



Unit 4 – The Atmosphere and Oceans

**Standards Covered in this Unit**

**Energy in the Earth System / Structure and Composition of the Atmosphere**

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:
  - a. *Students know* the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.
  - b. *Students know* the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
  - c. *Students know* the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.
  - d. *Students know* the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.
5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept:
  - a. *Students know* how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
  - b. *Students know* the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.
  - c. *Students know* the origin and effects of temperature inversions.
  - d. *Students know* properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.
  - e. *Students know* rain forests and deserts on Earth are distributed in bands at specific latitudes.
  - f. *Students know* the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.
  - g. *Students know* features of the ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.
6. Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:
  - a. *Students know* weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
  - b. *Students know* the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.
  - c. *Students know* how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.
  - d. *Students know* how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.
8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:
  - a. *Students know* the thermal structure and chemical composition of the atmosphere.
  - b. *Students know* how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.
  - c. *Students know* the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

The above standards will be covered by the Benchmark Tests given at the end of each unit. Students should use these standards as a study guide. General tutoring is available after school for all science classes; ask your teacher for details. Targeted tutoring will be available specifically for those students who do not pass the Benchmark Test. Details regarding targeted tutoring will be sent home as required.