

## Physical Science

| State Standard Number | State Standard Area/Description  | Unit Name                        | Course Topic Description                    |
|-----------------------|--|----------------------------------|---|
| 1                     | Building upon observation, exploration and analytical skills developed at the elementary level and middle school levels and foundational knowledge about matter (its basic particle composition and behavior under various conditions), an extensive understanding of matter, its composition and the changes it undergoes are further constructed. Substances within a closed system interact with one another in a variety of ways; however, the total mass and energy of the system remains the same. Instructional concepts include: |                                  |   |
| 1.1                   | Matter can be classified in different ways depending upon characteristics that are observable and characteristics that can be observed with magnification.   | Matter, Energy and Change        | The Properties of Matter                    |
| 1.2                   | Particulate nature of matter is represented by models because it is too small to see with the naked eye or with traditional visible-light microscopes.   | Matter, Energy and Change        | Kinetic Theory of Matter                    |
| 1.3                   | Atomic structure determines the properties of an element and how the atom (of the element) will interact with other atoms. Neutrons have little effect on how an atom interacts with other atoms, but they do affect the mass and stability of the nucleus.  | Elements, Compounds and Mixtures | Atomic Theory<br>Classification of Elements |
| 1.4                   | When elements are listed in order of increasing number of protons, the same sequence of properties appears over and over again. At times the masses do not correspond with periodic order, but the atomic number always does.  | Elements, Compounds and Mixtures | Classification of Elements                  |
| 1.5                   | Bonding describes how atoms are  | Elements, Compounds              | Compounds and Bonds                         |

## Physical Science

|     |   |                    |                                   |
|-----|---|--------------------|-----------------------------------|
|     | arranged in molecules and rearrange in chemical reactions. Atoms may be bonded together by losing, gaining or sharing electrons.  | and Mixtures       |                                   |
| 1.6 | Matter is conserved in all chemical/nonchemical analysis of mixtures. In a chemical reaction, the number, type of atoms and total mass are the same before and after the reaction.  | Chemical Reactions | Conservation of Energy and Matter |
| 1.7 | Radioactive substances are unstable nuclei that undergo spontaneous nuclear decay emitting particles and/or high-energy wave-like radiation. Nuclear fission involves the decay of large nuclei into smaller nuclei.  | Chemical Reactions | Nuclear Reactions                 |
| 1.8 | Nuclear fusion is the joining of nuclei into a larger nucleus accompanied by the release of large quantities of energy. Nuclear fusion in the stars creates all the elements in the universe beyond helium.   |                    |                                   |
| 2   | Building upon the knowledge that energy is transformed and transferred all the while being conserved, an understanding of the relative strength of the forces within an atom, the nature of motion and forces and how motion is affected by forces, and wave behavior, including the Doppler effect and its applications to understanding the movement of galaxies in the universe is developed. Mathematics, including graphing, should be used when describing these phenomena, moving from qualitative understanding to one that is more quantitative. Instructional concepts include: |                    |                                   |
| 2.1 | Motion of an object is a measurable quantity that depends on the observer's frame of reference and is described in terms of position, speed, velocity, acceleration and time.   | Energy in Motion   | Motion                            |

## Physical Science

|     |   |                  |   |
|-----|---|------------------|---|
| 2.2 | An object does not accelerate (remains at rest or maintains a constant speed and direction of motion) unless an unbalanced net force acts on it. The rate at which motion changes (speed or direction) is proportional to applied force and inversely proportional to the mass. A force is an interaction between two objects; both objects in the interaction experience an equal amount of force, but in opposite directions.   | Energy in Motion | Newton's Laws of Motion                 |
| 2.3 | Waves can be refracted, reflected, absorbed and superposed on one another. As waves enter a different medium, they can be reflected back into the original medium, absorbed by the new medium as energy. The waves may also be transmitted into the new medium which may result in bending the waves.   | Waves            | Modeling Waves<br>The Behavior of Waves |
| 2.4 | The wavelength of a wave depends upon the relative motion of the source and the observer. If either is moving toward the other, the wavelength is shorter; if either is moving away, the wavelength is longer.  |                  |   |
| 3   | Building a unified understanding of the universe from elementary and middle school science, insights from history, and mathematical ways of thinking, provides a basis for knowing the nature of the universe. Concepts from the previous section, Forces, Motion and Energy, are also used as foundational knowledge. The role of gravity in forming and maintaining the organization of the universe becomes clearer at this level, as well as the scale of billions and speed of light used to express relative distances. Instructional content includes: |                  |   |

## Physical Science

|     |  |              |                       |
|-----|--|--------------|-----------------------|
| 3.1 | The stars differ from each other in size, temperature and age.   | The Universe | Life Cycle of Stars   |
| 3.2 | Stars transform matter into energy in nuclear reactions. These and other processes in stars have led to the formation of all elements. The process of star formation and destruction continues.                              |              |                       |
| 3.3 | Early in the history of the universe, gravitational attraction caused matter to clump together to form countless trillions of stars and billions of galaxies.  |              |                       |
| 3.4 | The red shift provides evidence that the universe is and has been expanding. Data from measurements of this expansion have been used in calculations that estimate the age of the universe to be over ten billion years old. | The Universe | Cosmological Redshift |