

The Sun's Effect on Climate: Learning Goals for Students and Teachers

Overarching learning goal: Climates vary and change because the Sun's energy unevenly heats Earth's surface. The consistent tilt of Earth on its axis, Earth's orbit around the Sun, and the angle at which sunlight hits Earth's curved surface cause uneven heating at different latitudes and times of the year. Other factors, such as elevation and proximity to large bodies of water, also influence climate.

Student and Teacher Learning Goals	Additional Teacher Learning
<ol style="list-style-type: none"> 1. Temperatures on Earth's surface vary according to latitude and time of year. 2. Because Earth is a sphere, sunlight hits the curved surface more directly closer to the equator and less directly closer to the poles. Variations in the angle at which sunlight strikes Earth's surface at different latitudes create uneven heating. 3. The consistent tilt of Earth on its axis produces opposite seasons in the Northern and Southern Hemispheres. 4. Earth's consistent tilt and the angle at which sunlight strikes the surface at different times of the year causes the Northern and Southern Hemispheres to experience different intensities of sunlight and opposite periods of warmer and cooler temperatures (seasons). 5. The consistent tilt of Earth on its axis, Earth's orbital path around the Sun, and the angle at which sunlight hits Earth's curved surface are key factors that produce climate variations at different latitudes. But other factors, such as elevation and proximity to large bodies of water, also influence temperature patterns and climate. 6. Water and land absorb and release the Sun's incoming energy at differing rates. These variations in heating and cooling rates influence regional climates by affecting average air temperatures. 7. Because of Earth's curvature and consistent tilt, the angle of sunlight that strikes Earth's surface varies at different times of the year, causing uneven heating. While latitude is a key factor influencing climate, other factors are involved, such as elevation and proximity to large bodies of water. 	<ol style="list-style-type: none"> 1Ta. Weather is a short-term change in atmospheric conditions based on geographic location, time of year, local heating and cooling processes, atmospheric moisture, and the movement of air masses. 1Tb. Climate is an <i>average</i> of atmospheric conditions—including temperature, precipitation, humidity, air pressure, and wind—in a region over longer periods of time (e.g., weeks, months, years, decades). 4Ta. When the Earth's axis tilts neither away from nor toward the Sun (spring and fall), the equator receives the most direct rays of sunlight. When the Northern Hemisphere is inclined most toward the Sun, the Sun's rays are directly over the Tropic of Cancer (23.5° N latitude), and when the Southern Hemisphere is inclined most toward the Sun, the Sun's rays are directly over the Tropic of Capricorn (23.5° S latitude). 5Ta. Proximity to large bodies of water, such as oceans, influences regional climates because water absorbs and reflects the Sun's energy at different rates than land. 5Tb. Cooler temperatures exist at higher elevations because the air is less dense, holds less heat, and is farther from reflected solar radiation that produces heating in Earth's lower atmosphere. 6Ta. Energy from the Sun ultimately drives climatic conditions. Latitude, elevation, and proximity to large bodies of water are key factors that determine climate.