# *Praxis*® General Science: Content Knowledge (5435)
# Study Plan



| Test Content Categories | Description of content | How well do I know the content? (scale 1–5) | What resources do I have/need for this content? | Where can I find the resources I need? | Dates I will study this content | Date completed |
|---|---|---|---|---|---|---|
| **I. Scientific Methodology, Techniques, and History (11%)**<br>**A. Methods of Scientific Inquiry and Design** | | | | | | |
| 1. Identifying problems based on observations<br>2. Forming and testing hypotheses<br>3. Development of theories, models, and laws<br>4. Experimental design, including independent and dependent variables, controls, and sources of error<br>5. Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding<br>6. Nature of scientific knowledge<br>a. subject to change<br>b. consistent with evidence<br>c. based on reproducible evidence<br>d. includes unifying concepts and processes (e.g., systems, models, constancy and change, equilibrium, form and function) | | | | | | |

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|---|---|---|---|---|---|---|
| **B. Processes Involved in Scientific Data Collectionand Manipulation** | | | | | | |
| 1. Common units of measurement (metric and English) including unit conversion and prefixes such as milli and kilo<br>2. Scientific notation and significant figures in collected data<br>3. Organization and presentation of data<br>4. Basic data and error analysis including determining mean, accuracy, precision, and sources of error | | | | | | |
| **C. Interpret and Draw Conclusions from Data Presented in Tables, Graphs, Maps, and Charts** | | | | | | |
| 1. Trends in data<br>2. Relationships between variables<br>3. Predictions based on data<br>4. Drawing valid conclusions based on the data | | | | | | |

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|---|---|---|---|---|---|---|
| **D. Procedures for Correct Preparation, Storage, Use, and Disposal of Laboratory Materials** | | | | | | |
| 1. Appropriate and safe use of materials (e.g., chemicals, lab specimens)<br>2. Safe disposal of materials<br>3. Appropriate storage<br>4. Preparation for classroom or field use (e.g., how to prepare a solution of given concentration, staining slides, labeling samples) | | | | | | |
| **E. How to Use Standard Equipment in the Laboratory and the Field** | | | | | | |
| 1. Appropriate and safe use (e.g., Bunsen burner, glassware, GPS, microscope)<br>2. Appropriate storage (e.g., pH probes stored in appropriate buffer solution, dissection equipment, glassware)<br>3. Maintenance and calibration (e.g., cleaning microscopes, calibration of balances)<br>4. Preparation for classroom or field use (e.g., prelaboratory setup, classroom demonstrations, field research) | | | | | | |

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|---|---|---|---|---|---|---|
| **F. Safety and Emergency Procedures in the Laboratory** | | | | | | |
| 1. Location and use of standard safety equipment (e.g., eyewash, shower)<br>2. Laboratory safety rules for students<br>3. Appropriate apparel and conduct in the laboratory (e.g., wearing goggles)<br>4. Emergency procedures (e.g., fires, chemical spills, handling of injuries) | | | | | | |
| **G. Major Historical Developments of Science** | | | | | | |
| **1. Accepted principles and models develop over time**<br>**2. Major developments in science (e.g., atomic theory, plate tectonics)**<br>**3. Contributions of major historical figures (e.g., Darwin, Newton)** | | | | | | |
| **II. Physical Science (38%)**<br>**A. Basic Principles** | | | | | | |

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|---|---|---|---|---|---|---|
| **1. Structure of matter**<br>**a. Elements, compounds, and mixtures**<br>**b. Atoms, molecules, and ions**<br>**c. Basic properties of solids, liquids, and gases** | | | | | | |
| 2. Basic structure of the atom<br>a. Atomic models<br>b. Atomic structure including nucleus, electrons, protons, and neutrons<br>c. Atomic number, atomic mass, isotopes<br>d. Electron arrangements (e.g., valence electrons) | | | | | | |

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|---|---|---|---|---|---|---|
| **3. Basic characteristics of radioactive materials**<br><br>**a. Radioisotopes**<br>**b. Radioactive decay processes and half-life**<br>**c. Characteristics of alpha particles, beta particles, and gamma radiation**<br>**d. Fission and fusion** | | | | | | |

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|---|---|---|---|---|---|---|
| 4. Basic concepts and relationships involving energy and matter<br><br>a. Conservation of energy (first law of thermodynamics)<br>b. Entropy changes (second law of thermodynamics)<br>c. Conservation of matter in chemical systems<br>d. Kinetic and potential energy<br>e. Transformations between different forms of energy (thermal, chemical, radiant, nuclear, mechanical, electrical, electromagnetic)<br>f. Differences between chemical and physical properties/changes<br>g. Various temperature scales (Celsius, Fahrenheit, Kelvin)<br>h. Transfer of thermal energy and its basic measurement<br>– conduction, convection, and radiation<br>– specific heat capacity<br>– calorimetry (e.g., predict heat transfer in various systems)<br>i. Applications of energy and matter relationships<br>– trophic level<br>– matter cycling (carbon, nitrogen, water)<br>– energy flow in ecosystems<br>– convection currents in atmosphere, ocean, and mantle<br>– conservation of mass in the rock cycle<br>– chemical and physical changes in rocks<br>– impact of solar radiation on Earth and life<br>– energy transformations in living systems (e.g., photosynthesis, cellular respiration) | | | | | | |

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|---|---|---|---|---|---|---|
| **B. Chemistry** | | | | | | |
| **1. Periodicity and states of matter**<br><br>**a. Periodic table of the elements**<br>**– elements arranged in groups and periods**<br>**– atomic number, atomic mass, and isotopic abundance**<br>**– symbols of the elements**<br>**– trends in physical properties based on position of elements on the periodic table (e.g., atomic radius, ionization energy)**<br>**– trends in chemical reactivity based on position of elements on the periodic table (e.g., metals, nonmetals, noble gases)**<br>**b. States of matter and factors that affect phase changes**<br>**– basic assumptions of the kinetic theory of matter (e.g., particles in constant motion, average speed of gas particles related to temperature)**<br>**– ideal gas laws (e.g., volume is proportional to temperature, pressure is inversely related to volume)**<br>**– phase transitions and energy changes (e.g., heat of vaporization, heat of sublimation, phase diagrams, heating curves)** | | | | | | |

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|---|---|---|---|---|---|---|
| 2. Chemical nomenclature, composition, and bonding<br><br>a. Name of simple compounds and their chemical formulas<br>– interpreting chemical formulas<br>– naming compounds based on formula<br>– writing formulas based on name<br>– structural formulas (e.g., electron dot, Lewis structures)<br>b. Types of chemical bonding<br>– covalent and ionic<br>c. Mole concept and its applications<br>– Avogadro's number<br>d. Molar mass and percent composition | | | | | | |
| **3. Chemical reactions**<br><br>**a. Basic concepts involved in chemical reactions**<br>**– use and balance equations of simple chemical reactions**<br>**• balance equations**<br>**• simple stoichiometric calculations based on balanced equations**<br>**– endothermic and exothermic reactions**<br>**– factors that affect reaction rates (e.g., concentration, temperature, pressure, catalysts/enzymes, activation energy)**<br>**– factors that affect reaction equilibrium (e.g., Le Châtelier's principle)**<br>**– types of reactions (e.g., combustion, single or double replacement)**<br>**– simple oxidation-reduction reactions** | | | | | | |

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|---|---|---|---|---|---|---|
| **4. Acid-base chemistry**<br><br>**a. Simple acid-base chemistry**<br>**– chemical and physical properties of acids and bases**<br>**– pH scale**<br>**– neutralization**<br>**– acid-base indicators (e.g., phenolphthalein, pH paper, litmus paper)** | | | | | | |

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|---|---|---|---|---|---|---|
| **5. Solutions and solubility**<br><br>**a. Different types of solutions**<br>**– dilute and concentrated**<br>**– saturated, unsaturated, supersaturated**<br>**– solvent and solute**<br>**– concentration terms (e.g., molarity, parts per million (ppm))**<br>**– preparation of solutions of varying concentrations**<br>**b. Factors affecting the solubility of substances and the dissolving process**<br>**– effect of temperature, pressure, particle size, and agitation on the rate of dissolving**<br>**– effect of temperature and pressure on solubility (e.g., solubility curves)**<br>**– polar vs. nonpolar solvents and solutes**<br>**– dissociation of ionic compounds such as salts in water (e.g., ionization, electrolytes)**<br>**– precipitation**<br>**– freezing point depression** | | | | | | |
| **C. Physics** | | | | | | |
| **1. Mechanics**<br><br>**a. Description of motion in one and two dimensions**<br>**– speed, velocity, acceleration**<br>**– displacement**<br>**– linear momentum** | | | | | | |

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|---|---|---|---|---|---|---|
| **– vector and scalar quantities** | | | | | | |
| b. Newton's three laws of motion<br>– First law: inertia<br>– Second law: F = ma (i.e., net force, mass, and acceleration)<br>– Third law: action-reaction forces | | | | | | |
| c. Mass, weight, and gravity<br>– distinguish between mass and weight<br>– gravitational attraction (force of attraction between masses at various distances)<br>– acceleration due to gravity | | | | | | |

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|---|---|---|---|---|---|---|
| d. Analysis of motion and forces<br>– projectile motion<br>– inclined planes<br>– friction<br>– collisions (e.g., elastic, inelastic) and conservation of linear momentum<br>– circular motion (e.g., centripetal acceleration, centripetal force)<br>– center of mass<br>– periodic motion (e.g., pendulums, oscillating springs, planetary orbits, satellites)<br>– conservation of energy<br>– work, energy, and power<br>– basic fluid mechanics (e.g., buoyancy, density, pressure) | | | | | | |
| e. Simple machines<br>– mechanical advantage<br>– types of simple machines (e.g., wedge, screw, lever)<br>– concept of torque | | | | | | |

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|---|---|---|---|---|---|---|
| **2. Electricity and magnetism**<br><br>**a. Electrical nature of common materials**<br>**– electric charges**<br>**– electrostatic force (attraction and repulsion, Coulomb's law)**<br>**– conductivity, conductors, and insulators**<br>**b. Basic electrical concepts**<br>**– DC and AC current**<br>**– current, resistance, voltage, and power**<br>**– Ohm's law**<br>**– analyze basic series and parallel circuits**<br>**– voltage sources (e.g., batteries, generators)**<br>**c. Basic properties of magnetic fields and forces**<br>**– magnetic materials**<br>**– magnetic forces and fields (e.g., magnetic poles, attractive and repulsive forces)**<br>**– electromagnets** | | | | | | |

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|---|---|---|---|---|---|---|
| 3. Optics and waves<br><br>a. Electromagnetic spectrum<br>– nature of light (e.g., wave properties, photons)<br>– visible spectrum and color<br>– electromagnetic spectrum (e.g., ultraviolet, microwave, gamma)<br>b. Basic characteristics and types of waves<br>– transverse and longitudinal<br>–wave characteristics and relationships between them (e.g., frequency, amplitude, wavelength, speed, energy)<br>c. Basic wave phenomena<br>– reflection, refraction, diffraction, and dispersion<br>– absorption and transmission<br>– interference, scattering, and polarization<br>– total internal reflection<br>– Doppler effect (e.g., apparent frequency, moving source or observer, red/blue shift)<br>d. Basic optics<br>– mirrors<br>– lenses and their applications (e.g., the human eye, microscope, telescope)<br>– prisms<br>e. Sound<br>– pitch/frequency and loudness/intensity<br>– sound wave production, air vibrations, and resonance (e.g., tuning forks)<br>– application of the Doppler effect to sound | | | | | | |

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|---|---|---|---|---|---|---|
| **III. Life Science (20%)**<br>**A. Basic Structure and Function of Cells and Their Organelles** | | | | | | |
| 1. Structure and function of cell membranes (e.g., phospholipid bilayer, passive and active transport)<br>2. Structure and function of animal and plant cell organelles<br>3. Levels of organization (cells, tissues, organs, organ systems). Major features of common animal cell types (e.g., blood cells, muscle, nerve, epithelial, gamete)<br>4. Major features of common animal cell types (e.g., blood cells, muscle, nerve, epithelial, gamete)<br>5. Prokaryotes (bacteria) and eukaryotes (animals, plants, fungi, protists) | | | | | | |
| **B. Key Aspects of Cell Reproduction and Division** | | | | | | |
| 1. Cell cycle<br>2. Mitosis<br>3. Meiosis<br>4. Cytokinesis | | | | | | |

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|---|---|---|---|---|---|---|
| **C. Basic Biochemistry of Life** | | | | | | |
| 1. Cellular respiration<br>2. Photosynthesis<br>3. Biological molecules (e.g., DNA, carbohydrates, proteins, lipids, enzymes) | | | | | | |
| **D. Basic Genetics** | | | | | | |
| 1. Structure (double helix, single stranded, and base pairs) and function of DNA and RNA (replication, transcription, and translation)<br>2. Chromosomes, genes, alleles<br>3. Dominant and recessive traits<br>4. Mendelian inheritance (e.g., genotype, phenotype, use of Punnett squares, pedigrees)<br>5. Mutations, chromosomal abnormalities, and common genetic disorders | | | | | | |
| **E. Theory and Key Mechanisms of Evolution** | | | | | | |

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|---|---|---|---|---|---|---|
| 1. Mechanisms of evolution (e.g., natural selection)<br>2. Isolation mechanisms and speciation<br>3. Supporting evidence (e.g., fossil record, comparative genetics, homologous structures) | | | | | | |
| **F. Hierarchical Classification Scheme** | | | | | | |
| 1. Classification schemes (e.g., domain, class, genus)<br>2. Characteristics of bacteria, animals, plants, fungi, and protists | | | | | | |
| **G. Major Structures of Plants and Their Functions** | | | | | | |

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|---|---|---|---|---|---|---|
| 1. Characteristics of vascular and nonvascular plants<br>2. Structure and function of roots, leaves, and stems (e.g., stomata, xylem, phloem)<br>3. Asexual (budding) and sexual reproduction (flowers, fruit, seeds, spores)<br>4. Growth (e.g., germination, elongation)<br>5. Uptake and transport of nutrients and water<br>6. Responses to stimuli (e.g., light, temperature, water, gravity) | | | | | | |
| **H. Basic Anatomy and Physiology of Animals, including the Human Body** | | | | | | |

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| **1. Response to stimuli and homeostasis**<br>**2. Exchange with the environment (e.g., respiratory, excretory, and digestive systems)**<br>**3. Internal transport and exchange (e.g., heart, arteries, veins, capillaries)**<br>**4. Control systems (e.g., nervous and endocrine systems)**<br>**5. Movement and support (e.g., skeletal and muscular systems)**<br>**6. Reproduction and development**<br>**7. Immune system (e.g., antibodies, autoimmune disorders)** | | | | | | |
| **I. Key Aspects of Ecology** | | | | | | |
| **1. Population dynamics**<br>**a. growth curves and carrying capacity**<br>**b. behavior (e.g., territoriality)**<br>**c. intraspecific relationships (e.g., mating systems, social systems, competition)** | | | | | | |
| 2. Community ecology<br>a. niche<br>b. species diversity<br>c. interspecific relationships (e.g., predator-prey, parasitism) | | | | | | |

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| **3. Ecosystems**<br><br>**a. biomes**<br>**b. stability and disturbances (e.g., glaciation, climate change, succession)**<br>**c. energy flow (e.g., trophic levels, food webs)**<br>**d. biogeochemical cycles (e.g., water, nitrogen, and carbon cycles, biotic/abiotic interaction)** | | | | | | |
| **IV. Earth and Space Science (20%)**<br>**A. Physical Geology** | | | | | | |
| **1. Types and basic characteristics of rocks and minerals and their formation processes**<br><br>**a. The rock cycle**<br>**b. Characteristics of rocks and their formation processes (i.e., sedimentary, igneous, and metamorphic rock)**<br>**c. Characteristics of minerals and their formation processes (e.g., classes of minerals, crystals, hardness)** | | | | | | |

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|---|---|---|---|---|---|---|
| 2. Processes involved in erosion, weathering, and deposition of Earth's surface materials and soil formation<br><br>a. Erosion and deposition (e.g., agents of erosion)<br>b. Chemical and physical (mechanical) weathering<br>c. Characteristics of soil (e.g., types, soil profile)<br>d. Porosity and permeability<br>e. Runoff and infiltration | | | | | | |
| **3. Earth's basic structure and internal processes**<br><br>**a. Earth's layers (e.g., lithosphere, mantle, core)**<br>**b. Shape and size of Earth**<br>**c. Geographical features (e.g., mountains, plateaus, mid-ocean ridges)**<br>**d. Earth's magnetic field**<br>**e. Plate tectonics theory and evidence**<br>**– folding and faulting (e.g., plate boundaries)**<br>**– continental drift, seafloor spreading, magnetic reversals**<br>**– characteristics of volcanoes (e.g., eruptions, lava, gases, hot spots)**<br>**– characteristics of earthquakes (e.g., epicenters, faults, tsunamis)**<br>**– seismic waves and triangulation** | | | | | | |

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|---|---|---|---|---|---|---|
| **4. The water cycle**<br><br>**a. Evaporation and condensation**<br>**b. Precipitation**<br>**c. Runoff and infiltration**<br>**d. Transpiration** | | | | | | |
| **B. Historical Geology** | | | | | | |
| **1. Historical geology**<br><br>**a. Principle of uniformitarianism**<br>**b. Basic principles of relative age dating (e.g., superposition, stratigraphic correlation, fossil succession)**<br>**c. Absolute (radiometric) dating**<br>**d. Geologic time scale (e.g., age of Earth, scope of time)**<br>**e. Fossil record as evidence of the origin and development of life (e.g., fossilization methods, mass extinctions, ice ages, meteor impacts)** | | | | | | |

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|---|---|---|---|---|---|---|
| **C. Earth's Bodies of Water** | | | | | | |
| 1. Characteristics and processes of Earth's oceans and other bodies of water<br><br>a. Distribution and location of Earth's water<br>b. Seawater composition<br>c. Coastline topography and topography of ocean floor<br>d. Tides, waves, currents<br>e. Estuaries and barrier islands<br>f. Islands, reefs, and atolls<br>g. Polar ice, icebergs, and glaciers<br>h. Lakes, ponds, and wetlands<br>i. Streams, rivers, and river deltas<br>j. Groundwater, water table, wells, and aquifers<br>k. Geysers and springs<br>2. Properties of water that affect Earth systems (e.g., density changes on freezing, high heat capacity, polar solvent, hydrogen bonding) | | | | | | |
| **D. Meteorology and Climate** | | | | | | |
| 1. Basic structure and composition of Earth's atmosphere<br><br>a. Layers (e.g., stratosphere)<br>b. Composition of atmosphere (e.g., percent oxygen and nitrogen)<br>c. Atmospheric pressure and temperature | | | | | | |

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|---|---|---|---|---|---|---|
| **2. Basic concepts of meteorology**<br><br>**a. Relative humidity**<br>**b. Dew point**<br>**c. Wind (e.g., how it is generated and modified)**<br>**d. Cloud types and formation**<br>**e. Types of precipitation (e.g., hail, rain)**<br>**f. Air masses, fronts, storms, and severe weather (e.g., hurricanes, tornadoes)**<br>**g. Development and movement of weather patterns** | | | | | | |

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|---|---|---|---|---|---|---|
| **3. Major factors that affect climate and seasons**<br>**a. Effects of latitude, geographical location, and elevation (e.g., mountains and oceans)**<br>**b. Effects of atmospheric circulation (e.g., trade winds, jet stream)**<br>**c. Effects of ocean circulation**<br>**d. Characteristics and locations of climate zones (e.g., Tropics, Arctic)**<br>**e. Effect of the tilt of Earth's axis on seasons**<br>**f. Effects of natural phenomena (e.g., volcanic eruptions, solar radiation variations)**<br>**g. El Niño, La Niña** | | | | | | |
| **E. Astronomy** | | | | | | |
| **1. Major features of the solar system**<br>**a. Structure of the solar system**<br>**b. Laws of motion (e.g., gravitation, planetary orbits, satellites)**<br>**c. Characteristics of the Sun, Moon, and planets**<br>**d. Characteristics of asteroids, meteoroids, comets, and dwarf/minor planets**<br>**e. Theories of origin of the solar system** | | | | | | |
| 2. Interactions of the Earth-Moon-Sun system<br>a. Earth's rotation and orbital revolution around the Sun<br>b. Effect on seasons<br>c. Phases of the Moon<br>d. Effect on tides<br>e. Solar and lunar eclipses | | | | | | |

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|---|---|---|---|---|---|---|
| f. Time zones<br>g. Effect of solar wind on Earth | | | | | | |
| **3. Major features of the universe**<br><br>**a. Galaxies (e.g., definition, relative size, Milky Way)**<br>**b. Characteristics of stars and their life cycles**<br>**– life cycle of star, e.g., white dwarf, red giant, supernova, nebulae, black holes**<br>**– color, temperature, apparent brightness, absolute brightness, luminosity**<br>**– Hertzsprung-Russell diagrams**<br>**c. Dark matter**<br>**d. Theories about the origin of the universe (e.g., Big Bang)** | | | | | | |

# *Praxis*® General Science: Content Knowledge (5435)
# Study Plan



| Test Content Categories | Description of content | How well do I know the content? (scale 1–5) | What resources do I have/need for this content? | Where can I find the resources I need? | Dates I will study this content | Date completed |
|---|---|---|---|---|---|---|
| **4. Contributions of space exploration and technology to our understanding of the universe**<br>**a. Remote sensing devices (e.g., satellites, space probes, telescopes, spectral analysis)**<br>**b. Search for water and life on other planets** | | | | | | |
| **V. Science, Technology, and Society (11%)**<br>**A. Impact of Science and Technology on the Environment and Society** | | | | | | |

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| Test Content Categories | Description of content | How well do I know the content? (scale 1–5) | What resources do I have/need for this content? | Where can I find the resources I need? | Dates I will study this content | Date completed |
|---|---|---|---|---|---|---|
| 1. Air and water pollution (e.g., acid rain, eutrophication, groundwater pollution)<br>2. Climate change and greenhouse gases<br>3. Irrigation<br>4. Reservoirs and levees<br>5. Depletion of aquifers<br>6. Ozone layer depletion<br>7. Loss of biodiversity<br>8. Space exploration<br>9. Waste disposal (e.g., landfills)<br>10. Recycling<br>11. Environmentally friendly consumer products (e.g., biodegradable materials) | | | | | | |
| **B. Major Issues associated with Energy Production and the Management of Natural Resources** | | | | | | |

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|---|---|---|---|---|---|---|
| 1. Renewable and nonrenewable energy resources<br>2. Conservation and recycling<br>3. Pros and cons of power generation based on various resources including fossil and nuclear fuel, hydropower, wind power, solar power, geothermal power, and alternative energy sources<br>4. Issues associated with the use and extraction of Earth's resources (e.g., mining, land reclamation, deforestation) | | | | | | |
| **C. Applications of Science and Technology in Daily Life** | | | | | | |
| 1. Chemical properties of household products<br>2. Communication (e.g., wireless devices, GPS, satellites)<br>3. Science principles applied in commonly used consumer products (e.g., batteries, lasers, polarized sunglasses, and fiber optic cables)<br>4. Water purification<br>5. Common agricultural practices (e.g., genetically modified crops, use of herbicides and insecticides)<br>6. DNA evidence in criminal investigations<br>7. Nanotechnology | | | | | | |
| **D. Impact of Science on Public Health Issues** | | | | | | |

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|---|---|---|---|---|---|---|
| 1. Nutrition, disease, and medicine (e.g., vitamins, viruses, vaccines)<br>2. Biotechnology (e.g., genetic engineering, in vitro fertilization)<br>3. Medical technologies (e.g., medical imaging, X-rays, radiation therapy) | | | | | | |