperatures, it was before the industrial revolution so man didn't have an impact then. Global warming, now re-dubbed climate change, is not real. Man has too little impact to cause the temperature changes.

Pollution, on the other hand, has and in some places is making a big impact on the environment. The Unites States took important actions to control emissions from industry and cars a long time ago now and the air is much better. Other countries have yet to enact such measure and often endure a great deal of smog because of it. Here is a picture of Taiwan on a bad smog day.

One of the devices used to reduce pollutants is a catalytic converter. Most cars now have them as part of their exhaust systems. It has a catalyst in the system that raises the temperatures and works to burn up all the poorly burned fuel that might otherwise escape and combine with other components in the air to form sulfur dioxide and nitrous oxide. Mostly though, it converts carbon monoxide to harmless carbon dioxide.