Climate Cycles

A. Long-Term Cycles

1. A(n) ________ climate cycle takes much longer than a lifetime to complete.
   a. To learn about long-term climate cycles, scientists study natural records, such as growth rings of trees, fossilized pollen, and ocean ________.
   b. Scientists use this information to compare __________ climates to ancient climates.

2. Long-term cold periods when glaciers cover most of Earth are called ________.
   a. The most recent ice age began about ________ years ago.
   b. The maximum size of the ice sheets was reached ________ years ago.
   c. ________ are the warm periods that occur during ice ages.
   d. The current interglacial period is the ________ Epoch.

3. The shape of Earth’s ________ affects climate changes.
   a. Earth is cooler if the shape of its orbit is ________, because Earth is then farther from the Sun.
   b. Changes in the ________ of Earth’s tilt also affect climate.

B. Short-Term Cycles

1. Seasonal ________ are one source of short-term climate cycles.
   a. Seasons are caused by the ________ of Earth’s axis.
   b. Changes in tilt change the amount of ________ received in different regions throughout a year.
   c. When the northern hemisphere is tilted toward the Sun, it is ________ in the northern hemisphere.
   d. On the summer ________, which occurs on June 21 or 22 in the northern hemisphere, Earth’s axis is tilted toward the Sun.
   e. The ________ solstice in the northern hemisphere begins on December 21 or 22, at which time Earth’s axis is tilted away from the Sun.
   f. On a(n) ________, northern and southern hemispheres receive equal amounts of sunlight.
Lesson Outline continued

2. In the ______________ Ocean, trade winds usually blow from east to west.
   a. When these winds blow warm water away from South America, cold water rushes upward in the ocean in a process called ______________.
   b. Air over warm, eastern Pacific water has a(n) ______________ air pressure compared to the air over colder water, keeping the wind blowing from east to west.

3. ______________ occurs when the trade winds weaken and air pressure patterns are reversed, resulting in climate changes on Earth.

4. The combined ocean and atmospheric cycle that results in weakened trade winds across the Pacific Ocean is called ______________.

5. The ______________ changes climate for years by changing the position of the jet stream.

6. A wind circulation pattern that changes direction with the seasons is called a(n) ______________.
   a. Monsoons are the result of temperature differences between the ______________ and the land.
   b. When winds blow from high pressure over the ______________ to low pressure over ______________, they bring heavy rains.

C. Droughts, Heat Waves, and Cold Waves

1. During a(n) ______________, an area has less precipitation than usual.

2. Droughts are often accompanied by ______________, which are periods of unusually high temperatures.

3. Long periods of unusually cold temperature are called ______________.
Lesson Outline for Teaching

Lesson 2: Climate Cycles

A. Long-Term Cycles
1. A(n) long-term climate cycle takes much longer than a lifetime to complete.
   a. To learn about long-term climate cycles, scientists study natural records, such as growth rings of trees, fossilized pollen, and ocean sediments.
   b. Scientists use this information to compare present-day climates to ancient climates.
2. Long-term cold periods when glaciers cover most of Earth are called ice ages.
   a. The most recent ice age began about 2 million years ago.
   b. The maximum size of the ice sheets was reached 20,000 years ago.
   c. Interglacials are the warm periods that occur during ice ages.
   d. The current interglacial period is the Holocene Epoch.
3. The shape of Earth’s orbit affects climate changes.
   a. Earth is cooler if the shape of its orbit is circular, because Earth is then farther from the Sun.
   b. Changes in the angle of Earth’s tilt also affect climate.

B. Short-Term Cycles
1. Seasonal changes are one source of short-term climate cycles.
   a. Seasons are caused by the tilt of Earth’s axis.
   b. Changes in tilt change the amount of solar energy received in different regions throughout a year.
   c. When the northern hemisphere is tilted toward the Sun, it is summer in the northern hemisphere.
   d. On the summer solstice, which occurs on June 21 or 22 in the northern hemisphere, Earth’s axis is tilted toward the Sun.
   e. The winter solstice in the northern hemisphere begins on December 21 or 22, at which time Earth’s axis is tilted away from the Sun.
   f. On a(n) equinox, northern and southern hemispheres receive equal amounts of sunlight.
2. In the Pacific Ocean, trade winds usually blow from east to west.
   a. When these winds blow warm water away from South America, cold water rushes upward in the ocean in a process called upwelling.
   b. Air over warm, eastern Pacific water has a(n) lower air pressure compared to the air over colder water, keeping the wind blowing from east to west.
Lesson Outline continued

3. **El Niño** occurs when the trade winds weaken and air pressure patterns are reversed, resulting in climate changes on Earth.

4. The combined ocean and atmospheric cycle that results in weakened trade winds across the Pacific Ocean is called **El Niño/Southern Oscillation**.

5. The **North Atlantic Oscillation** changes climate for years by changing the position of the jet stream.

6. A wind circulation pattern that changes direction with the seasons is called a(n) **monsoon**.
   - a. Monsoons are the result of temperature differences between the **ocean** and the land.
   - b. When winds blow from high pressure over the **ocean** to low pressure over **land**, they bring heavy rains.

C. **Droughts, Heat Waves, and Cold Waves**
   1. During a(n) **drought**, an area has less precipitation than usual.
   2. Droughts are often accompanied by **heat waves**, which are periods of unusually high temperatures.
   3. Long periods of unusually cold temperature are called **cold waves**.

**Discussion Question**
How would a severe drought change the region where you live?
Possible answer: Plants that are not drought-tolerant would die, which could affect crops, wildlife, and soil erosion. We would probably have to ration our water consumption.