



Earth Science Learning Targets (2 pages)

Earth's Place in the Universe
1. Understand the current theories on the formation of the universe and use these theories to explain differences and similarities among the sun, the terrestrial planets and the gas planets.
2. Understand the geological evidence for the age of the Earth and the changes in the Earth over geologic time.
3. Understand the relative distances between the Earth, other planets, and stars, and know that typical stars (including our sun) are powered by nuclear reactions primarily the fusion of hydrogen to form helium. Understand the life cycles of different types of stars and the way in which astronomers study stars (e.g. visual, radio and x-ray telescopes).
4. Know the evidence for the role of asteroid impacts on shaping planets and moons as well as theories linking asteroid impacts to mass extinctions on Earth.
5. Know that galaxies are made of billions of stars and comprise most of the visible mass of the universe. Understand the location of our solar system in the Milky Way Galaxy, which spans 100,000 light years.
6. Know the evidence indicating that all elements with an atomic number greater than lithium have been formed by nuclear fusion in stars.
Dynamic Earth Processes
7. Understand the evidence for plate tectonics, including the features of the ocean floor, the three different types of plate boundaries, volcanic and earthquake data.
8. Explain the properties of rocks based on the physical and chemical conditions under which they formed, including plate tectonic properties.
9. Understand how and why earthquakes occur, as well as the difference between volcanoes caused by hot spots and those caused by subduction.
Energy in the Earth System
10. Know how the amount of solar energy that reaches the Earth's atmosphere compares with Earth's internal energy and energy used by society, and the relative amount of incoming solar energy that is reflected, absorbed, and used for photosynthesis.
11. Understand the greenhouse effect and know the atmospheric gases that contribute to the greenhouse effect.
12. Understand how differential heating of the Earth, along with the Earth's rotation, causes circulation patterns in the ocean and atmosphere which globally distribute the heat.
13. Understand how temperature and salinity explain the layered structure of the ocean, the generation of horizontal and vertical ocean currents, and the distribution of marine organisms within the ocean.
14. Understand how the location of rainforests and deserts are confined to specific

latitudes due to global climate patterns.
15. Understand how weather and climate are affected by latitude, elevation, topography, oceanic processes, and transfer of energy into and out of the atmosphere.
16. Understand how Earth's climate has changed over time in response to changes in geography, atmospheric composition, plate movement, and other factors.
Biogeochemical Cycles
17. Know the global carbon cycle, including the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and how the movement of matter among these reservoirs is driven by Earth's internal and external sources of energy.
18. Know how photosynthesis and respiration affect the global carbon cycle.
Structure and Composition of the Atmosphere
19. Understand the thermal structure and composition of the atmosphere, as well as the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the variations in this layer due to natural processes and human activities.
20. Know how the composition of Earth's atmosphere has evolved over geologic time due to outgassing, variations in carbon dioxide concentration, and the origin of atmospheric oxygen.
California Geology
21. Know the important economic resources as well as natural hazards in California, and the geologic basis for these resources and hazards.
22. Understand the importance of water to society, the origins of California's fresh water, and the controversies over water use in California.

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