

# M03 Lecture - Revised Graphics

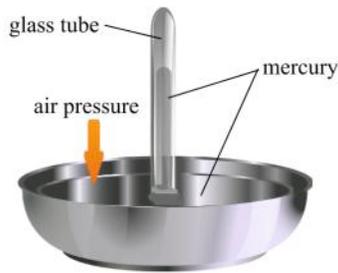
Sunday, October 09, 2011  
6:20 PM

I admit it. I just couldn't stand all the text and the blurry graphics of the original slide set. I just had to make a revised set of slides. Feel free to use them instead of the original set or use the original set as you prefer. :0)

This set is available in the M03 tab for this module.

VoiceThread <http://voicethread.com/share/2308828/>

Slides	Notes
 <p>Atmosphere</p> <p>The mass of air surrounding the planet</p>	<p>Atmosphere is the mass of air surrounding the planet.</p> <p>We are going to look at the ...</p> <ul style="list-style-type: none"><li>• Levels of the homosphere and the heterosphere</li><li>• Temperature gradients</li><li>• Gases at each level</li><li>• What happens at each level of the atmosphere</li></ul> <p>-----</p> <p>Questions that should be answered on this slide.</p> <p>The mass of air surrounding a planet <span style="float: right;">Atmosphere ▾</span></p>
 <p>Atmospheric Pressure</p> <p>small amount of water in the can</p> <p>bowl of ice water</p> <p>Use tongs or oven mits to keep from getting burned.</p>	<p>This is a lab that will be done in this module:</p> <p>Atmospheric pressure is the pressure exerted by the atmosphere on all objects within it</p> <p>It is 14.7 pounds for every square inch at sea level</p> <p>Place a small amount of water (would be about 10 mL) in the can. Heat it and use tongs to flip the can over into the ice water. The can will collapse in on itself.</p> <p>Why did the can collapse? Answer - The pressure on the inside of the can cannot push out as much as the pressure is pushing in and the pressure crushes it.</p>



Mercury barometer = 14.7 psi causes column of mercury to rise 29.9 inches above pool of mercury, therefore 14.7 psi = 29.9 in of Hg

Instrument used to measure atmospheric pressure. This is similar to an old fashioned design. Now they look a good bit different.

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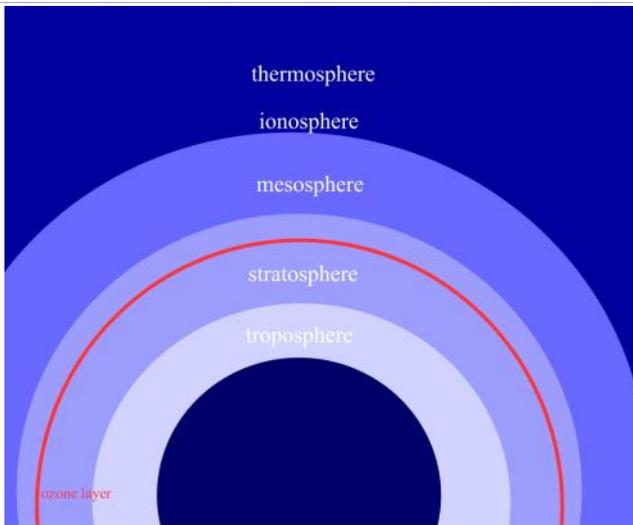
Questions from this slide:

An instrument used to measure atmospheric pressure

A barometer develops a leak in the column which is supposed to be free of air. As air seeps into the column, what will happen to the height of the liquid in that column?

Choose one answer.

- a. The height will increase
- b. The height will decrease



Homosphere includes the lower layers of atmosphere up to 80 km (50 mi) and includes the troposphere, stratosphere, and mesosphere.  
Gas composition: 78% N<sub>2</sub>, 21% O<sub>2</sub>, 1% other

Stratosphere = has ozone layer

The homosphere will contain the jet stream.

What is the jet stream? It is a narrow band of high speed winds that blow west to east. It significantly impacts weather.

Heterosphere includes the layers above the mesosphere such as the ionosphere, thermosphere, and exosphere. Exo means outside. Where would that layer go? Instructor should add it in. mostly He

Space shuttle flew in thermosphere

Ionosphere = between upper portions of mesosphere and lower portions of thermosphere (short wave radio signals can bounce off ionosphere, auroras)

For most layers, the temperature gets colder the higher you go. There is an exception to that rule though, the stratosphere layer. It actually gets warmer.

Questions from this slide:

Choose the region of the atmosphere in the following ...

If you wanted to study weather, which region of the atmosphere would you study?

If you wanted to study the ozone layer, which region would you study?

If a sample of air is predominately oxygen, did it most likely come from the homosphere or the heterosphere?

The lower layer of earth's atmosphere, which exists from ground level to roughly 80km (50 mi) above sea level

The upper level of earth's atmosphere, which exists from 80 km (50 mi) above sea level

Which regions are in the homosphere?

- Choose at least one answer.
- a. mesosphere
- b. thermosphere
- c. exosphere
- d. stratosphere
- e. troposphere

Which regions of the atmosphere are in the heterosphere?

- Choose at  a. thermosphere

Which regions of the atmosphere are in the heterosphere?

Choose at least one answer.

- a. thermosphere
- b. stratosphere
- c. exosphere
- d. troposphere
- e. mesosphere

A narrow band of high-speed winds that circle the earth, blowing from west to east

Jet stream

If you were able to measure the speed of the molecules in the air while you were traveling up through the troposphere, would the speed of the molecules increase, decrease, or stay the same as your altitude increased?

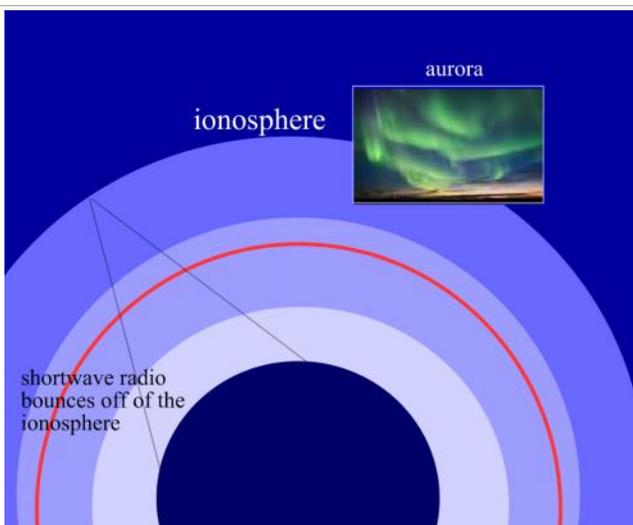
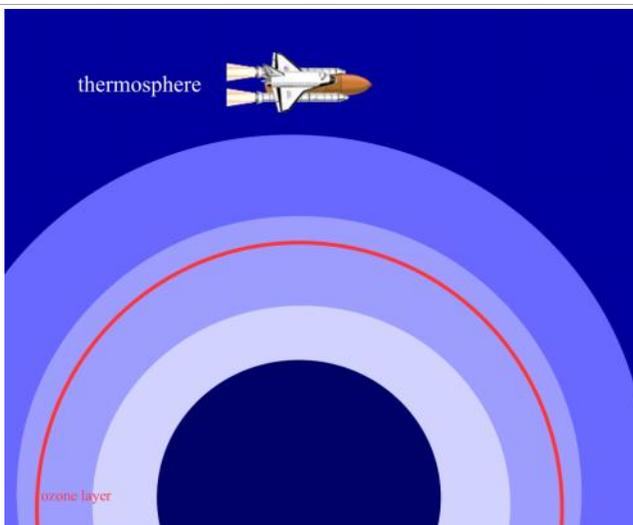
Choose one answer.

- a. stay the same
- b. decrease
- c. increase

In what region(s) of the homosphere does temperature increase with increasing altitude?

Choose one answer.

- a. stratosphere
- b. mesosphere
- c. thermosphere



SKIP past this slide!

# Heat is energy in Transit



The definition of heat is energy that is in transit.

Energy that is being transferred

Heat

We know that ice melts because of heat. Why is it also correct to say that ice also freezes because of heat?

Choose one answer.

- a. The molecules will not arrange correctly unless you have a little heat
- b. heat is energy transferred. You have to transfer heat to freeze a substance

Heat and temperature are not the same thing, but they are related.



A glass of water and a pool of water may have the same temperature, but they contain vastly different amounts of heat!

It takes much more energy to raise the temperature of the pool than it does the glass of water

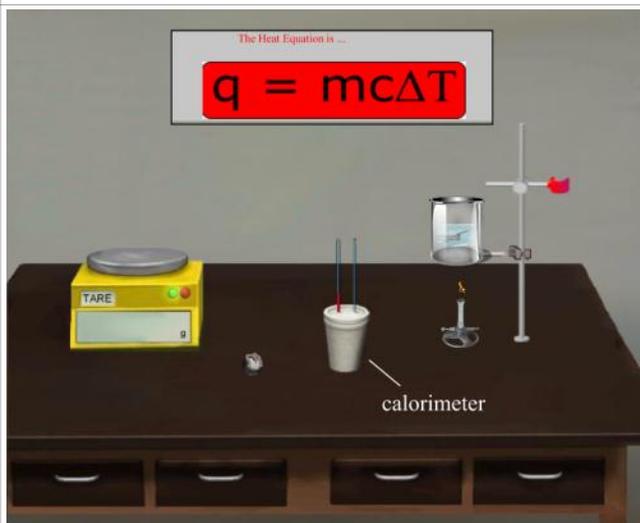
Added to screen if you want it (see upper right - black strip of color) ...

What has more heat. The ice swan or the match?

Let them think about it.

To answer it, answer this question: Can the match melt the entire swan?

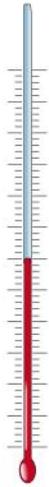
The swan actually has more heat. Strange, but true. Heat has a mass element and the swan has enough mass to make the fact that the match has higher temperature of no account. Heat and temperature are different things. The match has more temperature, but the ice swan has more heat.



Heat can be calculated with a calorimeter. There are many types of calorimeters, but this simple one with two nested Styrofoam cups is actually used by scientists out in the field quite frequently. You will do this lab when you get to high school chemistry. One of the things that you can do with calorimetry is figure out what a hunk of metal is composed of. You can identify what element it is such as copper, aluminum, gold, lead, and other solid substances. You can even figure out what an unknown liquid is.

The units are Joules, Calories (food calories like you see on food labeling), or chemistry calories which would be 1000 food Calories. In the US, we usually use chemistry calories in chemistry. In Europe and in physics, they usually use Joules.

There are also bomb calorimeters that are built much tougher and they measure the amount of heat given off by combustion and small explosions.



## Thermometers



man-made scale that indicates the direction of heat flow

measure of molecular motion

measures the expansion of substances

We have already discussed that heat and temperature are not the same thing. So what exactly is temperature? It is the measure of molecular motion. The faster the molecules move, the greater the temperature. When temperature increases causing the molecules to move faster you usually also get expansion of the substance. It gets bigger.

A thermometer is a man made device with a scale at regular, standard intervals. As the red stained alcohol or mercury warm up from the surround temperature the fluid rises. If it cools, the molecular motion slows causing the level to fall. You are measuring the energy of motion in the substances molecules.

A measure of the energy of motion in a substance's molecules

Temperature

boiling point of water?

212

100

373.15

freezing point of water?

32

0

273.15

absolute zero?

-459.67

-273.15

0

Fahrenheit

Celcius

Kelvin

There are three temperature scales each with a different man-made scale.

Fahrenheit:

Water boils at 212

Water freezes at 32 degrees

All molecular motion stops at -459.67

History - glass tube with equal markings. He put his thermometer into ice water and he found that it came to his 32 mark. Water was at his 212 mark.

Celsius:

Water boils at 100

Water freezes at 0 degrees

All molecular motion stops at -273.15

History - He calibrated the markings against the freezing and boiling point of water in 100 equal marks. It was a little less arbitrary in the scale/markings than Fahrenheit.

Kelvin:

Water boils at 373.15

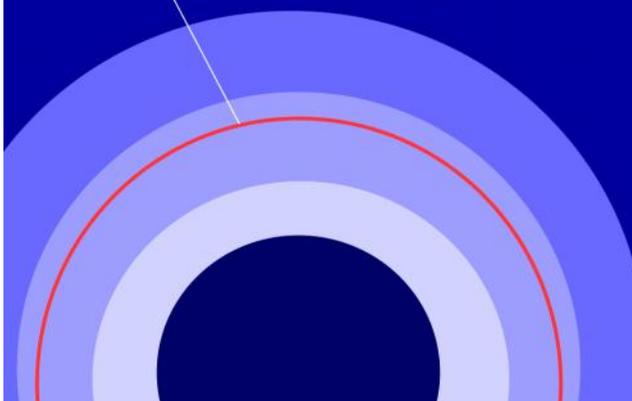
Water freezes at 273.15 degrees

All molecular motion stops at 0

History - Lord Kelvin set the 0 at where the theory said no molecular motion stops. We haven't ever made anything that cold, but we have gotten close.

ozone layer

ban on CFCs  
polar vortex



CFC was valuable as a fire retardant and for refrigeration.

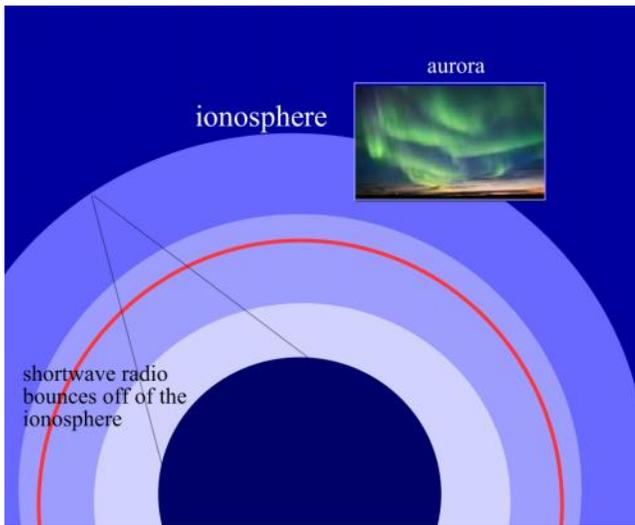
The chlorine released impacts the polar area only during August when the polar vortex occurs and that allows the chlorine to reach the ozone layer and cause a reduction in the formation of ozone. A temporary hole opens up. The ozone layer protects the earth from dangerous radiation.

The hole in the ozone layer was observed even before cfc's were widely used. Many scientist question the link between CFCs and the ozone hole.

Why is the "ozone hole" a seasonal phenomenon that exists only at the South Pole?

Choose one answer.

- a. The South Pole's magnetic feild is so weak that ozone escapes to space in certain seasons
- b. Ozone cannot be depleted by CFCs unless there is a polar vortex which only exists atthe south pole in specific seasons



65 to 350 km up in the atmosphere. Gases are ionized. That is when an atom becomes electrically charged. It isn't an atom anymore but an ion.

Aura Borealis is in the Northern one.  
Aurora Australialis is over the Southern polar region.

It is also used to bounce shortwave radio waves from one transmitting location to a receiving location. These waves can travel very great distances.

#### Twice the number of molecules in the atmosphere

- A. Pressure would be greater
- B. Pressure would be equal to
- C. Pressure would be less

#### Two Barometers

- A. The lighter liquid will have the higher column while the heavier liquid will be lower in its column.
- B. The heavier liquid will have the higher column while the lighter liquid will be lower in its column.
- C. The reason for the different levels is due to another variable.

#### Inches of Mercury

- Average atmospheric pressure is 14.7 psi or 29.9 inches of Hg. If the atmospheric pressure is 0.85 atm, what is the equivalent in. of Hg?
- A. 31.1 in Hg
- B. 29.9 in Hg
- C. 25.4 in Hg
- D. None of the above

#### Homosphere Gases

- A. 21%Oxygen, 78%Nitrogen, 1%other
- B. 95%Helium, 4%Hydrogen, 1%other
- C. 95%Hydrogen, 4%Helium, 1%other

All but the first question in each set is covered with a white rectangle.

Question in the top left: A

Question in the top right: C?

Question in bottom left: C

Question in bottom right: A  
Hint if needed - Homosphere = Lower layer of earth's atmosphere, which exists from ground level to roughly 80 km (50 mi) above sea level

#### Temperature Variations

- A. The temperature increases and then decrease as the balloon enters the stratosphere and decreases and then increases as it enters the mesosphere.
- B. The temperature decreases and then increase as the balloon enters the stratosphere and increases and then decrease as it enters the mesosphere.
- C. The temperatures do not vary from one "sphere" to the next.

#### Three Homosphere Regions

- A. Mesosphere, stratosphere, troposphere
- B. Stratosphere, troposphere, mesosphere
- C. Troposphere, stratosphere, mesosphere
- D. Troposphere, mesosphere, stratosphere

Question on top left: B

Question on top left: C  
(from sea level up in altitude) C

Question on lower left: A?

Question on lower right: A (weather's in the troposphere)

#### The Steady Gradient

- A. Pressure Gradient
- B. Gas Gradient
- C. System Gradient
- D. Partide Gradient

#### Flying through a Storm

- A. Troposphere
- B. Stratosphere
- C. Mesosphere

Temperature and Molecular Motion

Which gas has the higher temperature?

- A. Gas molecules traveling at 1000 mph
- B. Gas molecules traveling at 1300 mph
- C. Both have the same temperature.

Shivering

What causes you to shiver?



CFC Ban

- A. The ban has not saved or improved human lives.
- B. The ban has saved and improved human lives.
- C. The ban most likely will have no effect on human lives.

Carbon Dioxide in the Mesosphere

- A. Temperatures would decrease
- B. Temperatures would not be affected
- C. Temperatures would increase
- D. Other factors are involved.

Question on top left: B

Question on top left: Muscles on motion create heat. The body uses this to heat up when the outer temperature begins to be too cold to stay warm by other means.

Question on lower left: A

[http://www.windows2universe.org/earth/Atmosphere/mesosphere\\_temperature.html](http://www.windows2universe.org/earth/Atmosphere/mesosphere_temperature.html)

Link above has temp/altitude graph for layers of atmosphere

Question on lower right: A

Chlorofluorocarbons

Chlorine from CFC's breaking down ozone, apparently producing ozone hole  
Ozone hole discovered before CFC's widely used

Chlorine in the Atmosphere

- A. Man-made chlorine products wipe out the naturally occurring chlorine atoms.
- B. Naturally occurring chlorine atoms cannot survive the trip to the ozone layer whereas man-made chlorine atoms do make the trip.
- C. Naturally occurring chlorine atoms have a greater mass than man-made chlorine atoms.

Cause of ozone destruction

- A. Man's overuse of CFCs
- B. The polar vortex lifts the CFCs into the ozone layer
- C. The temperature gradient of the stratosphere attracts the CFCs to the ozone layer

Question on top left:

Question on top left: B (if radio is short wave) and C

Question on lower left: B

Ionosphere

- A. The ionosphere is between the stratosphere and the mesosphere and is useful for radio communication.
- B. The ionosphere is between the mesosphere and the thermosphere and is useful for radio communication.
- C. The ionosphere is between the mesosphere and the thermosphere and has pretty light shows.

2011-12 Quiz link: <http://www.virtualhomeschoolgroup.com/mod/quiz/view.php?id=17598>