PHYSICAL SCIENCE

COURSE DESCRIPTION:

This course is designed to develop scientific literacy through the vehicle of traditional physical concepts. It is designed to develop scientific literacy by developing reasoning skills, process skills, and an understanding of the nature of science and its impact on society.

The breadth of the reasoning skills includes recall of information, computational analysis, proportional reasoning, model building, prediction and hypothesizing, classifying, dimensional analysis, spatial reasoning, combinational reasoning and hypothetical deductive reasoning (logic).

The process skills to be taught are: making observations, inferences and operational definitions, predicting, hypothesis testing, controlling and manipulating variables, experimenting, interpreting data, analysis of space-time relations, model building, measurements, communication skills, graphing skills, contrast and comparison, daily journal recording and note taking, creative thinking and manipulation of laboratory equipment.

The Utah State Science Core Curriculum was one of the documents used as a resource in the development of these materials. The State Core was designed using Projects 2061's "Benchmarks for Science Literacy" as a guide to determine appropriate content and process skills.

Instructional Strategies:

The following Core concepts can best be taught using integrated instruction of science and skills from other curriculum areas. The nature of science and issues relating to technology have been infused into the material. The personal and spiritual relevance of science is an important part of this core and should be emphasized.

Hands-on student centered approaches to instruction with the student as scientist should emphasize. Instruction should be extend beyond the core to meet the students' spiritual and intellectual needs. The content and processes are designed to include and build upon the Diocesan Science Core Curriculum K-12. The hands-on nature of this Diocesan Curriculum emphasizes the need for master teachers and well-equipped science rooms as well as the proper use of animals, equipment, and chemicals in the classroom and for the safety of the students.

PHYSICAL SCIENCE

Science Benchmark

STANDARD 1: Volume and Mass

Objective 1: Be able to measure the volume of various objects
a. Use a graduated cylinder for water displacement
b. Use a ruler to measure dimensions then calculate volume
c. Use appropriate units in reporting data

Objective 2: Be able to measure the mass of various objects
a. Use a balance to measure mass
b. Know how to calibrate a balance
c. Determine the sensitivity of a balance

Objective 3: Be able to determine density from mass and volume data

Objective 4: Be able to convert between units of metric measure
a. Gigo ←-------→ Nano
b. Units of mass, distance, volume, temperature (SI System)

Objective 5: Be able to use scientific notation in calculations involving very large and very small numbers
a. Converting between standard and scientific notation
b. Solve problems using the relationship between powers of ten and the metric system unit labels

Objective 6: Be able to express scientific notation in the terms of correct significant figures

STANDARD II: Velocity and Acceleration

Objective 1: Be able to calculate velocity
a. Express measured velocities in a variety of units of measure
b. Measure average velocity in laboratory investigations

Objective 2: Be able to calculate acceleration
a. Graph changing velocities to determine acceleration
b. Synthesize laboratory data to determine values of acceleration

Objective 3: Be able to graph position versus time data
a. Construct and identify graphs of velocity and acceleration in terms of changing position

vs. time
b. Distinguish between dependent and independent variables

Objective 4: Be able to calculate velocity or acceleration from a graph
a. Interpret graph data in terms of velocity and acceleration
b. Calculate acceleration given appropriate velocity data
c. Calculate velocity given appropriate acceleration data

STANDARD III: Newton's Laws of Motion

Objective 1: Newton's First Law
a. State Newton's first law with appropriate examples from laboratory investigation
b. Relate the concept of inertia to Newton's first law
c. Identify the frame of reference for an object's movement from laboratory investigation

Objective 2: Newton's Second Law
a. State Newton's second law with appropriate examples from laboratory investigation
b. Calculate the amount of force from measured mass and acceleration in laboratory investigation
c. Measure forces in standard metric units
d. Identify direct or indirect relationships

Objective 3: Newton's Third Law
a. State Newton's Third Law with appropriate examples from laboratory investigation
b. Generalize the effect of multiple forces in terms of the third law

STANDARD IV:

Objective 1: Momentum
a. Differentiate mathematically between momentum and force

Objective 2: Gravitational Force
a. Distinguish between the concepts of weight and mass
b. Identify the concept of gravity as a property of mass

STANDARD V: Energy, Systems & Simple Machines

Objective 1: Energy- Use correct metric units to express energy
a. PE
b. KE
c. Gravitational
d. Heat

e. Differentiate between various forms of energy in terms of motion and position
f. Identify relationships between changes in KE and PE

Objective 2: Work
a. Measure the amount of work, in appropriate units, done on an object in laboratory investigations

Objective 3: Power
a. Calculate the relationship between work and power
b. Use the appropriate metric units to express various units of power

Objective 4: Simple Machines
a. Analyze three forms of levers in terms of their load, force, and fulcrum
b. Use inclined planes to predict the amount of work done on a load
c. Use pulleys to calculate the amount of work done on a load
d. Calculate the mechanical advantage of each form of lever, various pulley arrangements and inclined planes

STANDARD VI: Wave Theory and Electromagnetic Spectrum

Objective 1: Sound Waves
a. Identify and differentiate between transverse and longitudinal waves
b. Differentiate between physical waves and electromagnetic waves

Objective 2: Electromagnetic Waves
a. Develop concepts of energy, frequency, and wavelength
b. Generalize the different forms of electromagnetic radiation with respect to energy, frequency, and wavelength

Objective 3: Visible light Applications
a. Use laboratory devices to analyze the reflective properties of visible light
b. Calculate the angle of incidence and angle of reflection for mirrors
c. Measure the diffraction of light for real versus virtual images

STANDARD VII: Atomic Model of matter

Objective 1: Atomic Structure
a. Subatomic particles: location, charge, mass
b. Isotopes: Hydrogen isotopes, nuclear arithmetic
c. Average atomic mass
d. Historical development including the Bohr model, and the Quantum mechanical model

Objective 2: Perioelectron arrangement

a. Lewis Dot Symbols
b. Historical development of the periodic table
c. Group and period relationships

STANDARD VIII: Chemical Bonding

Objective 1: Ionic Bonding- Describe the nature of ionic bonds and opposite electrostatic attractions

a. Translate the position of an element in the Periodic Table into its bonding properties
b. Name ionic compounds using traditional and Stock system nomenclature
c. Write chemical formulas for ionic compounds

Objective 2: Covalent Bonds- Describe the nature of covalent bonds and shared pairs of electrons

a. Predict the formulas of covalent compounds
b. Use Lewis Dot diagrams to predict molecular structure
c. Polar and non-polar
d. Organic compounds
e. Build simple 3-D models of methane, ethane, and ethyne
f. Describe the multiple bonding capabilities of carbon

Objective 3: Metallic Bonding

a. Describe the nature of metallic bonds in terms of current chemical models
b. Relate the various physical characteristics of metallic elements to bonding in metals

STANDARD IX: Elements, Compounds, and Mixtures

Objective 1: Elements, Compounds, and Mixtures

a. Describe the principle differences between elements and compounds
b. Differentiate between homogeneous and heterogeneous mixtures
c. Perform lab activities:
d. Separation of a mixture
e. Chromatography
f. Distinguish between: physical and chemical changes, phases of matter, and describe the phase changes of water in terms of energy changes and order/disorder

Objective 2: Solutions

a. Factors affecting the dissolving process
b. Dissolving process steps
c. Unsaturated, saturated and supersaturated solutions
d. Calculate mass % of solutions
Solubility:

- calculate/extrapolate known solubility to various
- temperatures and volumes of solvent
- translate graphical and tabular data to determine the solubility of a compound

STANDARD X: Chemical Reactions

Objective 1: Four basic types of chemical reactions
a. Composition
b. Decomposition
c. Single Replacement
d. Double Replacement
e. Phase symbols and oxidation numbers

Objective 2: Write and balance a chemical reaction given the names of the elements and/or compounds
a. Word equations

STANDARD XI: Acids and Bases

Objective 1: Acids
a. Arrhemius definition

Objective 2: Bases
a. Neutralization

Objective 3: Ph and Indicators
a. Litmus
b. Phenolphthalein
c. Bromthymol Blue

STANDARD XII: Nuclear Chemistry
(if time allows)

Objective 1: Line of Stability and the causes of nuclear decay

Objective 2: Three general types of radioactive decay
a. Alpha, beta, gamma equations

Objective 3: Half Life

STANDARD XIII: Electricity and Magnetism

(if time allows)

Objective 1: Field lines

Objective 2: Conductors/Insulators

Objective 3: Circuits/Motors

Objective 4: Magnetic Fields

a. Polarity-planet