Potter Earth Science   Name: ______________________   Date: ________________   Hour: ________

#1

Unit 2: Climate Change

LT 2.1 Green House Gases: I can explain what causes greenhouse gases (natural and unnatural) and how the role these gases play in the atmosphere.

	Yes I can:
1. Can you explain the difference between weather and climate and the basic factors that affect climate	
2. Can you explain why the Earth is the temperature it is? (Where do we get our energy from and what happens to it when it gets here?)	
3. I can explain what the greenhouse effect is, the gases that cause it, and the gases that humans can control.	

LT 2.2 Past Climates: I can interpret data on past and present climates and use that data to support that climate change is happening and to predict future trends.

	Yes I can:
1. Can you explain at least 4 different ways how we know what past where like?	
2. Can you explain how a major change in the climate would affect living things on earth?	

LT 2.3 Impacts: I can use climate change data to anticipate the impact on the earth.

	Yes I can:
1. Can you interpret data (graphs) and explain what they mean?	
2. Can you predict possible negative events if the Earth's climate continues to change?	

LT 2.4 Human Impacts: I can explain how climate change has influenced human activity.

	Yes I can:
1. Can provide an example, past or present, of how climate change has altered human history?	
2. Can you predict possible future impacts to human activity as climate change continues?	

Potter Name: ______________________________________ Date: ____________________________ Hour: _____________

Earth Science

#2

Vocabulary I should know:

1. Greenhouse gases – Gases (like CO_2 and H_2O) that trap energy from the sun on the Earth. More gases means more energy trapped
2. Greenhouse effect – the process of trapping energy from the sun on the earth. An example of this would obviously be a greenhouse but also your car on a sunny day.
3. Weather – the conditions in the atmosphere right know
4. Climate – the average weather for a particular area.
5. Windward – the side of a mountain that faces the wind. Almost always rainy and cooler than the other side of the mountain
6. Leeward – the opposite of a mountain from the windward side. Usually dry and hot.
7. Prevailing winds – that direction that the usually comes from for a particular area
8. Tree rings – each year, a tree grows a new ring. Warmer and wetter seasons will grow bigger rings where warmer and drier seasons will have smaller rings.
9. Ice cores – like tree rings, each year there is a new layer of ice add to permanent glaciers at our poles. Trapped in the ice are tiny air bubbles filled with whatever was in the air at the time. Drilling them out is an accurate way to measure gasses in atmosphere (CO2) but can also determine many other things.
10. Climate Change – the well supported theory that our planets climate and climate patterns are changing as a result human production of CO2 through the burning of fossil fuels.
11. Global Warming – a term for the fact that the average temperature of our planet has risen about 1.5F. Which is about 600,000,000,000,000,000,000 Joules of energy
12. Latitude – your angle or horizontal distance from the equator
13. Elevation – your height above sea level

Potter Name: ____ Date: ______________________________ Hour: ______________
Earth Science

#3

Factors that Affect Climate

LT 2.1 Green House Gases: I can explain what causes greenhouse gases (natural and unnatural) and how the role these gases play in the atmosphere.

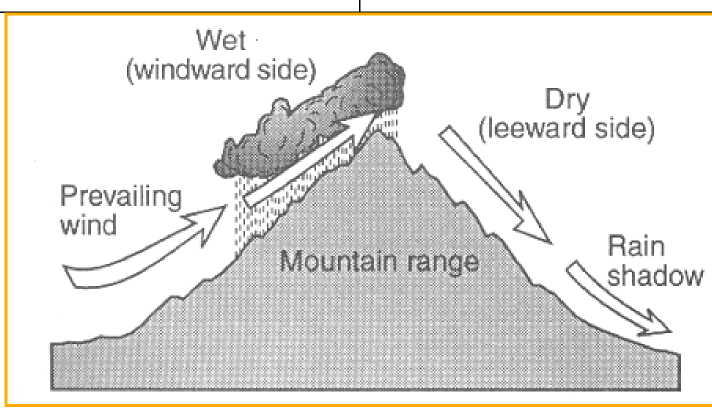
Weather: The short term condition of the atmosphere measured by the amount of precipitation and temperature.

Climate: Is the average weather over a long period of time as measured by precipitation and temperature.

Important Terms: Climate, latitude, windward, leeward, elevation, precipitation, prevailing winds

The Factors

Temperature	Precipitation
1. **Latitude** – As latitude increases (away from the equator), the temperature decreases	1. **Latitude –** Latitudes 0 and 60 (N and S) produces heavy precipitation. Latitudes near 30 (N and S) produce dry climates, even deserts
2. **Nearness to centers of large landmasses** – have wide ranges in temperature	2. **Nearness to centers of large landmasses** – are usually dry climates
3. **Nearness to large bodies of water** –large bodies of water don't change temperatures very fast, therefore these places have narrow ranges in temperature**.**	3. **Nearness to large bodies of water** – large bodies of water evaporate therefore areas nears water have higher levels of precipitation.
4. **Location relative to large mountains** – windward sides are cooled, leeward sides are warmed	4. **Location relative to large mountains** – windward sides of mountains tend to receive higher than average precipitation; leeward sides tend to receive lower than average precipitation.
5. **Elevation** – As elevation increases, the temperature decreases	5. **Prevailing wind direction –** wind direction determines the windward and leeward sides of both mountain ranges and large bodies of water.
6. **Ocean Currents** – Currents tend to warm temperatures of the eastern coast areas and cool temperatures of the western coast areas.	



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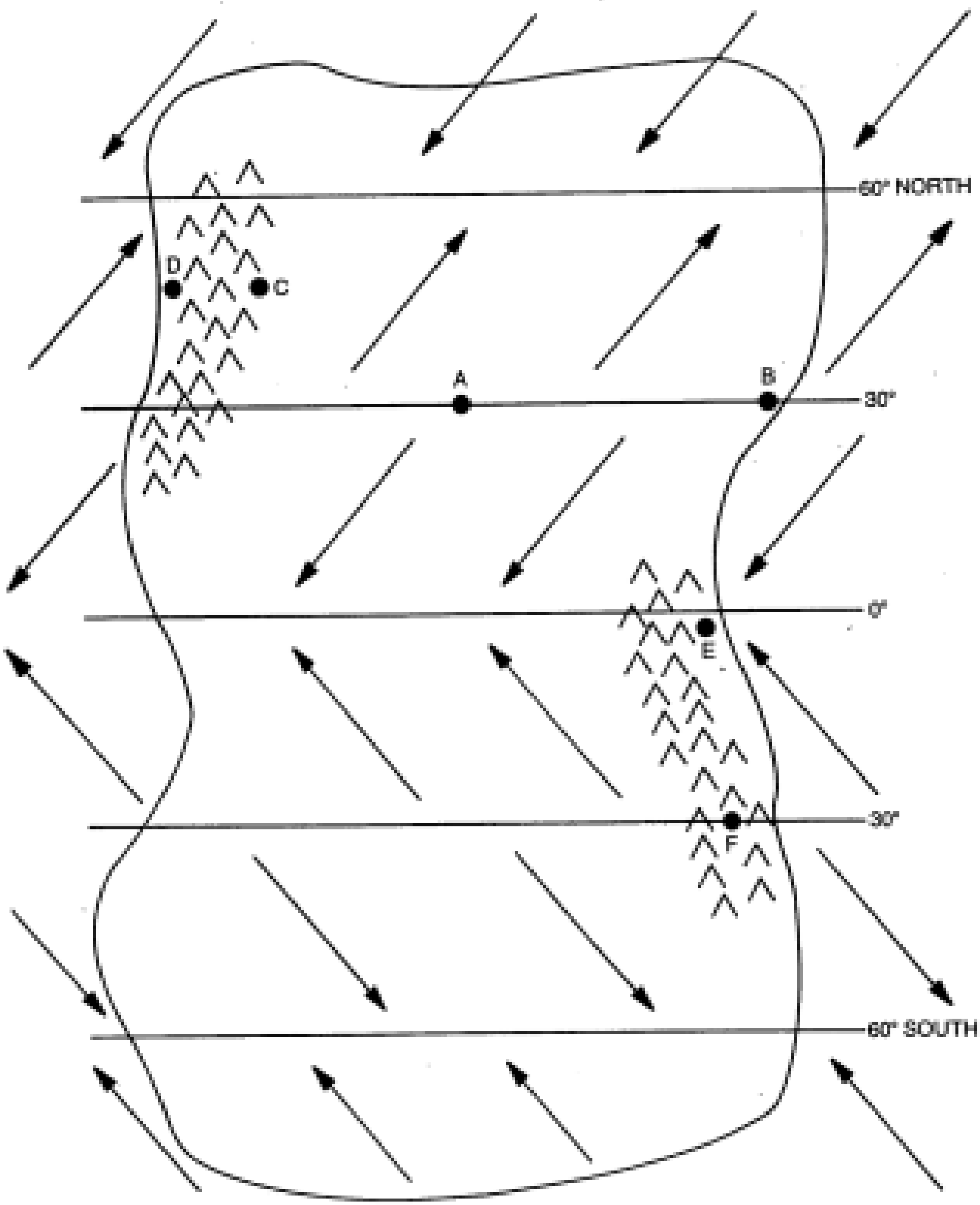
Earth Science

#4

Diagram of Imaginary Continent on Earth



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Earth Science

#5

Answer the following questions using the "Diagram of Imaginary Continent on Earth"

1. Make an educated guess what the climate might be like for city A.

2. Which would have a greater range in temperatures, city A or B? Why?

3. Compare the climates of cities C and D. How would they be different?

4. Name at least 2 factors that would cause D to be one of the coldest locations.

5. Name at least 3 factors that would cause E to be one of the rainiest locations.

6. What 3 factors would cause the climate of D to be cooler that B?

7. City A is in the center of a large desert. Name at least two reasons why A is desert.

8. Based on what you know about Michigan, what should our climate be like? (hint: our latitude is 45 degrees)

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Earth Science

#6

Factors that Affect Climate

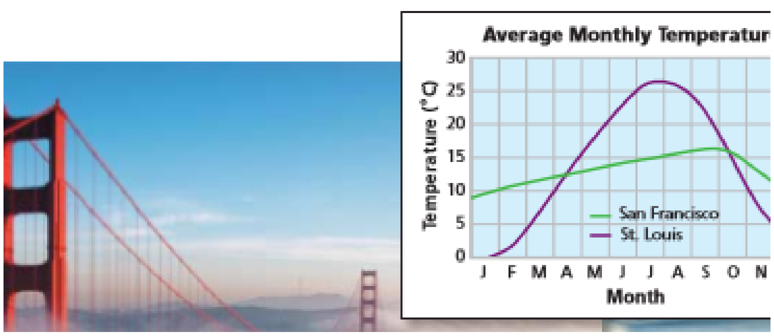
LT 2.1 Green House Gases: I can explain what causes greenhouse gases (natural and unnatural) and how the role these gases play in the atmosphere.

The average weather conditions for an area over a long period of time are referred to as **climate.** Climate is different from weather in that weather is the condition of the atmosphere at a particular time. Weather conditions, such as temperature, humidity, wind, and precipitation, vary from day to day. To understand climate, scientists study the features that define different climates.

Temperature and Precipitation

Climates are chiefly described by using average temperature and precipitation. To estimate the average daily temperature, add the high and low temperatures of the day and divide by two. The monthly average is the average of all of the daily averages for a given month. The yearly average temperature can be found by averaging the 12 monthly averages. However, using only average temperatures to describe climate can be misleading. As you can see in **Figure 1,** areas that have similar average temperatures may have very different temperature ranges. Another way scientists describe climate is by using the *yearly temperature range,* or the difference between the highest and lowest monthly averages.

Another major factor that affects climate is precipitation. It is also described by using monthly and yearly averages as well as ranges. As with temperature, average yearly precipitation alone cannot describe a climate. The months that have the largest amount of precipitation are important for determining climate. When describing climates, extremes of temperature and precipitation as well as averages have to be considered. The factors that have the greatest influence on both temperature and precipitation are latitude, heat absorption and release, and topography.



Heat Absorption and Release

Latitude and cloud cover affect the amount of solar energy that an area receives. However, different areas absorb and release heat differently. Land heats faster than water and thus can reach higher temperatures in the same amount of time. One reason for this difference is that the land surface is solid and unmoving. Surface ocean water, on the other hand, is liquid and moves continuously. Waves, currents, and other movements continuously replace warm surface water with cooler water from the ocean depths. This action prevents the surface temperature of the water from increasing rapidly. However, the surface temperature of the land can continue to increase as more solar energy is received. In turn, the temperature of the land or ocean influences the amount of heat that the air above the land or ocean absorbs or releases. The temperature of the air then affects the climate of the area.

Reading Check How do wind and ocean currents affect the surface temperature of oceans? (See the Appendix for answers to Reading Checks.)

Latitude

One of the most important factors that determines a region's climate is latitude. Different latitudes on Earth's surface receive different amounts of solar energy. Solar energy determines the temperature and wind patterns of an area, which influence the average annual temperature and precipitation.

Solar Energy

The higher the latitude of an area is, the smaller the angle at which the sun's rays hit Earth is and the smaller the amount of solar energy received by the area is. At the equator, or 0° latitude, the sun's rays hit Earth at a 90° angle. So, temperatures at the equator are high. At the poles, or 90° latitudes, the sun's rays hit Earth at a smaller angle, and solar energy is spread over a large area. So, temperatures at the poles are low.

Because Earth's axis is tilted, the angle at which the sun's rays hit an area changes as Earth orbits the sun. During winter in the Northern Hemisphere, the northern half of Earth is tilted away from the sun. Thus, light that reaches the Northern Hemisphere hits Earth's surface at a smaller angle than it does in summer, when the axis is tilted toward the sun. Because of the tilt of Earth's axis during winter in the Northern Hemisphere, areas of Earth at higher northern latitudes directly face the sun for less time than during the summer. As a result, the days are shorter and the temperatures are lower during the winter months than during the summer months. **Figure 2** describes these effects.

1. What is the difference between climate and weather?

2. What are the two ways that we descibe a climate?

3. How does the heat absorption of land and water compare?

4. How does latitude help determine the climate of the area? (two things)

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Earth Science

The Greenhouse Effect

LT 2.1 Green House Gases: I can explain what causes greenhouse gases (natural and unnatural) and how the role these gases play in the atmosphere.

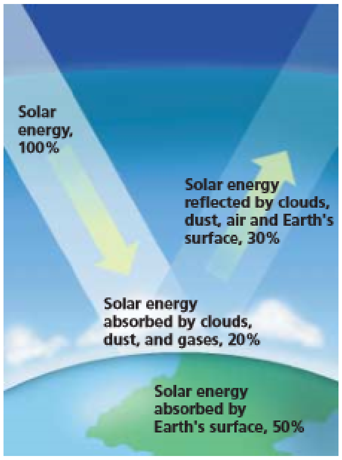

Figure 2 ▶ About 70% of the solar energy that reaches Earth is absorbed by Earth's land and ocean surfaces and by the atmosphere. The remainder is reflected back into space.

The Atmosphere and Solar Radiation

As solar radiation passes through Earth's atmosphere, the atmosphere affects the radiation in several ways. The upper atmosphere absorbs almost all radiation that has a wavelength shorter than the wavelengths of visible light. Molecules of nitrogen and oxygen in the thermosphere and mesosphere absorb the X rays, gamma rays, and ultraviolet rays. In the stratosphere, ultraviolet rays are absorbed and act upon oxygen molecules to form ozone.

Most of the solar rays that reach the lower atmosphere, such as visible and infrared waves, have longer wavelengths. Most incoming infrared radiation is absorbed by carbon dioxide, water vapor, and other complex molecules in the troposphere. As visible light waves pass through the atmosphere, only a small amount of this radiation is absorbed. **Figure 2** shows the percentage of solar energy that is reflected and absorbed by the atmosphere.

Scattering

Clouds, dust, water droplets, and gas molecules in the atmosphere disrupt the paths of radiation from the sun and cause scattering. Scattering occurs when particles and gas molecules in the atmosphere reflect and bend the solar rays. This deflection causes the rays to travel out in all directions without changing their wavelengths. Scattering sends some of the radiation back into space. The remaining radiation continues toward Earth's surface. As a result of scattering, sunlight that reaches Earth's surface comes from all directions. In addition, scattering makes the sky appear

Reflection

When solar energy reaches Earth's surface, the surface either absorbs or reflects the energy. The amount of energy that is absorbed or reflected depends on characteristics such as the color, texture, composition, volume, mass, transparency, state of matter, and specific heat of the material on which the solar radiation falls. The intensity and amount of time that a surface material receives radiation also affects how much energy is reflected or absorbed.

The fraction of solar radiation that is reflected by a particular surface is called the **albedo.** Because 30% of the solar energy that reaches Earth's atmosphere is either reflected or scattered, Earth is said to have an albedo of 0.3. **Table 1** shows the amount of incoming solar radiation that is absorbed and reflected by various surfaces.

albedo the fraction of solar radiation that is reflected off the surface of an object

Absorption and Infrared Energy

The sun constantly emits radiation. Solar radiation that is not reflected is absorbed by rocks, soil, water, and other surface materials. When Earth's surface absorbs solar radiation, the radiation's short-wavelength infrared rays and visible light heat the surface materials. Then, the heated materials convert the energy into infrared rays of longer-wavelengths and reemit it as those waves. Gas molecules, such as water vapor and carbon dioxide, in the atmosphere absorb these infrared rays. The absorption of thermal energy from the ground heats the lower atmosphere and keeps Earth's surface much warmer than it would be if there were no atmosphere. Sometimes, warm air near Earth's surface bends light rays to produce an effect called a *mirage*, as **Figure 3** shows.

Figure 3 ▶ Hot air near the surface of this road bends light rays. ***What objects in this photo appear to be reflected?***

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Earth Science

Figure 4 ▶ One process that helps heat Earth's atmosphere is similar to the process that heats a greenhouse.

The Greenhouse Effect

One of the ways in which the gases of the atmosphere absorb and reradiate infrared rays, shown in **Figure 4**, can be compared to the process that keeps a greenhouse warm. The glass of a greenhouse allows visible light and infrared rays from the sun to pass through and warm the surfaces inside of the greenhouse. But the glass prevents the infrared rays that are emitted by the warmed surfaces within the greenhouse from escaping. Similarly, Earth's atmosphere slows the escape of energy that radiates from Earth's surface. Because this process is similar to the process that heats a greenhouse, it is called the **greenhouse effect.**

greenhouse effect the warming of the surface and lower atmosphere of Earth that occurs when carbon dioxide, water vapor, and other gases in the air absorb and reradiate infrared radiation

Human Impact on the Greenhouse Effect

Generally, the amount of solar energy that enters Earth's atmosphere is about equal to the amount that escapes into space. However, human activities may change this balance and may cause the average temperature of the atmosphere to increase. For example, measurements indicate that the amount of carbon dioxide in the atmosphere has been increasing in recent years. These increases have been attributed to the burning of more fossil fuels. These increases seem likely to continue in the future. Increases in the amount of carbon dioxide may intensify the greenhouse effect and may cause Earth to become warmer in some areas and cooler in others.

Variations in Temperature

Radiation from the sun does not heat Earth equally at all places at all times. In addition, a slight delay occurs between the absorption of energy and an increase in temperature. Earth's surface must absorb energy for a time before enough heat has been absorbed and reradiated from the ground to change the temperature of the atmosphere. For a similar reason, the warmest hours of the day are usually mid- to late afternoon even though solar radiation is most intense at noon. The temperature of the atmosphere in any region on Earth's surface depends on several factors, including latitude, surface features, and the time of year and day.

1. Where does most of the heat on the earth come from?
2. When that heat gets to earth, what are the two possible outcomes?
3. What is the greenhouse effect?
4. What would happen to the earth if there were no greenhouse gases?
5. What happens to the earth if there are too many greenhouse gases?
6. Which greenhouse gas are we most concerned with, and why?

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Earths Greenhouse Gases

LT 2.1 Green House Gases: I can explain what causes greenhouse gases (natural and unnatural) and how the role these gases play in the atmosphere.

Greenhouse gases	Concentration (how much)	Ability to trap heat (GWP) Bigger numbers means more warming	How long does it stay in air?	Where does it come from?
Water vapor	40,000,000ppbv	0.23	Days to years (until it rains)	Evaporation from the surface of the Earth
Carbon dioxide				
Methane				
Nitrous oxide				
CFC's (fluorinated carbons)				

ppbv = parts per billion by volume. For example, 278,000 ppbv of CO_2 means, if you grabbed 1 billion particle of air, 278,000 of them would be CO_2.

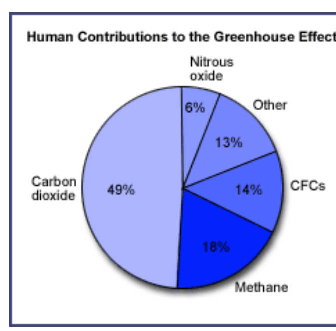
Another way to think about it, 1 drop of water in a standard 13,000 gallon backyard pool would be 1ppbv.

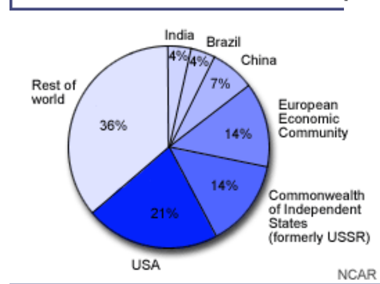
1. Which of these do humans contribute to?

2. Which have natural sources?

3. Which two gases have the highest concentrations?

4. If you consider how long these gases stay in the air and their GWP, which is the worst gas?





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Earth Science

#10

Measuring Climate Change, Past and Present

LT 2.2 Past Climates: I can interpret data on past and present climates and use that data to support that climate change is happening and to predict future trends.

Collecting Climate data

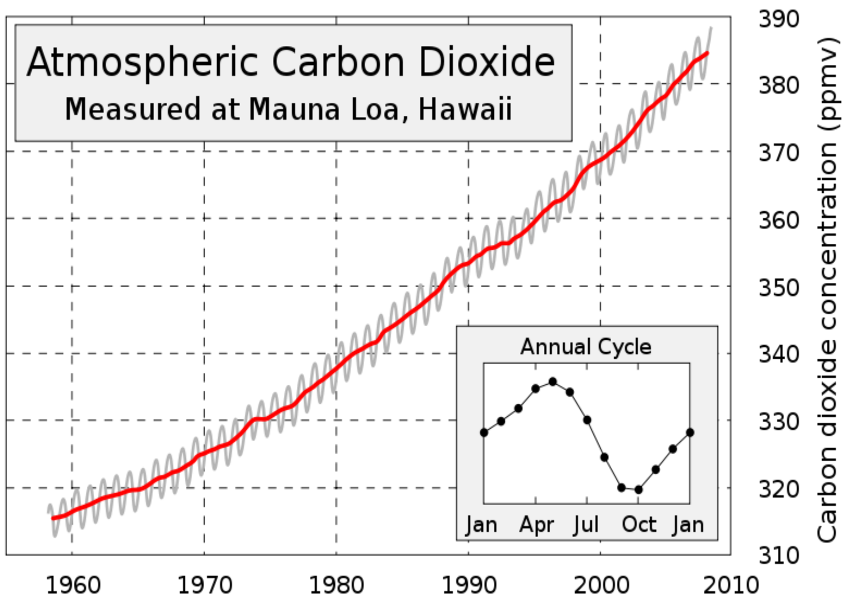
Method	What is measured	What it indicates	Length of Time
Ice Cores			
Oxygen Sea-floor sediments			
Fossils			
Tree Rings			

Answer the questions below by using the graph on the right.

1. What is general trend of this graph?

2. Why do you think the graph zigzags up and down?

3. What is the concentration of C0₂ now and in 1960?



4. Why is carbon dioxide looked at when we are researching climate change?

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Earth Science

#11

Graphing Ice core data

Years ago	temp
0	0
10000	0
20000	-6
30000	-9
40000	-6
50000	-7
60000	-8
70000	-7
80000	-6
90000	-4
100000	-4
110000	-7
120000	0
130000	3
140000	-4
150000	-8
160000	-8
170000	-7
180000	-9
190000	-6
200000	-2
210000	-4
220000	-2
230000	-4
240000	2
250000	-4

Years ago	Co2
0	300
10000	280
20000	260
30000	180
40000	210
50000	200
60000	190
70000	220
80000	240
90000	220
100000	230
110000	230
120000	250
130000	270
140000	200
150000	190
160000	190
170000	200
180000	200
190000	220
200000	230
210000	240
220000	240
230000	200
240000	280
250000	190

(Temp= difference in average tempature in ^{0}C)
(CO_2 = ppm CO_2)

5. Is there a corrilation between temperature and CO_2 levels?

Title:

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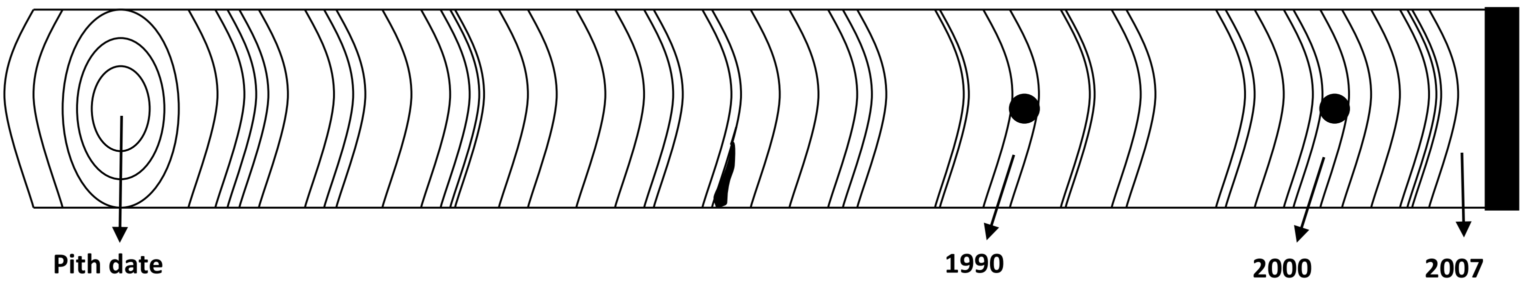
Earth Science

#12

Tree-Ring Activity

LT 2.2 Past Climates: I can interpret data on past and present climates and use that data to support that climate change is happening and to predict future trends.

Methods: : Tree rings contain up to 10,000 years of annual information about climate, fire history, insect outbreaks, glacial movement, and other disturbances. Count the tree rings backwards from the bark (2007) to find the pith date (when the tree started growing). Mark every decade with a dot (hint: the years 2000 and 1990 have already been marked for you). The tree rings are the white spaces between the lines!! Think about what might cause variation in the tree-ring width.



1. What is the inner date (pith date) of the tree core? ______________________
2. List the years of 5 of the narrowest rings. ______________________________
3. List two reasons why a tree ring would be narrow. ___________________________
4. Which year is there a visible scar in the tree core? ___________________________
5. List two reasons why a tree core would have a scar. ___________________________
6. Compare the precipitation record on the next page with the tree core and answer the following questions:

   A. Which year had the least amount of precipitation? _____________________

   B. Examine the tree ring for that year…is it narrow or wide? ______________

7. What might be one reason you would want to study tree rings? Write three sentences about how tree rings can be used to study the environment.

Year	Precipitation (cm)	Year	(cm)	Year	(cm)	Year	(cm)	Year	(cm)
1950	14.4	1963	16.5	1976	16.5	1989	15.1	2002	16.7
1951	15.4	1964	16.8	1977	16.9	1990	13.5	2003	12.2
1952	13.8	1965	15.5	1978	15.8	1991	16.1	2004	9.7
1953	12.6	1966	11.4	1979	11.7	1992	15.6	2005	11.7
1954	12.1	1967	19.1	1980	19.1	1993	20.3	2006	15.0
1955	16.5	1968	17.2	1981	17.6	1994	14.3	2007	Data incomplete
1956	11.6	1969	17.1	1982	18.7	1995	19.5		
1957	15.1	1970	17.9	1983	18.6	1996	13.7		
1958	14.5	1971	15.4	1984	16.3	1997	18.2		
1959	15.4	1972	14.8	1985	14.9	1998	15.6		
1960	11.9	1973	16.2	1986	16.2	1999	10.9		
1961	14.3	1974	11.9	1987	15.2	2000	12.9		
1962	16.5	1975	20.4	1988	11.9	2001	14.4		

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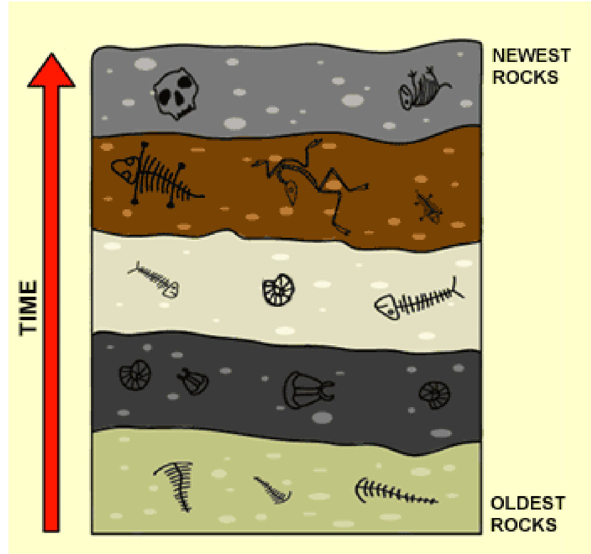
Earth Science

#13

Fossil Activity

LT 2.2 Past Climates: I can interpret data on past and present climates and use that data to support that climate change is happening and to predict future trends.



<u>Quick review, the law of superposition</u>: in layers of undisturbed rock, the layer on the bottom is the oldest and the layer on the top if the youngest.

Fossils go waaaaay back, millions of years. When we find a fossil, it tells us a little bit about the environment that was around then. Take a guess at what the following environments were like based on what you know about that organism or rock.

Organism	What do you know about them now?	Environment prediction
Large Leaf Plant or a fern		
Frog		
Pine cone		
Fish		
Coral		
An animal with an excessive amount of fur		
An animal with no fur		

Summarize how fossilize can tell us about past climates:

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Earth Science

The Carbon Cycle & Global Climate Change

LT 2.2 Past Climates: I can interpret data on past and present climates and use that data to support that climate change is happening and to predict future trends

Station #1

1. Look at the pattern that happens every year. The "annual cycle" graph is a blown-up section of one year. When does the amount of CO2 start to go down and when does it start to go back up?

2. Why do you think it does this? Suggest 2 reasons why CO_2 concentration would increase when it is winter in the Northern Hemisphere. (Hint: one is natural, one is humans)

3. What advantages are there be to measuring CO_2 content in the atmosphere in Hawaii rather than an on the continental United States? (why would measuring in Detroit or Lansing give us less accurate results?)

4. Fill in the blanks below to calculate the total change in CO_2 concentrations:

   Ave. CO_2 Levels in 2012 __________ **-** Ave CO_2 in 1957_______________ = Total Change in CO_2___________

5. What is the **Average Annual Change** in CO_2 concentration?

   Total change _______÷ Number of years of data collection ______= Ave. Rate of Change ___________

Station #2

6. What are the maximum___________ and minimum ____________CO_2 levels before "0" years ago, and what is the natural range (difference between max and min) in CO_2?

7. What is the minimum number of years it takes for the natural system to change from a high CO_2 levels to a low for CO_2 levels? (= What is the fastest time in which this has occurred naturally?).

8. What was the CO_2 values in 2006 and how much higher is this than the maximum level of CO_2 before the year "0" (= before human industrialization).

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Earth Science

Station #3

9. What was the major source of carbon emissions between 1850 and 1900?

10. How did this change after ~1970?

11. What other cause of increasing CO_2 levels is shown on this graph besides the burning of fossil fuels?

Station #4

Time period	Number of years with mean Temp. < 0° to -1° *below* normal	Number of years with mean Temp. > 0° to +1° *above* normal	Number of years with mean Temp. more than +1° *above* normal
1880-1899			
1900-1919			
1920-1939			
1940-1959			
1960-1979			
1980-1999			
2000-2012*			
Trend over time? (circle one)	**Warming / Cooling, No-trend**	**Warming / Cooling, No-trend**	**Warming / Cooling, No-trend**

*Note the last time-period is much shorter than the others. You will need to take this into consideration when looking for evidence of trends

Summary for Regional Temperature Records (the United States)

	Date
Hottest year	
Hottest 5-year period	
Coldest year	
Coldest 5-year period	

12. How do the dates of the coldest year compare to date of the coldest 5-year period (are the dates the same)?

13. How do the dates of the hottest year compare to date of the hottest 5-year period.

14. If you are looking for trend through time is it easier to identify changes in yearly mean temperatures or the 5-year mean temperature?

Potter
Earth Science

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#16

Other Possible Causes of Climate Change

LT 2.2 Past Climates: I can interpret data on past and present climates and use that data to support that climate change is happening and to predict future trends.

Potential Causes of Climate Change

By studying computer-generated climate models, scientists have determined several potential causes of climate change. Factors that might cause climate change include the movement of tectonic plates, changes in the Earth's orbit, human activity, and atmospheric changes.

Plate Tectonics

The movement of continents over millions of years caused by tectonic plate motion may affect climate changes. The changing position of the continents changes wind flow and ocean currents around the globe. These changes affect the temperature and precipitation patterns of the continents and oceans. Thus, the climate of any particular continent is not the same as it was millions of years ago.

Orbital Changes

Changes in the shape of Earth's orbit, changes in Earth's tilt, and the wobble of Earth on its axis can lead to climate changes, as shown in **Figure 2.** The combination of these factors is described by the *Milankovitch theory*. Each change of motion has a different effect on climate. Variation in the shape of Earth's orbit, from elliptical to circular, affects Earth's distance from the sun. Earth's distance from the sun affects the temperature of Earth and therefore affects the climate. Decreasing tilt decreases temperature differences between seasons. The wobble of Earth on its axis changes the direction of Earth's tilt and can reverse the seasons. These changes occur in cycles of 21,000 to 100,000 years.

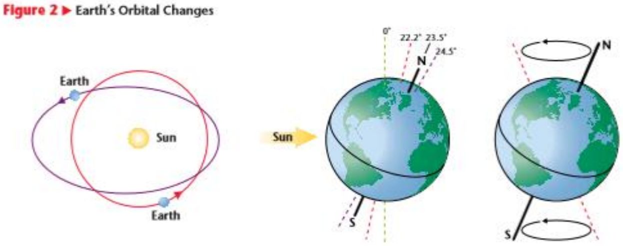
Human Activity

Many scientists think that human activity affects climate. Pollution from transportation and industry releases carbon dioxide, CO_2, into the atmosphere. Increases in CO_2 concentrations may lead to global warming, an increase in temperatures around Earth. CO_2 is also released into the atmosphere when trees are burned to provide land for agriculture and urban development. Because vegetation uses CO_2 to make food, deforestation, as shown in **Figure 3,** also affects one of the natural ways of removing CO_2 from the atmosphere. As scientists continue to study climate, they will learn more about how human activity affects climate and about how changes in climate may affect us.

Volcanic Activity

Large volcanic eruptions can influence climates around the world. Sulfur and ash from eruptions can decrease temperatures by reflecting sunlight back into space. These changes last from a few weeks to several years and depend on the strength and duration of the eruption.

Figure 2 ▸ Earth's Orbital Changes

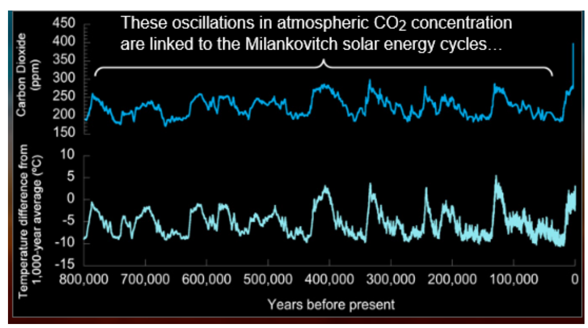


Eccentricity Earth encounters more variation in the energy that it receives from the sun when Earth's orbit is elongated than it does when Earth's orbit is circular.

Tilt The tilt of Earth's axis varies between 22.2° and 24.5°. The greater the tilt angle is, the more solar energy the poles receive.

Precession The wobble of Earth's axis affects the amount of solar radiation that reaches different parts of Earth's surface at different times of the year.

Go to the following website: http://media.hhmi.org/biointeractive/click/paleoclimate/



1. What are the four main causes of climate change?

2. How many of these four can humans influence?

3. How do we know that humans are most likely responsible for our current climate change?

4. From the "click and learn" website, how are CO2 and the temperature of our planet related?

5. From the "click and learn" website, what is unique about the amount of CO2 in our atmosphere right now?

Potter Name: ______________________ Date: ______________________ Hour: __________ #17
Earth Science

Potential Impacts of Climate Change

LT 2.3 Impacts: I can use climate change data to anticipate the impact on the earth..

Potential Impacts of Climate Change

Scientists are concerned about climate changes because of the potential impacts of these changes. Earth's atmosphere, oceans, and land are all connected, and each influences both local and global climates. Changes in the climate of one area can affect climates around the world. Climate change affects not only humans but also plants and animals. Even short-term changes in the climate may lead to long-lasting effects that may make the survival of life on Earth more difficult for both humans and other species. Some of these potential climate changes include global warming, sea-level changes, and changes in precipitation.

Reading Check What things are influenced by climate change? (See the Appendix for answers to Reading Checks.)

Global Warming

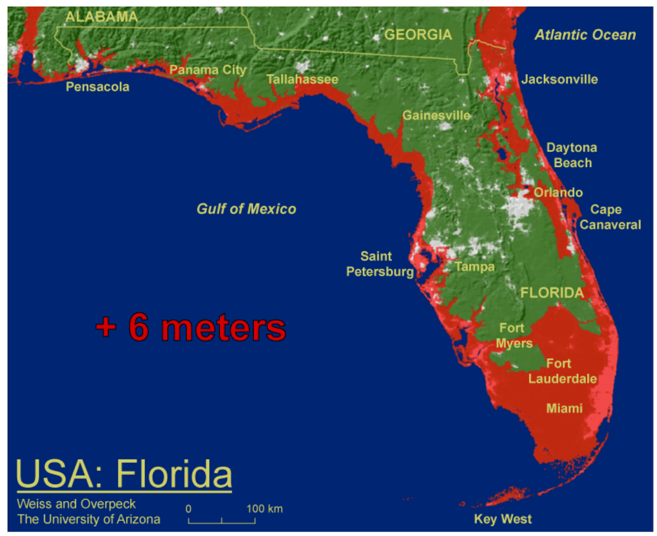
Global temperatures have increased approximately 1°C over the last 100 years. Researchers are trying to determine if this increase is a natural variation or the result of human activities, such as deforestation and pollution. A gradual increase in average global temperatures is called **global warming**. This process may result from an increase in the concentration of greenhouse gases, such as CO_2, in the atmosphere.

An increase in global temperature can lead to an increase in evaporation. Increased evaporation could cause some areas to become drier than they are now. Some plants and animals would not be able to live in these drier conditions. An increase in evaporation in other areas could cause crops to suffer damage. However, an increase in temperatures due to global warming might improve conditions for crops in colder, northern regions.

An increase in global temperatures could also cause ice at the poles to melt. If a significant amount of ice melts, sea levels around the world could rise. This rise in sea levels would cause flooding around coastlines, where many cities are located.

Sea-Level Changes

Using computer models, some scientists have predicted an increase in global temperature of 2°C to 4°C during this century. An increase of only a few degrees worldwide could melt the polar icecaps and raise sea level by adding water to the oceans. On a shoreline that has a gentle slope, the shoreline could shift inland many miles, as shown in **Figure 4.** Many coastal inhabitants would be displaced, and freshwater and agricultural land resources would be diminished. Because approximately 50% of the world population lives near coastlines, this sea-level rise would have devastating effects.



1. In the last 100 years, global temperatures have increased by how much?

2. What is global warming?

3. Why would sea levels change if the ocean warms up? (There are two reasons. For the second reason, think back to our last unit.)

4. What places in the U.S. would have to worry if there is significant sea level rise?

Potter Name: ____ Date: ______________________________ Hour: ______________
Earth Science

#18

Ocean Acidification Lab

LT 2.3 Impacts: I can use climate change data to anticipate the impact on the earth.

Purpose: The purpose of this lab is to investigate how CO2 changes the pH of ocean water.

Hypothesis:

Setup (draw a labeled picture):

Describe your experiment set by step (there should be at least 3-4 steps):

Results (describe what happened):

Conclusion (did you support your hypothesis and what does it all mean?)

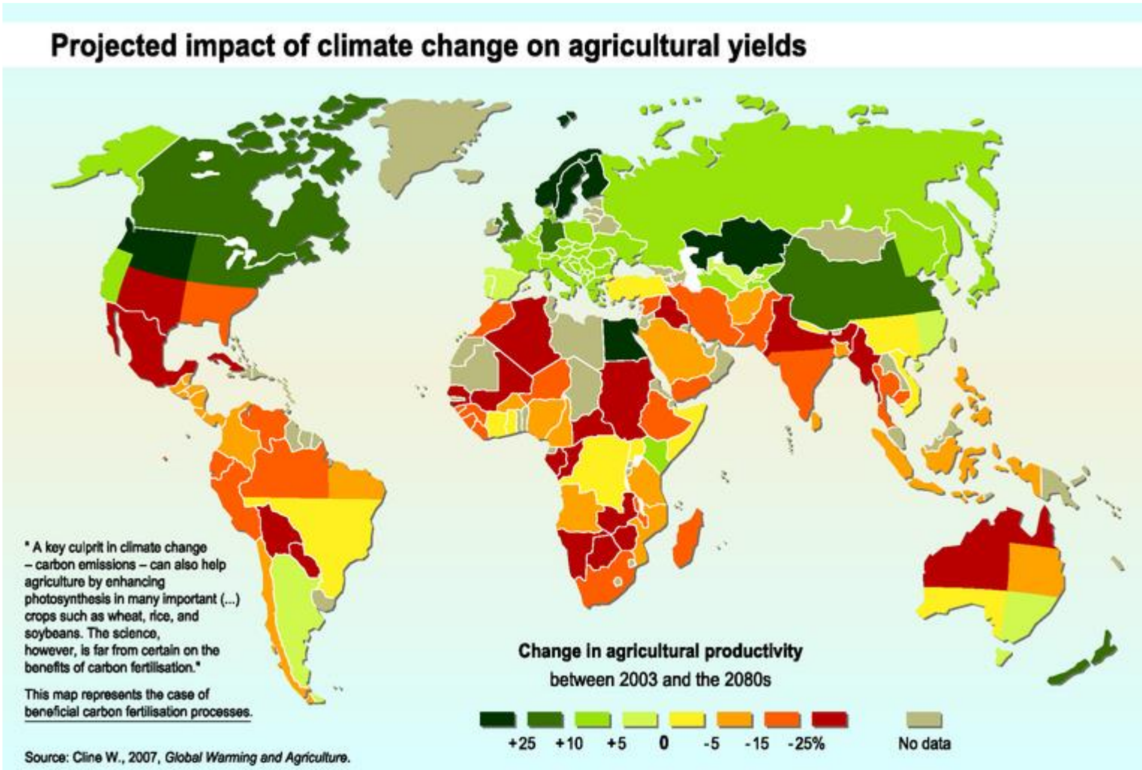
Potter Name: ____ Date: ______________________________ Hour: ______________

Earth Science

#19

Impact of Climate Change on Farming.

LT 2.3 Impacts: I can use climate change data to anticipate the impact on the earth.



1. In general, how will each continent be affect by climate change? Will it be better, worse, or no real change for growing crops?
    a. North America:
    b. South America:
    c. Africa:
    d. Europe:
    e. Northern Asia:
    f. Southern Asia:
    g. Australia:
2. Compare where most people live to the farming map. Are there any potential issues?
3. Compare where most of the food is currently grown to the farming map. Are there any potential issues?
4. To wrap things up, if the earth's climate warms up, what will that mean to:
    a. Farming
    b. Water supply (think California)
    c. Sea levels
    d. Polar ice caps
    e. Corals and shellfish
    f. Populations of animals.

Potter Name: ____ Date: ______________________________ Hour: ______________
Earth Science

#20

Tragedy of the Commons

LT 2.4 Human Impacts: I can explain how climate change has influenced human activity.

Scenario:
Each person represents the head of a starving family which requires food (strong motivation to acquire food). The only food source for these four families is a small fishing hole which can accommodate 20 fish.

Rules:
1. Start with 12 fish in the bowl.
2. Fish catch breakdown
   1. 1 fish = your family can eat but are hungry
   2. 2 fish = your family can eat, are full, but want more
   3. 3 or more = your family is happy
3. Fish double (up to 20) at the end of each round
4. Fish ponds have a carrying capacity of 20 (max # of fish)
5. You can only use the "fishing pole" to get the fish out of the pond

At the end of 5-8 rounds (it will end randomly)

1st Place =Your family survives and are happy
2nd Place = Your family survives and are hungry
3rd Place = Your family is struggling to survive
4th Place = Your family doesn't survive

Warm up rounds:

Round	Fish at Start	# Fish caught by Person 1	# Fish caught by Person 2	# Fish caught by Person 3	# Fish caught by Person 4	# Fish Remaining in Bowl
1						
2						

The challenge:

Round	Fish at Start	# Fish caught by Person 1	# Fish caught by Person 2	# Fish caught by Person 3	# Fish caught by Person 4	# Fish Remaining in Bowl
1						
2						
3						
4						
5						
6						
7						
8						
Total						

1. What is the best strategy for harvesting from this common resource? Use data to support this.

2. What are some examples of common resources we share on this planet?

3. The U.S. has pledged to stop participating in some clean air laws (some that limit CO2). What is the danger of this other than the fact that we will be making our own air worse?