Mr. Standifer

**Climates and Climate Changes**

**Climate: More Than Just Average Weather**

* Climate describes the long-term weather patterns of an area.
* Climate describes annual variations of 1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, 2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, wind, and other weather variables.
* Climatology is the meteorological study of climates and their phenomena
* Climatologists define a climatic 3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as the arithmetic average of a climate element such as temperature or precipitation over a prescribed 4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_-year interval

**What Causes Climates?**

* Climates around the country vary greatly due to
  1. 5.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. 6.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  3. Closeness of lakes and oceans
  4. availability of moisture
  5. global wind patterns
  6. 7.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  7. air masses

**Latitude**

* The amount of solar radiation received by any one place varies because Earth is tilted on its axis, and this affects how the Sun’s rays strike Earth’s surface.

**Topographic Effects**

* A 8.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is an area of land that receives reduced precipitation due to proximity to mountain ranges. The mountains block the passage of rain-producing weather systems, casting a "shadow" of dryness behind them.
* The condition exists because as warm moist air rises through "orographic lifting" to the top of a mountain range or large mountain, it expands and cools to the point that the air reaches its dew point. At the dew point, moisture condenses onto the mountain and it precipitates *precipitation* onto the 9.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and atop the mountain.
* The air descends on the leeward side, and due to the process of precipitation has lost much of its initial moisture.
* Descending air typically gets warmer in the process on the 10.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the mountain, creating an arid region.

**Climate Classification**

* The 11.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_classification system is a climate classification system that looks at:
* 12.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* 13.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Distinct vegetation found in different climates.
* 6 main divisions:

1. Tropical - Constant high temperatures
2. Dry – largest zone where cT air dominates
   * + precipitation low & vegetation scarce.
     + evaporation rates > precipitation rates
3. Mild – hot & muggy summers, cold & dry winters
4. Continental - clashing tropical and polar air masses.
   * + extreme summer and winter temperatures.

5. & 6. Polar & High elevation – Brutally Cold

* + - Found at poles and high elevations
    - Avg. Temps < 10°F

**Microclimates**

* A microclimate is a localized climate that differs from the main regional climate.
* Concrete and asphalt can create 14.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, where the climate is warmer than surrounding rural areas.

**Climatic Changes**

* During the average human lifetime, climates do not appear to change significantly.
* Climatic change is:
  + Natural
  + Constantly ongoing
  + usually occurs over extremely long time periods.

**Ice Ages**

* Ice ages - periods where average global temps decreased by about 15.\_\_\_\_\_°C and there was extensive glacial coverage.
* warm periods between ice ages 🡪interglacial intervals.
* The most recent ice age ended only about 10,000 years ago.

**Short-Term Climatic Changes**

1. The Seasons
   * When the north pole is pointed toward the sun, the northern hemisphere experiences 16.\_\_\_\_\_\_\_\_\_\_and the southern hemisphere experiences 17.\_\_\_\_\_\_\_\_\_\_\_\_.

2. El Ninõ

* 18.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from the western Pacific surges eastward toward the South American coast.
  + develops about every 19.\_\_\_\_\_ years
  + causes many short-term climatic changes.
* Tends to create stormy weather to areas that are normally dry and drought conditions to areas that are normally wet.
* The strong upper winds help suppress hurricanes in the Atlantic Ocean.

**Change Can Be Natural**

Some changes in Earth’s climate may be caused by natural cycles such as:

* + - Solar activity
    - Changes in Earth’s orbit
    - Changes in Earth’s axis tilt
    - Earth’s axis wobbles
    - Volcanic eruptions.

**Solar Activity**

* The Maunder minimum
  + a period of very low sunspot activity from 1645 to 1716
  + closely corresponds to an unusually cold climatic episode called the “Little Ice Age.”
* High solar activity = 20.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Low solar activity = 21.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Earth’s Orbit**

* Elliptical Orbit
  + Earth passes 22.\_\_\_\_\_\_\_\_\_ to the Sun
  + temperatures become 23.\_\_\_\_\_\_\_\_\_ than normal.
  + Circular Orbit
  + Earth is 24.\_\_\_\_\_\_\_\_\_\_ from the Sun
  + temperatures 25.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_average.

**Earth’s Tilt**

* Earth’s tilt varies every 41,000 years
* Changes in angle cause 26.\_\_\_\_\_\_\_\_\_\_ to become more severe and may cause ice ages

**Earth’s Wobble**

* Earth wobbles as it spins on its axis.
* By about the year 27.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the axis will be tilted in the opposite direction of today.
* Seasons will be reversed
  + Our Summer will be in December, Winter in June.

**Volcanic Activity**

* Some scientists theorize that high volcanic activity causes cool climatic periods.
* Volcanic dust can remain in the atmosphere for several years.
  + blocks 28.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + “The Year Without a Summer” - 1816
    - Temperatures dropped to below freezing in 29\_\_\_\_\_\_\_\_
    - Snow storms in New England
    - Crop Shortages in New England and Northern Europe

**The Greenhouse Effect**

* The greenhouse effect is natural
  + Heating of Earth’s surface caused by the retention of heat by certain atmospheric gases.
* Without the greenhouse effect our planet would be cold.
* A marked increase in the greenhouse effect might cause our planet to be hot.
* Solar radiation reaches Earth’s surface and is reradiated as 30.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* This radiation cannot escape through the atmosphere and is absorbed and re-released by atmospheric gases. This process is called the 31.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it is similar to the way that heat is trapped and released in a greenhouse. (actually this isn’t true)

**Global Warming**

* The greenhouse effect is a natural phenomenon in which Earth’s atmosphere traps heat in the troposphere to warm Earth.
* Global warming, a phenomenon related to the greenhouse effect, is an 32.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Human activities, especially the burning of 33.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, are largely responsible for increased levels of 34.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is the main greenhouse gas that causes global warming.
* The amount of atmospheric carbon dioxide has increased greatly since the 1850s.
* Earth’s mean surface temperature has risen about 35.\_\_\_\_\_\_\_\_\_\_in the last century.
* Some scientists predict it may rise by 1 to 3.5°C in the next 100 years as a result of global warming.
* Other scientists argue that the increase in Earth’s temperature could be part of a natural pattern of climatic change.

**Environmental Efforts**

* We must closely examine activities that cause pollution and deforestation and work to reduce their environmental impact.
* Individuals can combat global warming by 36.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which in turn reduces the consumption of fossil fuels.

**Human Impact on Air Resources**

* **37. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** is a photochemical haze caused by the action of solar radiation on an atmosphere polluted with hydrocarbons and nitrogen oxides mostly from automobile exhaust systems.
* 38.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the major chemical in smog, is a gas molecule made up of three oxygen atoms.
  + Ozone is beneficial in the upper atmosphere because it absorbs and filters out harmful ultraviolet (UV) radiation.
  + Ground-level ozone irritates the eyes, noses, throats, and lungs of humans, and it also has harmful effects on plants.
* Air pollution also occurs in the form of 39.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ranging in size from microscopic bits to large grains.
* Particulates can lodge in lung tissues and cause breathing difficulties and lung disease.

**Ozone Depletion**

* The ozone layer serves as a protective shield as it absorbs and filters out harmful 40.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Chlorofluorocarbons (CFCs), which were previously used in 41.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, used to contribute to ozone destruction in the upper atmosphere.
* Since the mid-1980s, atmospheric studies have detected a thinning of the ozone layer, including an “ozone hole” over 42.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Ozone depletion is entirely a result of human activity.
* The 43.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which 186 countries had signed by 2003, calls for a phase-out in the production and use of most ozone-destroying chemicals by developed countries by the year 2005 and developing countries by the year 2015.
* Based on current trends in data, the return to pre-1980 ozone amounts over Antarctica is expected by the middle of this century.

**Acid Precipitation**

* Acid precipitation is precipitation with a pH of less than 44.\_\_\_\_\_\_\_\_\_\_\_\_.
* Acid precipitation forms when 45.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and 46.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ combine with atmospheric moisture to create sulfuric acid and nitric acid.
* Although volcanoes and marshes add sulfur gases to the atmosphere, 90 percent of the sulfur emissions in eastern North America are of human origin.
* 47.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the greatest source of the nitrogen oxides that cause acid precipitation. Electrical utilities produce most of the sulfur dioxide.
* Coal-burning power plants in the midwestern United States release large amounts of sulfur dioxide because the coal they burn contains high amounts of sulfur.
* When acids are carried into wet weather, they become part of the rain, snow, or fog that falls to the ground in areas far from their source.
  + Acid precipitation causes damage to aquatic ecosystems and affects plants and soil.
  + It also damages stone buildings and statues, and can corrode metal structures.

**Reducing Air Pollution**

* Solving air pollution problems requires cooperation between multiple governments because pollution travels across borders.
  + There has been an international effort to reduce global air pollution caused by carbon dioxide and CFCs.
  + In the United States, the 1990 48.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ set specific reduction goals and enforcement policies for many types of air pollution.
* The Clean Air Act of 1972 was an attempt to reduce the amount of air pollution in the United States. This graph tracks the emission rates of six major air pollutants over a   
  30-year period.
* Many coal-burning power plants have installed a device such as the 49.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to reduce emissions of particulate matter and sulfur dioxide.
* Removing older, highly polluting vehicles from roadways is the most effective way to reduce air pollution.

**Indoor Air Pollution**

* About 90 percent of the furniture sold in the United States also contains 50.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is just one of the many air pollutants that occurs indoors.
* **“Sick” Buildings**
  + Indoor air pollutants have been linked to headaches, coughing, sneezing, burning eyes, nausea, chronic fatigue, and flulike symptoms.
  + A building is said to be “sick” when these symptoms are experienced by 51.\_\_\_\_\_\_\_\_\_\_ percent of its occupants.
  + Often, these symptoms disappear when the affected people go outside.
  + 52\_\_\_\_\_\_\_\_ buildings are more likely to be “sick” than 53.\_\_\_\_\_\_\_ buildings.
* **Radon Gas**
  + Radon-222 is a 54.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ naturally occurring gas produced by the radioactive decay of uranium-238.
  + Outdoors, radon gas seeps from the ground into the atmosphere, where it is diluted to harmless levels.
  + Radon gas can enter through cracks in a foundation and build up to high levels indoors.
  + Once indoors, radon gas decays into radioactive elements that can be inhaled, causing an increased risk of 55.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.