

Standard 2: Interactions of Earth's Systems

The student will analyze and apply the properties of systems thinking and modeling to the study of Earth's systems.

A. Earth Systems

Indicator 1. The student will analyze and explain the interactions of earth's systems.

- a. Identify Earth's systems as the geosphere, hydrosphere, atmosphere, cryosphere, and biosphere.
- b. Illustrate that earth systems may be so closely related that there is no way to draw boundaries that separate all the parts of one from all the parts of the other(s).
- c. Cite evidence to show that interactions among the solid earth, oceans, atmosphere and organisms have resulted in the on-going evolution of earth's systems using examples such as:
 - gradual change (mountain- building, plate tectonics, sea level change; natural selection)
 - change on a human life time scale (hurricane, volcanic eruption, flooding, human impacts).

B. Systems Thinking

Indicator 1. Analyze, explain and apply the properties of systems thinking to earth systems interactions.

- a. Define a system by:
 - Specifying its apparent boundaries and subsystems.
 - Indicating its relation to other systems.
 - Indicating its parts
 - Identifying inputs and outputs.
 - Identify flow between and among the parts.
- b. Cite examples to illustrate that the present arises from the conditions of the past, and in turn, affects what is possible in the future.
- c. Demonstrate that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts (emergent properties).
- d. Observe and demonstrate that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.
- e. Cite evidence to explain that if a system in equilibrium is disturbed, it may:
 - return to a very similar state of equilibrium;
 - undergo a radical change until the system achieves a new state of equilibrium with very different conditions or;
 - it may fail to achieve any type of equilibrium.
- f. Give examples to explain that whatever happens within a system, whether through decay, metabolism, movement or recombination, the total amount of matter and energy remains the same.

Indicator 2. Modeling

See Science State Curriculum Skills and Processes