| **Required Course Numbers** |
| --- |
| **Test Content Categories** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **I. Scientific Inquiry, Methodology, Techniques, and History (12%)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Understands methods of scientific inquiry and how they are used in basic problem solving** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Observations, hypotheses, experiments, conclusions, theories, models, and laws |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Experimental design, including independent and dependent variables, controls, and sources of error |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Nature of scientific knowledge |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. subject to change, consistent with evidence, based on reproducible evidence |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. includes unifying concepts and processes (e.g., systems, models, constancy and change, equilibrium, form and function) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Understands the processes involved in scientific data collection and manipulation** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Common units of measurement, including prefixes such as milli and kilo (e.g., units of length, time, mass, volume, pressure, energy, force) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Scientific notation and significant figures |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Organization and presentation of data (e.g., graphs, tables, charts) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Basic error analysis (e.g., accuracy, precision) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Basic descriptive statistics (e.g., calculate averages, distinguish between mean, mode, and median) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  **C. Knows how to interpret and draw conclusions from data presented in tables, graphs, and charts** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Trends in data |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Relationships between variables |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Predictions based on data |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Drawing conclusions based on evidence |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Is familiar with the procedures for safe and correct preparation, storage, use, and disposal of laboratory materials** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Safe storage |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Proper and safe disposal (e.g., chemicals, biohazards) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Proper preparation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Use of equipment such as fume hoods |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **E. Understands safety and emergency procedures in the laboratory** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Equipment (e.g., eyewash stations, safety showers) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Appropriate student apparel and behavior (e.g., goggles, clothing) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Emergency procedures for minor burns and other injuries |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Emergency procedures for mishaps (e.g., fires, chemical spills) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Evacuation procedures |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **F. Is familiar with how to use standard equipment in the laboratory** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Appropriate use of equipment (e.g., thermometers, microscopes, barometers, graduated cylinders, Bunsen burners, balances, pH meters) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Basic care, preparation, and maintenance of equipment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **G. Is familiar with the historical developments of science and the contributions of major historical figures** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. How major concepts developed over time (e.g., atomic models, genetics, plate tectonics) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Key historical figures and their contributions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **II. Basic Principles of Matter and Energy (12%)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Is familiar with the structure and properties of matter** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Solids, liquids, gases, and plasmas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Elements, atoms, compounds, molecules, and mixtures |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Occurrence and abundance of the elements and their isotopes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Knows the basic relationships between energy and matter** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Conservation of energy (first law of thermodynamics) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Entropy changes (second law of thermodynamics) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Conservation of matter in chemical systems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Forms of kinetic and potential energy (thermal, chemical, radiant, mechanical) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Energy transformations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Chemical and physical properties/changes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Temperature scales (e.g., Celsius, Fahrenheit, and Kelvin; comparisons and conversions between the scales) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8. Effect of thermal energy on matter and the measurement of thermal energy (e.g., specific heat capacity, joules) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9. Methods of heat transfer (e.g., convection, radiation, conduction) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10. Interdisciplinary applications of energy and matter relationships |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. trophic levels |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. matter cycling and energy flow in ecosystems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. convection currents in atmosphere, ocean, and mantle |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. conservation of mass in the rock cycle |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. nitrogen cycle |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| f. chemical and physical changes in rocks |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| g. impact of solar radiation on Earth and life |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| h. photosynthesis and cellular respiration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| i. energy transformations in living systems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Knows the basic structure of the atom** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Atomic models |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Atomic structure including electrons, protons, and neutrons |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Atomic number and mass |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Ions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Electron arrangements |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Radioisotopes, radioactive decay, half-life, fusion, and fission |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Applications of radioactivity (e.g., carbon dating, evidence for evolution, medical imaging) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **III. Physical Sciences (22%)**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Physics** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands mechanics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Describe linear and circular motion in one and two dimensions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - speed |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - velocity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - acceleration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - momentum |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Newton’s first law: inertia |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Friction |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Work, energy, and power |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Mass, weight, and gravity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - characteristics of gravitation (e.g., gravitational attraction, acceleration due to gravity, mass, distance) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - distinguish between mass and weight |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| f. Analyze motion and forces in a physical situation, including basic problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - Newton’s second law: F = ma |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - Newton’s third law: action-reaction forces |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - inclined planes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - collisions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - projectile motion |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - periodic motion (e.g., pendulums, springs, planetary orbits) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - conservation of energy and conservation of momentum |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| g. Simple machines and mechanical advantage |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| h. Physical properties of fluids (e.g., buoyancy, density, pressure) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Knows electricity and magnetism |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Electrical nature of materials |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - electric charges |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - electrostatic attraction and repulsion |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - conductivity, conductors, and insulators |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Analyze basic series and parallel electrical circuits |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - DC and AC current |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - current, resistance, voltage, and power |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - Ohm’s law |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - voltage sources (e.g., batteries, generators) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Magnetic fields and forces |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - magnetic materials |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - magnetic forces and fields (e.g., magnetic poles, attractive and repulsive forces) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - electromagnets |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Understands basic waves and optics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Characteristics of light and the electromagnetic spectrum |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - nature of light |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  - visible spectrum and color |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - ultraviolet, infrared, microwave, and gamma |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Basic characteristics and types of waves |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - transverse and longitudinal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - frequency, amplitude, wavelength, speed, intensity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Basic wave phenomena |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - reflection, refraction, diffraction, and dispersion |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - absorption and transmission |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - interference, scattering, and polarization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - doppler effect |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Basic characteristics and phenomena of sound |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - pitch/frequency and loudness/intensity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - sound-wave production, air vibrations, and resonance (e.g., tuning forks) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Basic optics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - mirrors |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - lenses and their applications (e.g., the human eye, microscope, telescope) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - prisms |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - fiber optics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Chemistry** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Is familiar with how to use the periodic table to predict the physical and chemical properties of elements |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Organization of the periodic table |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - arranged in columns and rows (e.g., groups/families, periods) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - includes symbol, atomic number, and atomic mass for each element |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. General trends in chemical reactivity based on position of elements in the periodic table (e.g., metallic and nonmetallic elements, noble gases) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. General trends in physical properties based on  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| position of elements in the periodic table (e.g., atomic radius, ionization energy) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Knows the types of chemical bonding and the composition of simple chemical compounds |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Covalent and ionic bonding |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Intermolecular attractions such as hydrogen bonding |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Names of simple chemical compounds |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - ionic |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - covalent compounds involving two elements |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - acids and bases |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Interpret chemical formulas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - describe formulas in terms of moles of atoms |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - percent composition |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - empirical/molecular formulas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - electron dot and structural formulas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Understands states of matter and phase changes between them |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Basic assumptions of the kinetic molecular theory of matter (e.g., particles in constant motion, speed and energy of gas particles are related to temperature) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Ideal gas laws (e.g., Charles’ law: volume is proportional to temperature; Boyle’s law: pressure and volume are inversely proportional) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Phase changes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - melting/freezing |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - vaporization/condensation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - sublimation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - heating/cooling curves |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Knows how to balance and use simple chemical equations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Balance simple chemical reactions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Simple stoichiometric calculations involving balanced equations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Use chemical formulas to identify and describe simple chemical reaction equations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - combustion |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - oxidation (e.g., iron rusting) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - neutralization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - single or double replacement |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Energy relationships (e.g., endothermic reactions, exothermic reactions) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Factors that affect reaction rates (e.g., concentration, temperature, pressure, catalysts/enzymes) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Understands basic concepts in acid-base chemistry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Chemical and physical properties of acids and bases |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. pH scale |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Neutralization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Buffers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Is familiar solutions and solubility |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Solution terminology and identification of different types of solutions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - dilute and concentrated |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - saturated, unsaturated, and supersaturated |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - solvent and solute |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - concentrations of solutions in terms of molarity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Factors affecting the dissolving process and solubility of substances |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - effect of temperature and particle size on dissolving |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - effect of temperature on solubility |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - polar versus nonpolar solvents and solutes (e.g., like dissolves like) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - ionic compounds dissociate into ions in solution (e.g., electrolytes) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **IV. Life Sciences (24%)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Understands basic structure and function of cells and their organelles** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Structure and function of cell membranes (e.g., passive and active transport, osmosis) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Structure and function of cell organelles |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Levels of organization (cells, tissues, organs, organ systems)  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Major cell types (e.g., muscle, nerve, epithelial) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Prokaryotes and eukaryotes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Understands basic cell reproduction** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Cell cycle |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Mitosis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Meiosis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Cytokinesis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Is familiar with the basic biochemistry of life** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Cellular respiration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Photosynthesis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Biological molecules (e.g., DNA, carbohydrates, proteins, lipids, enzymes) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Understands basic genetics** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. DNA structure |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Replication, transcription, and translation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Dominant and recessive alleles |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Mendelian inheritance (e.g., genotype, phenotype, use of Punnett squares) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Mutations, chromosomal abnormalities, and common human genetic disorders |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **E. Understands the theory and key mechanisms of evolution** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Mechanisms of evolution (e.g., natural selection, punctuated equilibrium) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Isolation mechanisms and speciation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Supporting evidence (e.g., fossil record, comparative genetics, homologous structures) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Knows the elements of the hierarchical classification scheme and the characteristics of the major groups of organisms** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Classification schemes (e.g., domain, kingdom, phylum/division, class, order, family, genus, species) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Characteristics of animals, plants, fungi, protists, and monera |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| G. Knows the major structures and functions of plant organs and systems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Characteristics of vascular and nonvascular plants |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Control mechanisms and responses to stimuli |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Structure and function of leaves, roots, and stems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Asexual and sexual reproduction |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Uptake and transport of nutrients and water |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Growth |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H. Knows the basic anatomy and physiology of animals, including structure and function of human body systems and the major differences between humans and other animals |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Homeostasis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Exchange with the environment (e.g., respiratory, excretory, digestive systems) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Internal transport and exchange (e.g., circulatory system) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Movement and support (e.g., skeletal and muscular systems) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Reproduction and development |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Immune systems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Control systems (e.g., nervous system, endocrine system) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8. Response to stimuli and other organismal behavior |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **I. Knows key aspects of ecology** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Population dynamics (e.g., growth curves; carrying capacity; behavior such as territoriality, mating systems, and social systems) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Community ecology (e.g., niche, succession, species diversity, interspecific relationships such as predator-prey and parasitism) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Ecosystems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. biomes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. stability and disturbances (e.g., glaciation, effect of global warming) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. energy flow (e.g., trophic levels, food webs) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. biogeochemical cycles (e.g., water, nitrogen, and carbon cycles, biotic/abiotic interaction) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **V. Earth and Space Sciences (18%)**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Is familiar with physical geology** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Types and characteristics of rocks, minerals, and their formation processes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Characteristics of rocks and their formation processes (e.g., igneous, metamorphic, and sedimentary rocks; the rock cycle) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Characteristics of minerals and their formation processes (e.g., classes of minerals, crystals, hardness) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Processes involved in erosion, weathering, and deposition of Earth’s surface materials and soil formation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Erosion and deposition (e.g., agents of erosion) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Chemical and physical (mechanical) weathering |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Characteristics of soils (e.g., types, soil profile) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Porosity and permeability |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Runoff and infiltration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Earth’s basic structure and internal processes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Earth’s layers (e.g., lithosphere, mantle, core) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Earth’s shape and size |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Geographical features (e.g., mountains, plateaus, mid-ocean ridges) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Earth’s magnetic field |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Plate tectonics theory and evidence |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - folding and faulting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - continental drift |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - magnetic reversals |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - characteristics of volcanoes (e.g., types, lava, eruptions) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - characteristics of earthquakes (e.g., epicenters, faults, tsunamis) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - seismic waves and triangulation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Water cycle |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Evaporation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Condensation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Precipitation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Runoff |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Is familiar with Historical Geology** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Principle of uniformitarianism |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Basic principles of stratigraphy (e.g., law of superposition) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Relative and absolute time (e.g., index fossils, radioactive dating) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Geologic time scale (e.g., eras, periods) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Fossil formation and the fossil record |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Important events in Earth’s geologic history (e.g., mass extinctions, Cambrian explosion, ice ages, meteor impacts) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Is familiar with the structure and processes of Earth’s oceans and other bodies of water** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Geographic location of Earth’s oceans and seas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Tides, waves, and currents |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Estuaries and barrier islands |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Island, reef, and atoll formation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Polar ice caps, icebergs, and glaciers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Lakes, ponds, streams, rivers, and river deltas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Groundwater, water table, wells, and aquifers |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8. Properties of water that affect Earth systems (e.g., density changes upon freezing, high heat capacity, polar solvent, hydrogen bonding) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Knows basic meteorology and major factors that affect climate and seasons** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Basic meterology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Structure of Earth’s atmosphere (e.g., troposphere, stratosphere) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Composition of Earth’s atmosphere (e.g., percent composition of oxygen and nitrogen) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Atmospheric pressure and temperature |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Wind |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Cloud types and cloud formation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| f. Frontal systems, weather maps, storms, and severe weather |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| g. Humidity, dew point, and frost point |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| h. Forms of precipitation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Major factors that affect climate and seasons |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Climate zones (e.g., Tropics, Arctic) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Proximity to mountains and oceans |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Global winds and ocean circulation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Latitude, geographical location, and elevation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Natural phenomena (e.g., volcanic eruptions) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| f. Human activity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| g. Effect of tilt of Earth’s axis on seasons |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **E. Is familiar with astronomy** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Major features of the solar system |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Structure of the solar system |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Characteristics of planets (e.g., composition, unique features) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Characteristics of the Sun |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Asteroids and comets |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Theories of origin of the solar system |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Interactions of the Earth-Moon-Sun system |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Earth’s rotation and orbital revolution around the Sun |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Effect on seasons |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Phases of the Moon |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Effect on tides |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| e. Eclipses |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Major features of the universe and theories of its origins |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Galaxies |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Stars and their life cycle (e.g., types, nebulae, black holes) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| c. Units of celestial distance (e.g., light-year, astronomical unit) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| d. Theories of origin (e.g., Big Bang) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Contributions of space missions, exploration, and technology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| a. Remote-sensing devices (e.g., telescopes, satellites, space probes) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| b. Search for life and water on other planets |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **VI. Science, Technology, and Society (12%)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Understands the impact of science and technology on the environment and society** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Air and water pollution |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Greenhouse gases |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Global climate and sea level change |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Waste disposal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Acid rain |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. Loss of biodiversity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7. Ozone depletion |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Knows major issues associated with energy production and the management of natural resources** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Conservation and recycling |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Renewable and nonrenewable energy resources |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Pros and cons of power generation based on various sources (e.g., fossil, nuclear, water, wind, solar, biomass, geothermal) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Use and extraction of Earth’s resources (e.g., mining, reclamation, deforestation) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **C. Is familiar with applications of science and technology in daily life** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Chemical properties of household products |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Batteries, wireless devices, microchips, lasers, and fiber optics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Communication satellites |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Contributions of space technology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5. Common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6. DNA evidence in criminal investigations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **D. Is familiar with the impact of science on public-health issues** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Nutrition, disease, and medicine (e.g., food preservation, vitamins, vaccines, viruses) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Biotechnology (e.g., genetic engineering, in vitro fertilization) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Medical technologies (e.g., MRIs, X-rays, radiation therapy) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |