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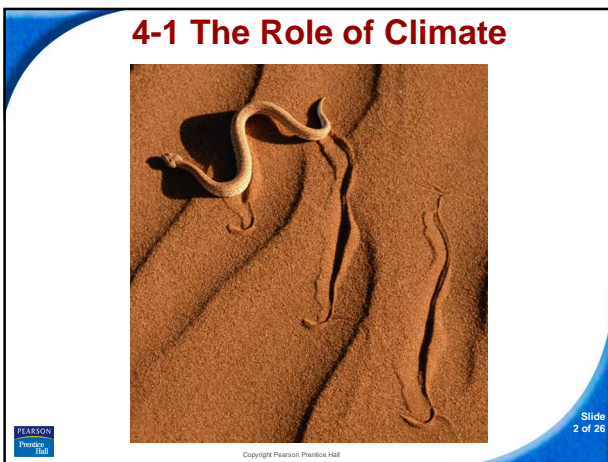
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4-1 The Role of Climate ➡ What Is Climate?

### What Is Climate?

**Weather** is the day-to-day condition of Earth's atmosphere at a particular time and place.

**Climate** refers to the average year-after-year conditions of temperature and precipitation in a particular region.

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4-1 The Role of Climate ➡ What Is Climate?

Climate is caused by:

- trapping of heat by the atmosphere
- latitude
- transport of heat by winds and ocean currents
- amount of precipitation
- shape and elevation of landmasses

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4-1 The Role of Climate ➡ The Greenhouse Effect

 **How does the greenhouse effect maintain the biosphere's temperature range?**

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4-1 The Role of Climate ➡ The Greenhouse Effect

**The Greenhouse Effect**

 **Atmospheric gases that trap the heat energy of sunlight and maintain Earth's temperature range include:**

- carbon dioxide
- methane
- water vapor

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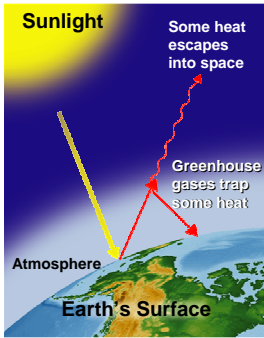
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4-1 The Role of Climate ➡ The Greenhouse Effect

The natural situation in which heat is retained in Earth's atmosphere by this layer of gases is called the **greenhouse effect**.



The diagram illustrates the greenhouse effect. A yellow arrow labeled 'Sunlight' points from the top left towards the 'Earth's Surface'. A red arrow points from the 'Earth's Surface' up into the 'Atmosphere'. Another red arrow points from the 'Atmosphere' back down to the 'Earth's Surface', labeled 'Greenhouse gases trap some heat'. A third red arrow points from the 'Atmosphere' up and away from the Earth, labeled 'Some heat escapes into space'.

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4-1 The Role of Climate ➡ The Effect of Latitude on Climate

### The Effect of Latitude on Climate

Solar radiation strikes different parts of Earth's surface at an angle that varies throughout the year.

At the equator, energy from the sun strikes Earth almost directly.

At the North and South Poles, the sun's rays strike Earth's surface at a lower angle.

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4-1 The Role of Climate ➡ The Effect of Latitude on Climate

 **What are Earth's three main climate zones?**

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As a result of differences in latitude and thus the angle of heating, Earth has three main climate zones:

- polar,
- temperate, and
- tropical.

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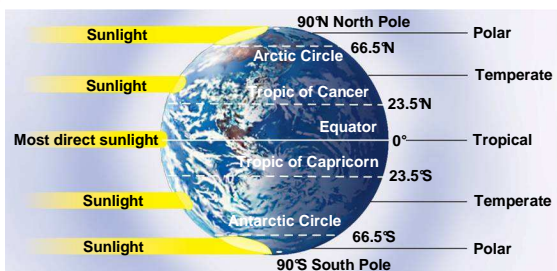
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### Earth's Main Climate Zones



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The **polar zones** are cold areas where the sun's rays strike Earth at a very low angle.

Polar zones are located in the areas around the North and South poles, between 66.5° and 90° North and South latitudes.

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4-1 The Role of Climate ➡ The Effect of Latitude on Climate

The **temperate zones** sit between the polar zones and the tropics.

Temperate zones are more affected by the changing angle of the sun over the course of a year.

As a result, the climate in these zones ranges from hot to cold, depending on the season.

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4-1 The Role of Climate ➡ The Effect of Latitude on Climate

The **tropical zone**, or tropics, is near the equator, between 23.5° North and 23.5° South latitudes.

The tropics receive direct or nearly direct sunlight year-round, making the climate almost always warm.

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4-1 The Role of Climate ➡ Heat Transport in the Biosphere

### Heat Transport in the Biosphere

Unequal heating of Earth's surface drives winds and ocean currents, which transport heat throughout the biosphere.

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4-1 The Role of Climate ➡ Heat Transport in the Biosphere

Warm air over the equator rises, while cooler air over the poles sinks toward the ground.

The upward and downward movement of air creates air currents, or winds, that move heat throughout the atmosphere.



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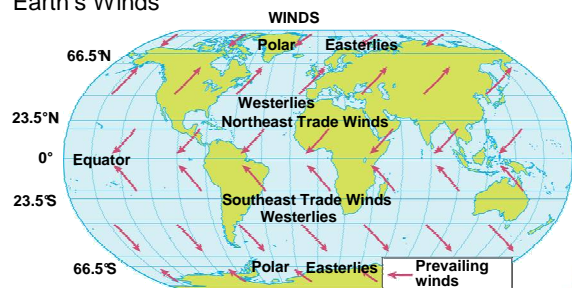
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4-1 The Role of Climate ➡ Heat Transport in the Biosphere

Earth's Winds



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4-1 The Role of Climate ➡ Heat Transport in the Biosphere

Similar patterns of heating and cooling occur in Earth's oceans. Cold water near the poles sinks, then flows parallel to the ocean bottom, and rises in warmer regions.

Water is also moved at the surface by winds.



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4-1 The Role of Climate ➡ Heat Transport in the Biosphere

The movement of the water creates ocean currents, which transport heat energy throughout the biosphere.

Surface ocean currents warm or cool the air above them, affecting the weather and climate of nearby landmasses.



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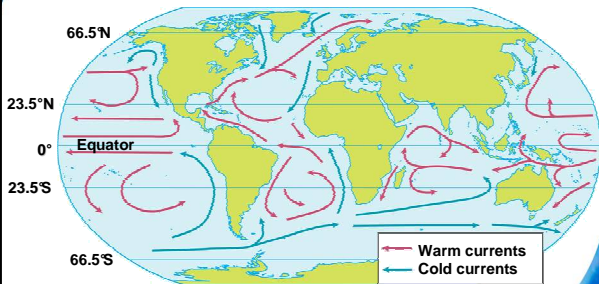
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4-1 The Role of Climate ➡ Heat Transport in the Biosphere

Ocean Currents OCEAN CURRENTS



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4-1 Section QUIZ

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**Section QUIZ**

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#### 4-1 Section QUIZ

- 1 The Earth's polar zones are cold because
- a. they are never heated by the sun.
  - A b. at the poles, the sun's rays are at a very low angle.**
  - c. the greenhouse effect does not occur at the poles.
  - d. heat is transported from the poles to the equator.



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#### 4-1 Section QUIZ

- 2 The upward movement of warm air and the downward movement of cool air creates
- a. upwellings.
  - A b. air currents.**
  - c. ocean currents.
  - d. the greenhouse effect.



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#### 4-1 Section QUIZ

- 3 Earth's temperature range is maintained by
- A a. the greenhouse effect.**
  - b. climate zones.
  - c. ocean currents and winds.
  - d. latitude differences.



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#### 4-1 Section QUIZ

- 4 Variation of temperature in the temperate zone is due primarily to
- a. air and ocean currents.
  - b. the greenhouse effect.
  - c. variation in the sun's energy production.
  - A d. latitude and season.



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#### 4-1 Section QUIZ

- 5 The tropical zone is warm all year long because
- a. the sun's angle changes the most in that part of Earth.
  - b. ocean water is warmest near the equator.
  - A c. it receives direct or nearly direct sunlight year-round.
  - d. landmasses in the tropic latitudes hold on to heat.



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**END OF SECTION**

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