Name: _____ Date: _____

-Ch 13: Atmosphere and Climate Change

13.1 Climate and Climate Change

* _____ is the state of the _____at a particular place at a particular moment.
* _____ is the long-term prevailing weather conditions at a particular place based upon_____ taken

A. What Factors Determine Climate?

- Climate is determined by a variety of _____
- Most important of these factors is _____ from the _____.

B. Latitude

- _____ is the distance from the equator measured in _____ north or south of the equator.
- The most northerly latitude is North pole at _____, and most southerly latitude is the South Pole at _____

1. Low Latitudes
    - Latitude influences _____ because the amount of solar energy an area of earth _____ depends on its _____
    - More solar energy _____ on areas near the _____
    - In regions near the _____ the night and day are both about _____ hours long
    - Temperatures are _____ year-round, and there are no _____ or winters.
2. High Latitudes
    - In regions closer to the poles the amount of _____ arriving at the _____ is reduced.
    - Sunlight hits the earth at an _____ angle and spreads over a _____ surface
    - Near the poles the sun _____ for only a few hours each day in the summer
    - The sun _____ for only a few hours each day in the _____

C. Atmospheric Circulation

- 1st: _____ _____ sinks because it is denser than warm air, as cold air sinks it compresses and warms
- 2nd : _____ _____ rises and it expands and cools at is rises
- 3rd : warm air can hold more _____ _____ than cold air can
- When warm air _____ the water vapor may _____ into liquid to form rain, snow or fog

- _____ energy heats the ground which warms the air, and cooler air _____ into replace it
- The movement of air within the atmosphere is called _____
- The circulation pattern determines earth's _____ pattern

1. Global Circulation Patterns
    - Cool air normally _____, but cool air over the equator _____ sink because hot air is _____ below the cool air
    - As a result the cool air rises and is _____ away from the _____.
    - At about _____ some of this cool air sinks back down to earth
    - Air descending at 30° either moves toward the _____ or toward the _____
    - Air moving towards the poles _____ while it is near earth's _____
    - At _____ this air collides with cold air traveling from the poles.
    - Cold dry air _____ at the poles, which are essentially very cold _____.
2. Prevailing Winds
    - _____ _____ are winds that blow predominantly in one direction throughout the _____
    - Because of the _____ of the earth these winds do not blow directly _____ or _____.
    - _____ _____ are belts of prevailing winds that blow most of the time in _____ hemispheres between 30° and the equator
    - _____ are produced between 30° and 60°.
    - In the northern hemisphere these westerlies are _____ winds
    - In the southern hemisphere these westerlies are _____ winds

D. Oceanic Circulation Patterns

- Ocean _____ have a great effect on climate because water holds large amounts of _____
- Movement of surface oceans currents is caused mostly by _____ and the rotation of the earth
- _____ currents affect the _____ in many parts of the world

1. El Nino –Southern Oscillation
    - _____ is the name given to the _____, periodic change in the location of warm and cold water masses, and is known as the warm phase.
    - During El Nino winds in the western Pacific Ocean (which are normally weak) strengthen and push warm water eastward
    - This produces increased rainfall in the southern ½ of the US and in South America

- Causes drought in Indonesia and Australia
- _____ is where the water in the eastern Pacific Ocean is colder than usual
- it is considered the _____ _____
- both El Nino and La Nina are opposite phases of the _____ _____ _____ cycle

2. Pacific Decadal Oscillation
   - *Pacific Decadal Oscillation (PDO)* is a _____ change in the location of warm and cold water masses in the Pacific _____
   - This influenced the climate in the _____ pacific ocean and north _____
   - It affects ocean _____ temps, air temps, and _____ patterns.

E. Topography

- _____ above sea level (elevation) has a important effect on climate
- Temperature falls by _____for every _____meter increase in elevation
- _____ and mountain ranges influence the distribution of _____.

F. Other Influences on Earth's Climate

- Both _____ and volcanic _____ influence earth climate
- _____ _____ is when the sun emits an increased amount of ultraviolet (UV) radiation.
- UV radiation produces more _____ , warming the _____
- In large-scale volcanic eruptions, _____ _____ gas can reach the upper atmosphere.
- The reaction of sulfur dioxide gas forms a bright layer of haze that _____ sunlight.

G. Seasonal Changes in Climate

- Seasons result from the _____ of the earth's axis
- Because of this tilt the angle at which the sun's rays strike the earth _____ as the earth moves around the sun
- During _____ in the northern hemisphere the northern hemisphere tilts _____ the sun and receives direct sunlight.
- The southern hemisphere tilts _____ from the sun and receives _____ direct sunlight.

Section 14.1 Active Reading: Climate and Climate Change
Read the passage below and answer the questions that follow.

You know that the temperature and precipitation change with the seasons. But do you know what causes the seasons? The seasons result from the tilt of Earth's axis (about 23.5° relative to the plane of its orbit). Because of this tilt, the angle at which the sun's rays strike the Earth changes as the Earth moves around the sun. During summer in the Northern Hemisphere, the Northern Hemisphere tilts toward the sun and receives direct sunlight. The number of hours of daylight is greatest in the summer. Therefore, the amount of time available for the sun to heat the Earth becomes greater. During summer in the Northern Hemisphere, the Southern Hemisphere tilts away from the sun and receives less direct sunlight. During summer in the Southern Hemisphere, the situation is reversed. The Southern Hemisphere is tilted toward the sun, whereas the Northern Hemisphere is tilted away.

IDENTIFYING MAIN IDEAS

Read each question and write the answer in the space provided.

1. How much does Earth tilt on its axis?_____ _____

2. The number of hours of daylight is greatest when? _____

3. Where is the Northern Hemisphere in relation to the sun in summer? _____

_____

_____ 4. Which of the following sentences best states the main idea of the passage?

a. The amount of time for the sun to heat Earth becomes greater.
b. The seasons result from the tilt of Earth on its axis.
c. The Southern Hemisphere is tilted away from the sun.
d. Temperature and precipitation change with the seasons.

RECOGNIZING SIMILARITIES AND DIFFERENCES

Read each question and write the answer in the space provided.

5. What season is it in the Northern Hemisphere when the Southern Hemisphere is tilted toward the sun?

_____

6. What season is it in the Southern Hemisphere when the Northern Hemisphere is tilted away from the sun?

_____

RECOGNIZING CAUSE AND EFFECT
Read each question and write the answer in the space provided.

7. What causes the seasons? _____

8. How does the tilt of Earth affect sunlight? _____

_____

9. How does the amount of time in which the sun can warm Earth affect the seasons?

_____

10. Where is the Southern Hemisphere in relation to the sun when it is summer in the Northern Hemisphere?

_____

11. Where is the Northern Hemisphere in relation to the sun when it is summer in the Southern Hemisphere?

_____

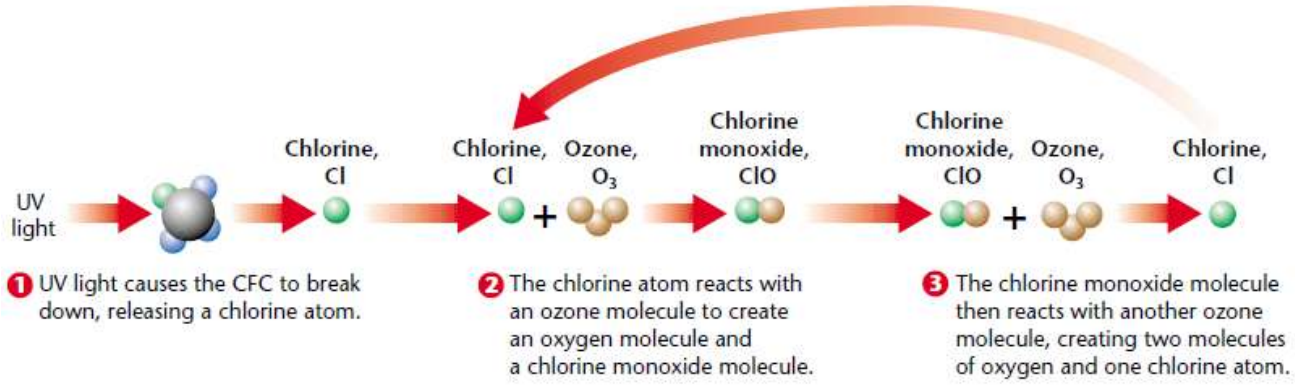
Name: _____ Date: _____

13.2 The Ozone Shield

* _____ _____ is an area in the stratosphere where ozone is highly concentrated
* Ozone is a molecule made of _____ oxygen atoms
* Ozone absorbs most of the _____ light form the sun.
* UV light is _____ to organisms because it can damage the _____ material in cells.

A. Chemicals That Cause Ozone Depletion

- _____ _____ (CFCs) are hydrocarbons in which some or all of the hydrogen atoms are replaced by _____ and _____.
- CFC's were used in _____ for refrigerators and air conditioners and in cleaning _____
- Scientists worry that they might be _____ the ozone layer.
- Once the CFC molecules break apart, parts of the CFC molecules destroy _____
- Scientists have estimated that a single chlorine atom from CFC can destroy _____ ozone molecules

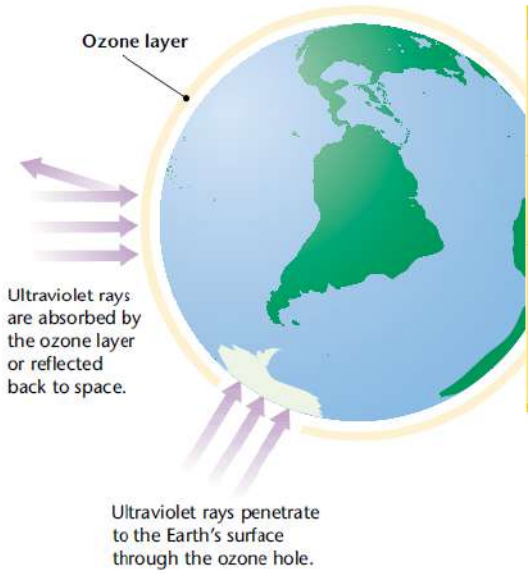


B. The Ozone Hole

- In 1985 a study revealed that the ozone layer above the south pole had thinned by _____ percent
- _____ _____is a thinning of stratospheric ozone that occurs over the poles during the spring
- The concentrations of ozone _____ during the year but data showed a growing ozone hole

1. How Does the Ozone Hole Form?
    - *Polar vortex* is the strong _____ winds over Antarctica during the dark polar winters
    - _____ _____ _____ are high altitude clouds made of water and nitric acid

- On the surface of polar stratospheric clouds the products of CFCs are converted to molecular _____
- When the sunlight returns the molecular chlorine is split into two chlorine atoms and _____ destroys ozone
- Ozone produce by pollution _____ down or combines with other substance before it can _____ the stratosphere to replace the ozone being destroyed.



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2. Effects of Ozone Thinning on Humans
   - As the amount of ozone _____ more UV light is able to pass through the atmosphere and reach Earth's _____
   - Exposure to UV light makes the body more susceptible to _____ _____
3. Effects of Ozone Thinning on Animals and Plants
   - High levels of UV light can _____ single-celled organisms call _____
   - Loss of phytoplankton could disrupt_____ food chains and reduce _____ harvests
   - UV light can kill unprotected DNA in eggs of _____, increased _____ light will kill more eggs
   - UV light damages _____ by interfering with _____
   - This can result in lower _____ _____

Damaging Effects of UV Light	
Humans	• increased incidence of skin cancer • premature aging of the skin • increased incidence of cataracts • weakened immune response
Amphibians	• death of eggs • genetic mutations among survivors • reduction of populations
Marine Life	• death of phytoplankton in surface water • disruption of food chain • reduction in the number of photosynthesizers
Land Plants	• interference with photosynthesis • reduced crop yields

C. Protecting the Ozone Layer

- _____ _____is an agreement between nations to agree to sharply limit their production of CFCs
- US pledged to _____ all substances that pose a significant danger to the ozone layer by 2000
- The battle to protect the ozone is not over CFC's can remain active for _____ years

Section13.2 Active Reading: The Ozone Shield
Read the passage below and answer the questions that follow.

High levels of UV light can kill single-celled organisms called phytoplankton that live near the surface of the ocean. The loss of phytoplankton could disrupt ocean food chains and reduce fish harvests. In addition, a reduction in the number of phytoplankton would cause an increase in the amount of carbon dioxide in the atmosphere. Some scientists believe that increased UV light could be especially damaging for amphibians, such as toads and salamanders. Amphibians lay eggs that lack shells in the shallow water of ponds and streams. UV light at natural levels kills many eggs of some species by damaging unprotected DNA. Higher UV levels might kill more eggs and put amphibian populations at risk. Ecologists often use the health of amphibian populations as an indicator of environmental change due to the environmental sensitivity of these creatures.

IDENTIFYING MAIN IDEAS

Read each question and write the answer in the space provided.

1. Authors sometimes use one person, place, or thing as the main focus of their writing. What group of organisms is the center of focus in the first paragraph of this passage?

_____

2. Where do these organisms live? _____

3. What group of organisms is the center of focus in the second paragraph? _____

4. Where do these organisms lay their eggs? _____

5. In your own words, state the main idea of this passage. _____

_____

6. What is notable about the eggs of these organisms? _____

7. Why do ecologists use amphibians to gauge environmental change? _____

RECOGNIZING CAUSE AND EFFECT

Read each question and write the answer in the space provided. _____

8. What effect does a high level of UV light have on phytoplankton? _____

_____

9. If the number of phytoplankton decreases, what happens to the amount of carbon dioxide in the atmosphere? _____

_____

10. If the number of phytoplankton decreases, what happens to the food chains in the ocean?

_____

_____

11. What effect does UV light have on amphibians? _____

_____

12. What in an amphibian egg is damaged by UV light? _____

_____

13. If UV levels are increased, what is likely to happen to amphibian populations?

_____

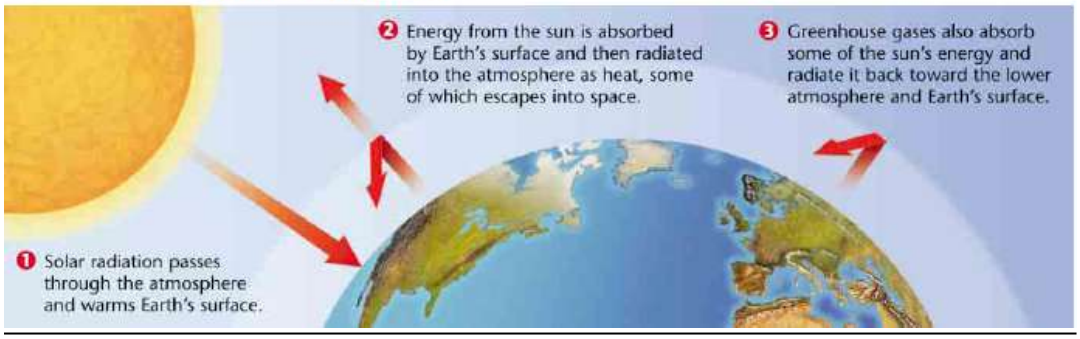
_____

Name: _____ Date: _____

13.3 Global Warming

* The reason a car interior _____ up is because the suns energy streams into it through the windows and the carpets and upholstery _____ the light and change it into _____ energy
* The heat continues to build up and is _____ inside the car.
* This is similar to what happens in a _____.

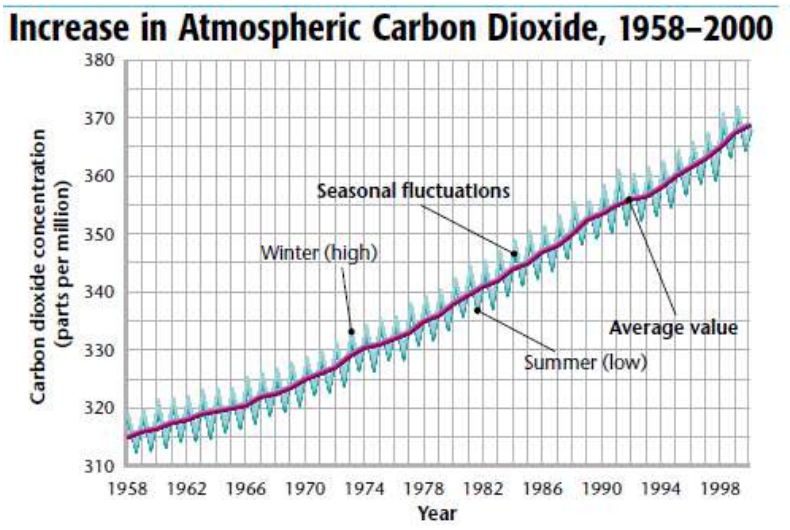
A. The Greenhouse Effect

- The earth's _____ acts like the _____ in a greenhouse
- Heat streams through the atmosphere and _____ the earth, some of this heat radiates out into _____ and the rest of the heat is absorbed by the _____ in the troposphere and warms the air.
- That process is known as the _____ _____.
- _____ _____are gases in our atmospheres that absorb and radiate heat.
- the major greenhouse gases are _____ vapor, _____ _____, chlorofluorocarbons, _____ and nitrous oxide.
- Water vapor and carbon dioxide account for _____ of the absorption of heat that occurs in the _____.
- 

1. Measuring Carbon Dioxide in the Atmosphere
    - 1958 Charles Keeling installed an instrument at the top of a tower on the volcano _____ _____ in Hawaii.
    - This instrument was to measured the _____ levels in the air.
    - This location was picked because it is far from _____ and _____ (CO_2 levels vary daily in these areas)

- Most of the CO_2 that is released into the air _____ in the ocean or is used by plants for _____.
- During the summer plants use _____ CO_2 than they release in _____.
- This causes CO_2 levels in the air to _____ in the summer
- In the winter the dying grasses and fallen leaves decay and _____ the carbon that was stored in them and as a result the CO_2 levels _____ rise

2. Rising Carbon Dioxide Levels
   - After a few years of measuring it was _____ that the CO_2 levels were changing in ways other than just the _____ fluctuations
   - The figure below show that CO_2 level in the atmosphere have increased by _____ in less than _____ years



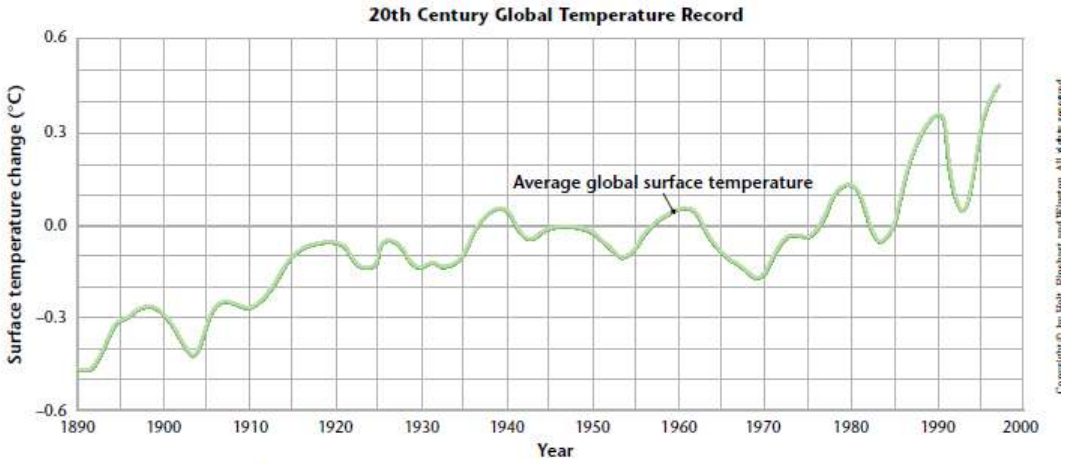
   - This increase is due largely to the _____ of _____ fuels
   - These measurements show that CO_2 levels in the atmosphere today are _____ than they have been for the last _____years, and probably for the last _____ million years.

3. Greenhouse Gases and the Earth's Temperature
   - Many scientists think that more greenhouse gases in the _____ will result in an increase in global _____
   - The comparison of CO_2 levels and the average global temperatures for the past _____ years supports this view.
   - Today we are releasing _____ CO_2 gasses than any other _____ gas into the atmosphere.

- The CO_2 comes from _____ plants that burn _____l or oil, and from _____
- Also from burning _____ in the tropical rain forests to clear the land for farming

B. Global Warming

- The figure below shows that the average temperature at Earth's surface _____ during the _____ century.



Source: National Center for Atmospheric Research.

- _____ _____ is the increase in the Earth's surface temperature.
- The temperature is _____ at a similar rate to the _____ in greenhouse gases in the atmosphere
- Many scientists have _____ that the increase in greenhouse gases has _____ the increase in _____.
- But it is not possible to rule out _____ climatic _____
- We know that _____ in temperate on Earth occur naturally over the centuries.

1. Modeling Global Warming
   - _____ about future changes in climate are based on _____ models
   - The models can be used to predict how factors such as _____ and _____ _____will be affected.
   - The programs and models they produce are not always _____
   - Computer models are becoming more _____, as more data is available and additional _____ are included

C. The Consequences of a Warmer Earth

- In North America, tree swallows; Baltimore orioles and robins are nesting about _____ days earlier than they did _____ years ago.

- In Britain _____ species of plants are flowering up to _____ days earlier in the year than they did 40 years ago.
- There is no _____ that these changes are caused by global _____
- But both are strongly _____ by temperature
- Scientists are not sure how _____ the earth will warm or how _____ the effects will be
- Possible effects of _____ warming include changes in _____ patterns and rising _____ levels
- The effects of a warmer Earth will not be the _____ everywhere

1. Melting Ice and Rising Sea Levels
    - Ice _____ as global temperatures _____.
    - The melting of ice causes sea levels around the world to _____
    - Coastal _____ and other _____areas could be _____
    - Beaches could be extensively _____ and the _____of bays and estuaries might increase
2. Global Weather Patterns
    - If the Earth warms up significantly the surface of the _____ will absorb more heat and make _____and _____more common
    - Global warming could change the oceans _____ patterns, like shutting off the _____ _____
    - Some regions might have more _____ then normal and other regions might have _____.
3. Human Health Problems
    - Warmer average global temperatures pose potential threats to humans health
    - Greater numbers of _____ related _____ could occur
    - Trees and flowering plants would flower _____ and for_____ causing people with allergies to pollen would suffer from allergies longer
    - _____ temperatures could enable _____ to establish themselves in areas that are too _____ for them at the moment.
4. Agriculture
    - _____ would be most _____ impacted by global warming if extreme weather events become more frequent.
    - Higher temperatures could result in _____ crop yields

- Demands for _____ would further deplete aquifers

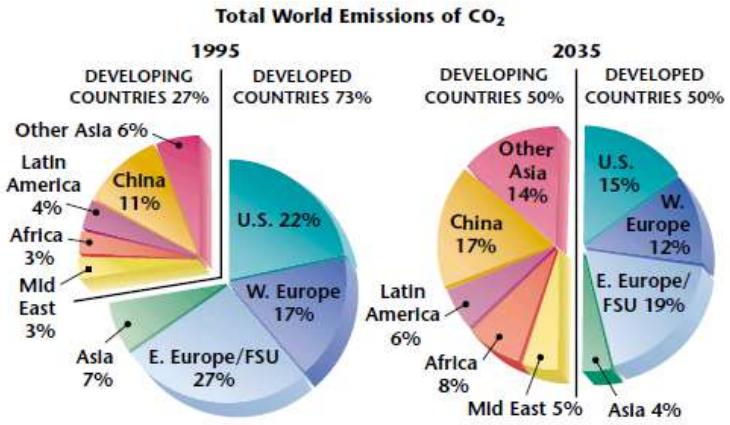
5. Effects on Plants and Animals
   - Climate change could after the _____ of plants species and the _____ of plant communities
   - Trees could _____ cooler areas
   - Forests could s_____ in the _____ part of the range
   - There may be a shift in the geographical range of _____
   - _____ in surface water of the ocean might cause a reduction of _____ (the source of food for many fish)
   - Warming in tropical waters may kill the _____ that nourish the corals and destroy _____ _____

D. Recent Findings

- The Intergovernmental Panel on Climate Change (IPCC) is a network of leading climatologists from _____ countries
- IPCC issued its Third Assessments Report (TAR) that describes future estimates about the state of the global climate system.
- Some findings include that the _____ global surface temperature increased by _____
- Snow cover and ice extend have _____and the average global sea level has _____
- TAR predicted that human influences will continue to _____ the composition of the Earth's atmosphere throughout the _____century.

E. Reducing the Risk

- In 1997 representatives from _____ countries met and set timetables for reducing emissions of _____ _____.
- The _____ _____requires developed countries to decrease emissions of carbon dioxide and other greenhouse gasses by an average of _____ below the 1990 levels
- The need to _____ global warming has been recognized by the global community
- The attempt to slow global warming is made difficult by _____, political, and social _____ faced by different countries.



- Source: U.S. Environmental Protection Agency.

Section 14.3 Active Reading: Global Warming
Read the passage below and answer the questions that follow.

Many scientists think that the increasing greenhouse gases in our atmosphere result in increasing the average temperature on Earth. The result, they believe, will be a warmer Earth. This predicted increase in global temperature is known as global warming. Earth's average global temperature increased during the 20th century. Many scientists project that the warming trend that began in the 20th century will continue throughout the 21st century. However, not all scientists agree that the observed global warming is due to greenhouse gases. Some scientists believe that the warming is part of natural climatic variability. They point out that widespread fluctuations in temperature have occurred throughout geologic time.

IDENTIFYING MAIN IDEAS

In the space provided, write the letter of the term or phrase that best completes each statement.

_____ 1. Earth's average temperature during the 20th century.
a. increased c. stayed the same
b. decreased d. fluctuated

_____ 2. Scientists predict that the Earth's average temperature will throughout the 21st century.
a. stabilize c. begin to decrease
b. continue to increase d. fluctuate more sharply

_____ 3. Many scientists blame the presence of in the atmosphere for Earth's increased average temperature.
a. CFCs c. ozone
b. oxygen d. greenhouse gases

VOCABULARY DEVELOPMENT

Read each question and write the answer in the space provided.

4. The predicted increase in Earth's average temperature is known as: _____

_____

5. What is another key term for this chapter that appears in this passage? _____

_____

6. Global can mean “worldwide.” Given this definition, whom would you say is affected by global warming? _____

_____

RECOGNIZING SIMILARITIES AND DIFFERENCES

Read each question and write the answer in the space provided.

7. What do those scientists who believe the Earth is experiencing global warming use as evidence to support their claims?

_____

_____

8. What do these scientists say is the cause of global warming?

_____

_____

9. What do those scientists who do not believe the Earth is experiencing global warming use as evidence to support their claims?

_____

_____

10. What do these scientists say is the cause of the increase in temperature throughout the 20th century?

_____

_____