

Shenandoah Community School District

Earth Science, Health of the World

Grade -11

11.3 Physical Science

11.3.1 (SCSD) Understand and apply knowledge of the properties of matter as it pertains to our environment and health (I,D,M)

- Understand periodic table and periodic trends (M)
 - An element is composed of a single type of atom (M)
 - Chemicals are made from atoms (elements) and that these elements are everywhere (M)
 - Elements are listed in order according to the number of protons (atomic number)(M)
 - There are more than 100 known elements that combine in a multitude of ways (M)
 - Repeating patterns of physical and chemical properties identify families of elements with similar properties (M)
 - The periodic table is a consequence of the repeating pattern of outermost electrons and their permitted energies (M)
- Understand molecular and ionic structures (M)
 - Atoms are bonded together into molecules or crystalline solids (M)
 - Element (M)
 - ✚ A substance composed of a single kind of atom (M)
 - Compound (M)
 - ✚ Formed when two or more kinds of atoms bind together chemically (M)
 - Bonds (M)
 - ✚ Created when electrons are paired (shared or transferred)(M)
- Understand physical properties of chemical compounds (M)
 - Chemical compound (M)
 - A pure chemical substance consisting of two or more different chemical elements that can be separated into simpler substances by chemical reactions (M)
 - Consist of a fixed ratio of atoms (M)
 - Held together in a defined spatial arrangement by chemical bonds (M)
 - Elements in a compound cannot be separated by physical methods (M)
- Understand the states of matter (M)
 - States of matter differ in the distances and angles between molecules or atoms, therefore, the energy that binds them together (M)
 - Solids (M)
 - Liquids (M)
 - Gases (M)
- Understand Hydrocarbon compounds(M)
 - Carbon atoms can bond to one another in:
 - Chains (M)
 - Rings (M)
 - Branching networks (M)
 - Carbon atoms form a variety of structures, including:
 - Polymers (M)
 - Oils(M)
 - Large molecules essential to life (M)
- Understand that chemical are made from elements, that these elements are everywhere (including food that we eat) which effect our health (I,D,M)
 - Ninety-six percent of the body's weight is made up of:

- Oxygen (I,D,M)
- Carbon (I,D,M)
- Hydrogen (I,D,M)
- Nitrogen (I,D,M)
- Four percent of the body's weight is made up of:
 - Calcium (I,D,M)
 - Copper (I,D,M)
 - Iron (I,D,M)
 - Magnesium (I,D,M)
 - Phosphorus (I,D,M)
 - Potassium (I,D,M)
 - Sodium (I,D,M)
 - Zinc (I,D,M)
- Know the movement of the elements as they are recycled in the environment (I,D,M)
- Know the daily value of the elements that we consume (I,D,M)
 - Breakfast cereals (I,D,M)

11.3.2 (SCSD) Understand and apply knowledge of chemical reaction as it pertains to the environment and health (I,D,M)

- Understand conservation of matter (D,M)
 - During an ordinary chemical change, there is no detectable increase or decrease in the quantity of matter (D,M)
- Understand common reactions (D,M)
 - Chemical reactions occur all around us, for example:
 - Health care (D,M)
 - Cooking (D,M)
 - Cosmetics (D,M)
 - Automobiles (D,M)
 - Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our bodies (D,M)
 - Chemical reactions in living system are often catalyzed by protein molecules called enzymes (D,M)
- Understand thermochemistry (D,M)
 - The study of the energy evolved or absorbed in chemical reactions and physical transformations (D,M)
 - Chemical reactions may release or consume energy (D,M)
 - Some reactions, such as the burning of fossil fuels release large amounts of energy by:
 - Losing heat (D,M)
 - Emitting light (D,M)
 - Light can initiate many chemical reactions such as:
 - Photosynthesis (D,M)
 - ☀ Energy for life is ultimately derived from the Sun and energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers (D,M)
 - Evolution of urban smog (D,M)
 - Heat energy consists of random motions and the vibrations of atoms, molecules, and ions (D,M)
 - The higher the temperature, the greater the atomic or molecular motion (D,M)
 - Energy tends to move spontaneously from hotter to cooler objects by conduction, convection, or radiation (D,M)
- Understand types of reactions (D,M)
- Understand common reactions in living systems (D,M)
 - Radical reactions control many processes such as:
 - Presence of ozone and greenhouse gases in the atmosphere (D,M)

- Burning and processing of fossil fuels (D,M)
- Formation of polymers (D,M)
- Explosions (D,M)
- Understand reaction rates and equilibrium (D,M)
 - Chemical reactions can take place in time periods (D,M)
 - Few femtoseconds (10⁻¹⁵ seconds) required for an atom to move a fraction of a chemical bond distance (D,M)
 - Geologic time scales of billions of years (D,M)
 - Reaction rates depend on:
 - How often the reacting atoms and molecules encounter one another (D,M)
 - The temperature (D,M)
 - The properties—including shape—of the reacting elements (D,M)
 - Catalysts, such as metal surfaces, accelerate chemical reactions (D,M)
- Understand the effects of chemicals and their impact on our society (I,D,M)
 - Know the effects of chemicals on our environment (I,D,M)
 - Know the effect of substances on men and women (I,D,M)
 - Aspirin (I,D,M)
 - Cocaine (I,D,M)
 - Depression medication (I,D,M)

11.3.3 (SCSD) Understand the Science of Toxicology (I,D,M)

- Define Toxicology (I,D,M)
- Understand the concept “the dose make the poison” (I,D,M)
 - Differentiate between (I,D,M)
 - Exposure and dose (I,D,M)
 - Acute and chronic toxicity (I,D,M)
 -  Effects of alcohol and tobacco on California Black Worms (I,D,M)
 - Identify (I,D,M)
 - The routes of exposure(I,D,M)
 - Factors that can influence the effect of a chemical on living things (I,D,M)
- Analyze the effects of the use of animal for toxicological research and testing (I,D,M)
- Understand “risk assessment” and “risk management” (I,D,M)

11.3.4 (SCSD) Understand the impact of science and technology as it pertains to our environment and health (I,D,M)

- Understand the impact of science and technology on the economic development of the United States (I,D,M)
- Understand the impact of scientific and technological innovations on daily life in the United States (I,D,M)
 - Analyze technological innovations (I,D,M)
 - Analyze how technological innovations changed the way goods were manufactured and marketed nationally (I,D,M)
- Understand that perfectly designed solutions do not exist (I,D,M)
 - All technological solutions have trade-offs such as:
 - Safety (I,D,M)
 - Cost (I,D,M)
 - Efficiency (I,D,M)
 - Appearance (I,D,M)
 - Technological solutions have intended benefits and unintended consequences (I,D,M)
 - Some consequences can be predicted, others cannot (I,D,M)

11.3.5 (SCSD) Develop an understanding of the effects on personal health with relationships to natural hazards, and environmental disasters (I,D,M)

- Analyze the risk and benefits of natural hazards and environmental disasters (I,D,M)
- Understand and know the effects of:
 - Hinkley Disaster (I,D,M)
 - Minamata Disaster (I,D,M)
 - Bhopal Disaster (I,D,M)
 - Dust Bowl (I,D,M)
 - Love Canal New York (I,D,M)
- Understand that environmental disaster have legal and political implication (I,D,M)

11.3.6 (SCSD) Develop an understanding of the history and nature of science as it pertains to our environment and health (I,D,M)

- Understand science as a human endeavor (I,D,M)
- Understand the nature of science (I,D,M)
- Understand the history of science (I,D,M)
 - Understanding of issues and events in U.S. history (I,D,M)
 - Apply absolute and relative chronology through the sequencing of significant individuals, events and time periods (I,D,M)

11.3.7 (SCSD) Develop an understanding of economic, social, and political influence on historical issues and events in relationship to environment and health (I,D,M)

- Identify contributions of people (I,D,M)
 - Political (I,D,M)
 - Social (I,D,M)
 - Economic (I,D,M)
- Analyze the contributions of people of various groups (I,D,M)
 - Racial (I,D,M)
 - Ethnic (I,D,M)
 - Religious (I,D,M)
- Know how industrialization changed life in the United States (I,D,M)
- Know:
 - Alienable Rights (I,D,M)
 - Bill of Rights (I,D,M)
 - Free speech and press (I,D,M)
- Know the roots of Manifest Destiny (I,D,M)
 - Analyze the relationship between Manifest Destiny and the westward growth of the nations (I,D,M)

11.3.8 (SCSD) Understand and use tools and instruments for observing, measuring, and manipulating scientific equipment and materials (D,M)

- Develop and use systematic procedures for recording and organizing information (D,M)
 - Use the metric unit (D,M)
 - Use a variety of graphs (D,M)
 - Graph using coordinate axis (D,M)
 - Find percentages of concentrations (D,M)
- Use technology to produce tables and graphs (D,M)
- Use technology to develop, test, and revise experimental or mathematical models (D,M)

11.3.9 (SCSD) Demonstrate the computation and estimation skills necessary for analyzing and developing reasonable scientific explanations (D,M)

- Trace the source on any large disparity between estimated and calculated answers to problems (D,M)

- Consider possible effects on measurement errors on calculations (D,M)
- Recognize the relationship between accuracy and precision (D,M)
- Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate (D,M)
- Solve scientific problem by substituting quantitative values, using dimensional analysis/ or simple algebraic formulas as appropriate (D,M)

11.4 (SCSD) Science as Inquiry

11.4.1 (SCSD) Identify questions and concepts that guide scientific investigations (M)

- Understand hypothesis and formulate a testable Hypothesis, demonstrating;
 - Logical connections between the scientific concepts guiding:
 - A hypothesis (M)
 - The design of an experiment (M)
- Understand scientific investigations and demonstrate:
 - Appropriate procedures (M)
 - A knowledge base (M)
 - Conceptual understanding (M)

11.4.2 (SCSD) Design and conduct scientific investigations (M)

- Requires:
 - Understanding of the major concepts in the area being investigated (M)
 - Proper equipment (M)
 - Safety precautions (M)
 - Understanding of methodological problems (M)
 - Use of technologies (M)
 - Scientific knowledge obtained from sources other than the actual investigation (M)
 - Clarification of :
 - Ideas that guide the inquiry (M)
 - Question (M)
 - Method (M)
 - Controls (M)
 - Variables (M)
 - Organization and display of data (M)
 - Revision of methods and explanations (M)
 - Public presentation of the results with a critical response from peers (M)
- Must:
 - Use evidence (M)
 - Apply logic (M)
 - Construct an argument for their proposed explanations (M)

11.4.3 (SCSD) Use technology and mathematics to improve investigations and communications (M)

- A variety of technologies are an integral component of scientific investigations (M)
 - Hand tools (M)
 - Measuring instruments (M)
 - Calculators (M)
 - Computers for data (M)
 - Collection (M)
 - Analysis (M)
 - Display (M)
- Mathematics plays an essential role in all aspects of an inquiry investigation (M)
 - Measurement (M)
 - Posing questions (M)

- Formulas are used for developing explanations (M)
- Charts and graphs are used for communicating results (M)

11.4.4 (SCSD) Formulate and revise scientific explanations and models using logic and evidence (M)

- Inquiries culminate in formulating an explanation or model (M)
 - Model
 - Physical (M)
 - Conceptual (M)
 - Mathematical (M)
- Process of answering the questions involves:
 - Discussions (M)
 - Arguments (M)
 - Revisions of explanations (M)
 - Based on:
 - Scientific knowledge (M)
 - Use of logic (M)
 - Evidence from investigation (M)

11.4.5 (SCSD) Think critically and logically to make the relationship between evidence and explanations (M)

- Think critically about evidence includes:
 - Deciding what evidence should be used (M)
 - Accounting for anomalous data (M)
- Process
 - Review data from a simple experiment (M)
 - Summarize the data (M)
 - Form a logical argument about the cause-and-effect relationship in the experiment (M)

11.4.6 (SCSD) Recognize and analyze alternative explanations and predictions (M)

- Develop critical abilities of analyzing an argument by reviewing:
 - Current scientific understanding (M)
 - Weighing the evidence (M)
 - Examining the logic (M)
- Develop the ability to decide which explanations and models are best (M)
 - There may be several plausible explanations, they do not all have equal weight (M)
 - Use scientific criteria to find the preferred explanations (M)
- Know that scientific knowledge is based on repeatable standards to ensure accuracy of the information. This knowledge may be constantly updated or corrected as the world tests and makes new advances in science (M)

11.4.7 (SCSD) Communicate and defend scientific procedures and explanations

- Develop the abilities associated with accurate and effective communication these include:
 - Writing and following procedures (M)
 - Expressing concepts (M)
 - Reviewing information (M)
 - Summarizing data (M)
 - Using language appropriately (M)
 - Developing diagrams and charts (M)
 - Explaining statistical analysis (M)
 - Speaking clearly and logically (M)
 - Constructing a reasoned argument (M)
 - Responding appropriately to critical comments (M)

11.4.8 (SCSD) Use mathematics in all aspects of scientific inquiry (M)

- Use mathematics to ask and answer questions about the natural world (M)
- Mathematics is used to:
 - Ask questions (M)
 - Gather data (M)
 - Organize data (M)
 - Present data (M)
 - Structure convincing explanations (M)

11.4.9 (SCSD) Know that a code of ethics governing testing, funding, and the disclosure of scientific information bind progress in science and technology (M)

11.4.10 (SCSD) Know that advances in science involve technology and research that are bound by the laws of our society (M)

