**Unifying Concepts and Processes of Science**
(under development)

Below are a number of examples of how the unifying concepts and processes of science can be incorporated into an inquiry-oriented lesson. This is one of eight important areas in the content standards of the *Nations Science Education Standards* (see pp. 115-119). According to this standard, students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

According to the *NSES* (p. 115), some of the criteria of the standard are:

- The concepts and processes provide connections between and among traditional scientific disciplines.
- The concepts and processes are fundamental and comprehensive.
- The concepts and processes can be expressed in a developmentally appropriate manner during science instruction.

Below are some examples to consider when developing ideas in relation to unifying concepts and processes as you develop your inquiry lessons. See the *NSES* for additional ideas and clarification.

| **Physics Topic** | **Biology Application** | **Chemistry Application** | **Earth Science Application** |
|---|---|---|---|
| Atomic theory, structure of atoms, molecule formation, atomic and molecular models | Health and safety concerns | Atomic and nuclear structure or nuclear processes, radioactivity, atomic stability, | Geological sources of radiation |
| Conservation of energy | Energy; Flow of energy in living systems; surface-to-volume ratios of life forms; activation energy (qualitative only; concept of an "energy hump") | Bond geometry, bond tension; change of state; chemical reactions move to a lower energy situation; thermodynamics; processes will go one way, but not the other. | Erosion; weather phenomena; Coriolis effect; the water cycle; resources for energy |
| Potential and kinetic energy | | | |
| Conservation of mass | Biogeochemical cycles, flow of matter within life forms | Gas reactions, Dalton's Law; stoichiometry; conservation of matter; number of atoms does not change. | Biogeochemical cycles, flow of matter and energy |

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| Electricity/Charge; electrical energy and power | The human body as an electrical system | Chemical reactivity and relationship to structure; simple chemical bonding; electro-negativity used to describe bonding | Lightning |
| Energy as a universal currency | Energy use by living systems | Exothermic or endothermic reactions or energy transformations | Energy in Earth systems |
| Gases and laws of thermodynamics | | Equilibrium; thermodynamics | Structure and composition of Earth's atmosphere |
| Forces and motion | | | Plate tectonics |
| Gravity | Geotropism, | | Gravity and orbital systems |
| Kinetic theory of gases | | Ideal gas law or reaction rates | |
| Light; spectral lines and a glimpse of quantum phenomena | Photosynthesis; light energy and chemical energy conversion in molecules useful to living things | Atomic and molecular reactions with light | |
| Light as a wave and particle | | | |
| Matter, properties of matter | | | |
| Momentum | | | |
| Pressure, gas laws with a simple, operational derivation | Sound | | |
| Waves | Ultrasound | | Seismic wave, the structure of the Earth, and how we know it. |