Long-Term Climate Change

Study Tip

Remember **S**ally **P**icks **M**any **G**rapes, to remember the four main causes of long-term climate change.

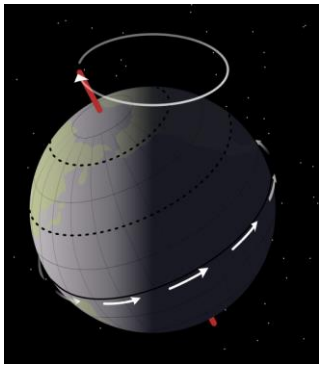
Solar Variation

- The amount of energy the sun radiates changes over time. **Sunspots**—magnetic storms that appear on the sun's surface—can increase the amount of solar radiation that the earth receives.

Plate Tectonics

- As plates move, ocean currents can change and distribute heat differently on continents.
- Continents drifting toward the poles can cause more ice to accumulate, thus lowering the global temperature.
- Plate motions can also cause volcanic eruptions, releasing dust and carbon dioxide that can change climates for years.

Milankovitch Cycles



- The elliptical shape of the orbit, the wobbling on the axis of rotation, and the tilt of the axis can all cause variations in the amount solar radiation Earth receives.
- This creates a **Milankovitch cycle**, a climate pattern estimated to be 100,000 years long.
    - Ice ages are often timed with the Milankovitch cycle.

Greenhouse Gas Levels

- Greenhouse gases trap the heat that radiates off Earth's surface; therefore, changes in levels of carbon dioxide can change global temperature.
- The amount of carbon dioxide and other greenhouse gases can be increased by volcanic eruptions and the decaying of organic matter, and can be decreased from the absorption by plants and animal tissue.

Concept Check

- How do plate tectonics, solar variation, Milankovitch cycles, and differing levels of greenhouse gases affect long term climate change?