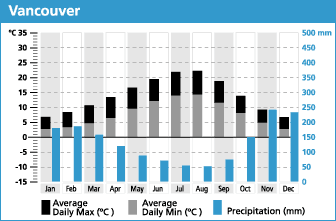
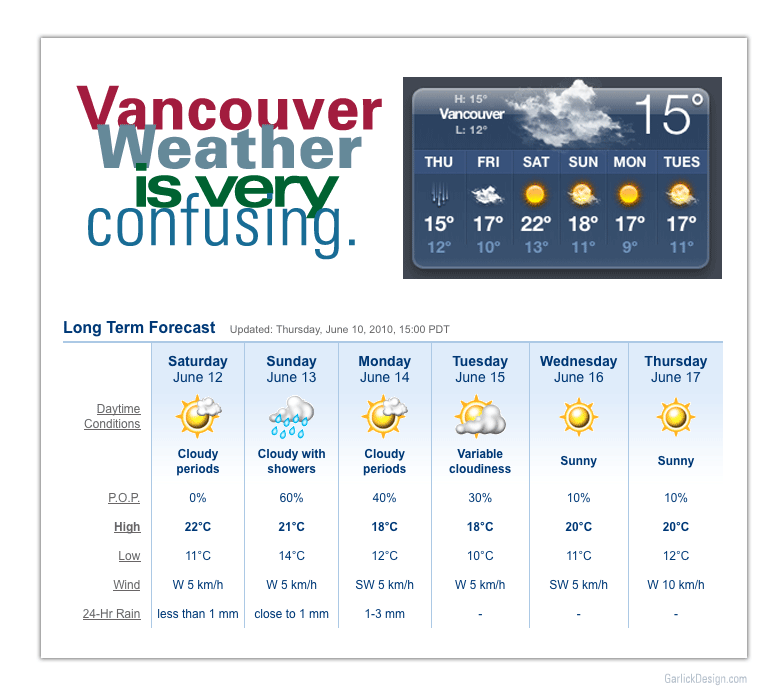
**Atmosphere Unit**

**Heating the Earth’s Atmosphere**

Chapter 11 (pg. 328 – 357)

|  |
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| **11.1: Focus on the Atmosphere: Weather and Climate** |

****

**What is the difference between the weather and climate in Vancouver?**

|  |  |
| --- | --- |
| **Weather** | **Climate** |
| **state of the atmosphere at a given time and place. Constantly changing** | **the sum of all statistical weather information that helps describe a place or region. Average weather** |

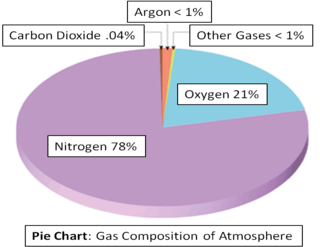
Weather and Climate are described using the same elements:

1. Air Temperature
2. Humidity

**All of these elements are interconnected and have an effect on each other**

1. Type and amount of cloudiness
2. Type and amount of precipitation
3. Air pressure
4. Speed and direction of the wind

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| **11.2: Composition of the Atmosphere** |

**Earth’s Atmosphere:** Envelope of air between Earth’s surface and Space

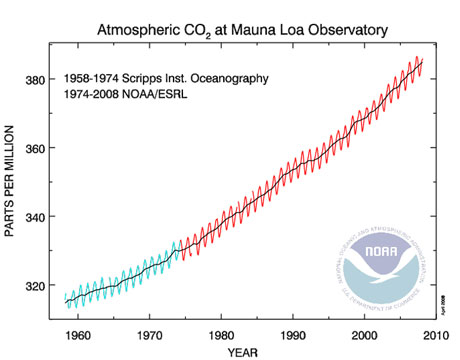
What can you tell about the Earth’s atmosphere based on the pie chart?

**- Air is a mixture of many different gases and other components**

**- The composition is not constant**

**What is the importance of the components that make up air?**

|  |  |
| --- | --- |
| **Nitrogen** | Building block of proteins, atmosphere is the major source |
| **Oxygen** | Necessary for cellular respiration |
| **Carbon Dioxide** | Absorbs energy emitted by earth (infrared radiation) = plays a role in heating the atmosphere. |
| **Water Vapour** | Humidity varies by location/season. Source for all clouds, precipitation, absorbs heat from Earth/Sun, energy source driving storm |
| **Aerosols** | Particles kept in the atmosphere by air movement. Condensation surfaces, absorb/reflect incoming solar radiation. |
| **Ozone** | Concentrated in the stratosphere and absorbs UV radiation |



* Oxygen and Nitrogen are the most abundant but have little or no importance in affecting weather phenomena

Explain the graph to the right.

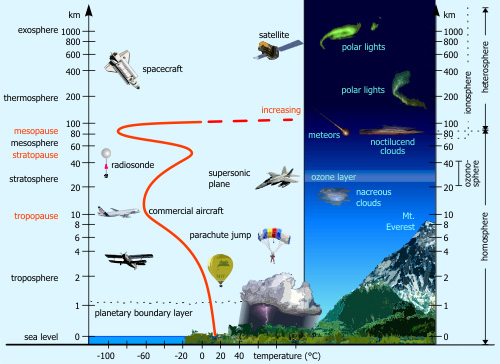
**Carbon dioxide levels have increased significantly since 1960. Evidence from global warming**

*\*Origins of the Atmosphere video* [*http://channel.nationalgeographic.com/videos/origins-of-the-atmosphere/*](http://channel.nationalgeographic.com/videos/origins-of-the-atmosphere/)

|  |
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| **11.3: Structure of the Atmosphere** |

* The atmosphere is divided into layers based on fluctuating:
  + Temperature
  + Pressure
  + Gas composition

Using the information from the atmosphere layers lab and the diagram below. Complete the table on the following page.



* *Earth’s Atmosphere Animation* [*https://svs.gsfc.nasa.gov/20014*](https://svs.gsfc.nasa.gov/20014)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Layer** | **Height Above Earth** | **Temperature Conditions** | **Pressure Conditions** | **Other Notes** |
| Exosphere | 130 + |  | <10 | SPACE |
| Thermosphere | 80 – 130 | -90 to -10 | <10 | Temp increase due to short wavelength energy solar radiation |
| Mesophere | 47 – 80km | 0 to -90 | <10 | Coldest temperatures of any level  Least explored region |
| Stratosphere | 10km – 47km | -60 to 0 | 10 mb – 300 | Increased heat due to ozone layer |
| Trophosphere | 10 km | 20 to -60 | 300 – 1000 mb | Most of the gases are found here  Turbulent air, area where meteorologists focus |

*\*View Power of the Planet: Atmosphere, 0 to 24:31 minutes.*

What are two important roles of the atmosphere?

* **Absorbs UV radiation**
* **Reduces temperatures extremes between day and night (cycles warm air from the equator to the poles and cooler air back to the equator)**

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| **11.4: Earth-Sun Relationships** |

* Earth’s weather patterns, climates and ocean currents are the products of the **unequal distribution of energy from the Sun**.
* The angle of insolation effects how much solar energy is being transferred. The more direct (ie. Closer to 90°, the more energy that is transferred)
  + **Angle of insolation:** the angle of the sun’s rays when they meet Earth’s surface.

**What is the difference between a solstice and an equinox?**

**Solstice occur during summer and winter (ie. June 21 and December 31)**

**Equinixes occur during autumn and spring (ie. Sept 21 or March 21)**

* Exploring this idea will draw on many ideas from our Solar System Unit, such as the Earth’s rotation, revolution and the creation of seasons.
* ***You will use Exercise 12 in your workbook to explore these ideas. This is testable material. Make sure you complete Activity 12.1 and 12.2.***

|  |
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| **11.5 and 11.6: Heating the Atmosphere** |

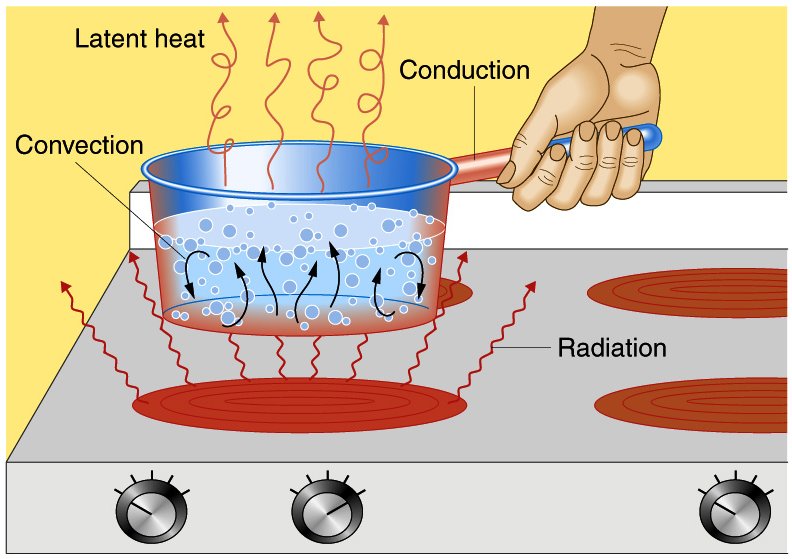
**What is the difference between temperature and heat?**

**Temperature is the measure of average kinetic energy of the particles of an object**

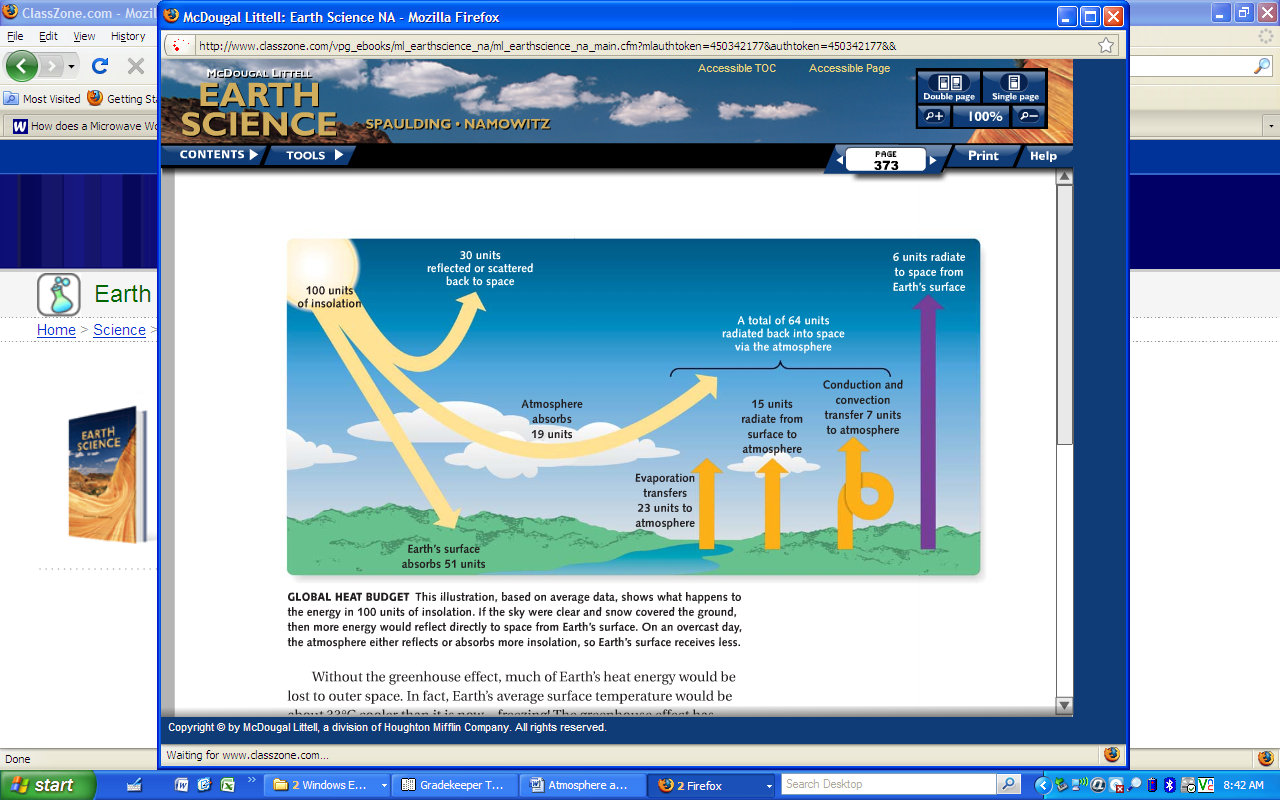
**Heat is the transfer of thermal energy between objects**

**Mechanisms of Heat Transfer**

* In all scenarios heat is always transferred from warmer to colder objects.



|  |  |  |  |
| --- | --- | --- | --- |
|  | **Conduction** | **Convection** | **Radiation** |
| **General Definition** | **Transfer of energy through matter by molecules colliding.** | **Transfer of energy by movement/circulation of a substance (e.g. air, water, magma). Creates convection currents** | **Doesn’t require a medium for the transfer of energy.** |
| **Earth Examples** | Transfer of heat between particles in Earth’s surface and lowest layer of the atmosphere | Air at surface is heated, becomes **less dense** and rises  Air expands, cools and begins to **sink**. | How solar energy (visible light, UV radiation, infrared radiation) reaches us through space.  Incoming solar radiation is **shorter** wavelength and more difficult for atmosphere to absorb  Gets absorbed by the Earth’s surface and radiated back towards space in **longer** wavelengths, easier for atmosphere to absorb |

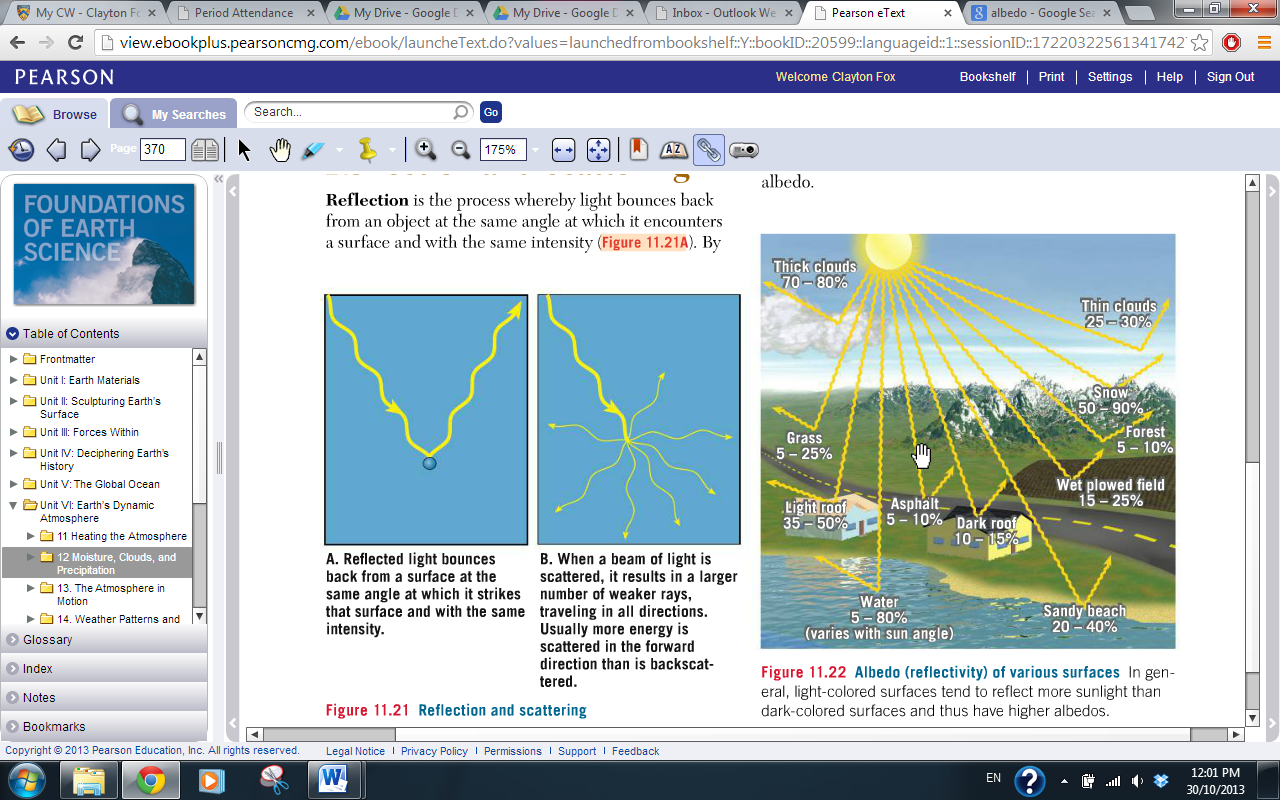
**Incoming Solar Radiation**

Incoming solar energy can be:

What is Earth’s average planetary albedo?

**30%**

|  |  |
| --- | --- |
| **Redirected** | Radiation is bounced off a surface without any energy being absorbed or transmitted.  30% of the solar radiation entering Earth’s atmosphere is returned directly back to space.  **Albedo:** the amount of solar radiation reflected by a surface  High albedo = highly reflective |
| **Transmitted** | Radiation can pass through substances transparent to  certain wavelengths (water, air). The substance does not absorb any  energy. |
| **Absorbed** | Gases selectively absorb specific radiation wavelengths,  primarily longwave infrared radiation (energy re-radiated from Earth). |

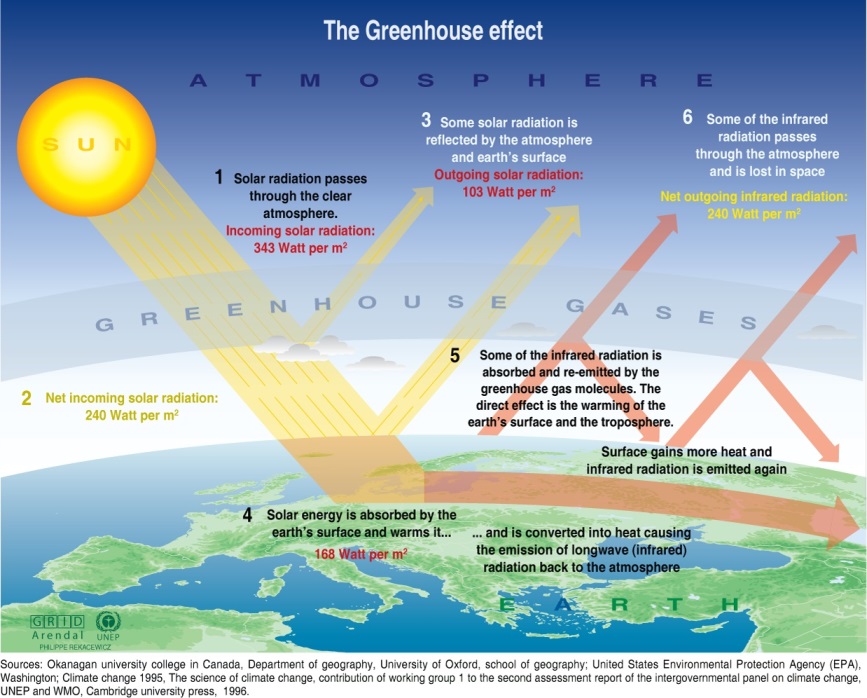


What are some factors that affect albedo? Use the diagram to the right

* **Colour of the surface (dark absorbs more solar radiation**
* **Cloud cover**
* **Angle of sun’s rays**

[](http://media.pearsoncanada.ca/bc/bc_0media_geo/smartfigure/sf-ozone.html)

\**Complete Activity 13.1 and 13.2 in your workbook*

[](https://mediaplayer.pearsoncmg.com/assets/secs-geology-SmartFigures-3_Planets_3_Climates)**

*\*Check out Smartfigure 11.23!*

Is the Greenhouse Effect a useful or harmful process?

**Useful: on Earth it is good for keeping warmth in,**

**Harmful: If it occurred at a higher rate Earth could be too hot for life (e.g. more Martian).**

*\*View Power of the Planet: Atmosphere, 47 minutes to End*

*\*Complete activity 13.3 in your workbook*

Which two components of the atmosphere absorb the most energy emitted from Earth?

**CO2 and H2O**

|  |
| --- |
| **11.7: Human Impact on the Atmosphere’s Composition** |

**CO2 Emissions**

What are the potential consequences of increasing the CO2 concentration in the atmosphere be?

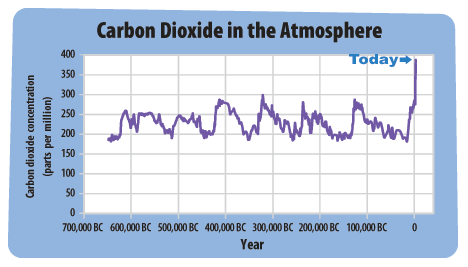
**CO2 absorbs infrared radiation, preventing it from leaving Earth. Would Produce a magnified greenhouse effect and therefore increase Earth’s global temperature**

What natural and human activities add CO2 to the atmosphere?

**Natural: Forest fires, respiring**

**Burning fossil fuels (coal, natural gas, pertroleum), deforestation (burning vegetation, removing trees that can remove CO2 from atmosphere)**

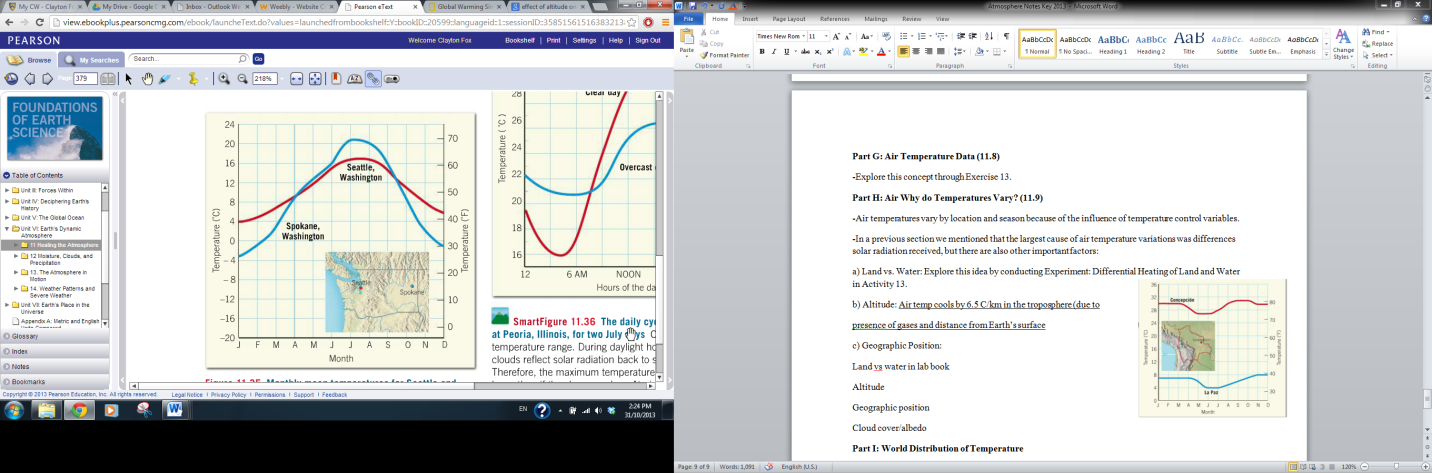
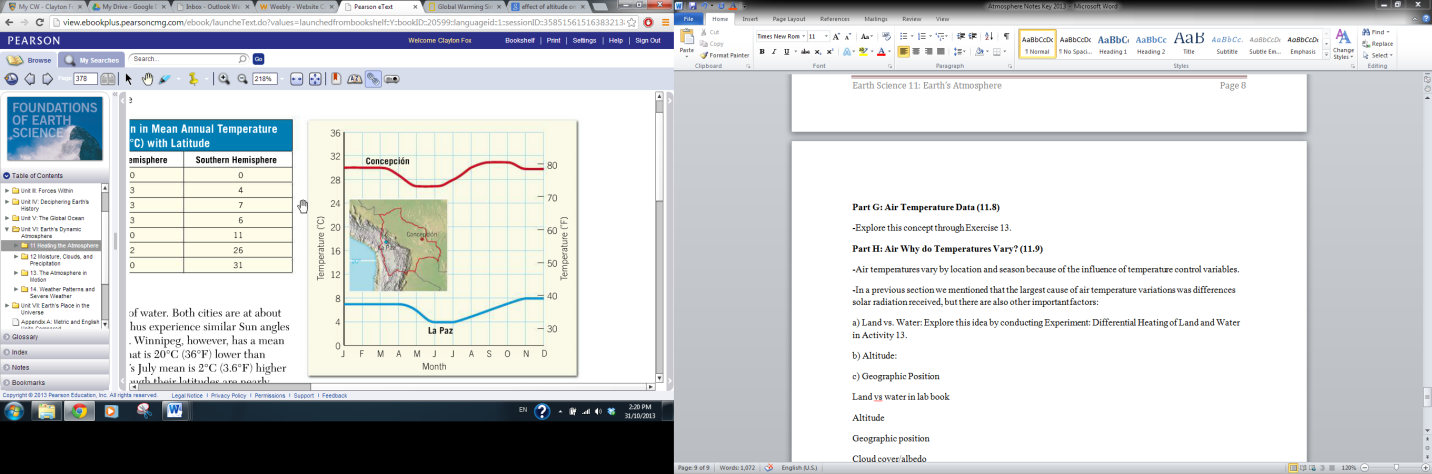
* One of the most significant ways humans are impacting the atmosphere is through the addition of CO2.



|  |
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| **11.8 and 11.9: Air Temperatures and Why do They Vary?** |

* Air temperatures vary by location and season because of the influence of temperature control variables.
* In a previous section we mentioned that the largest cause of air temperature variations was differences in solar radiation received (e.g. Due to latitude, angle of insolation), but there are also other important factors:

|  |  |
| --- | --- |
| **Land vs. Water** | Explore this idea by conducting Experiment: Differential Heating of Land and Water in Activity 13B. |
| **Altitude** | Air temp cools by 6.5 C/km in the troposphere (due to presence of gases and distance from Earth’s surface) |
| **Geographic Position** | **Windward coasts** have a climate moderated by oceans (cool summers, mild winters)  **Leeward coasts** have a continental climate (warm summers, cold winters). |
| **Cloud Cover and Albedo** | Watch *Smartfigure 11.36* to examine the effect of these variables on air temperature.  **Clouds reflect solar radiation and prevent most of it from reaching the Earth’s surface = mild day.**  **By the same process, clouds can also prevent infrared radiation from escaping into space at night = warm nights.** |

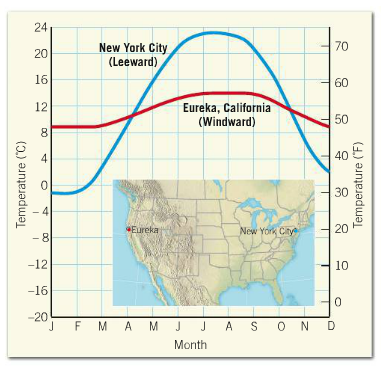
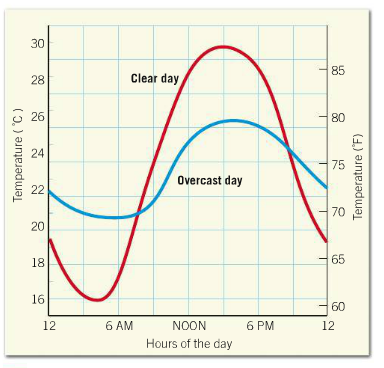


Outline one possible reason for the differences in temperature between Concepcion and La Paz

**Altitude**

Outline one possible explanation for the differences in temperatures between Seattle and Spokane

**Spokane has mountains blocking the ocean winds, so has a continental climate**

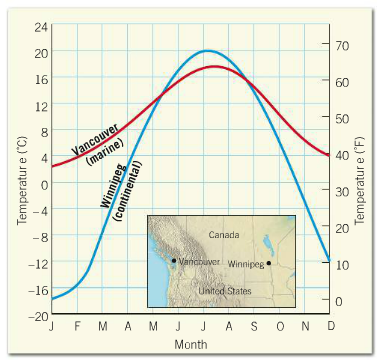
 

Outline one explanation for the difference in temperature between a clear day and an overcast day

**Overcast traps heat so less variation**

Outline one explanation for the differences in temperature between New York City and Eureka

**Windward coast vs. leeward coast**



Outline one explanation for the difference in temperature between Vancouver and Winnipeg

**Ocean moderates temperature in Vancouver**