

Praxis[®] Earth and Space Sciences: Content Knowledge (5571) 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. Basic Scientific Principles and Processes (12%) A. Science Methodology, Techniques, and History						
1. Scientific inquiry methods a. Observations, hypotheses, experiments, conclusions, theories, models, and laws b. Experimental design, including variables, controls, and sources of error c. Scientific knowledge is consistent with evidence, subject to change						
2. Collect, evaluate, process, interpret, and report data a. Units of measurement b. Scale [orders of magnitude], uncertainty in measurement, accuracy versus precision c. Appropriate calculations and conversions d. Scientific notation and significant figures e. Organization and presentation of data f. Interpretation of data using inductive and deductive reasoning processes						

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3. Interpret and draw conclusions from models and data presented in various forms a. Trends in data b. Maps (e.g., geologic, topographic, weather) c. Models (e.g., Earth systems, solar system) d. Map projections e. Tables, graphs, charts, and cross sections						
4. Use materials and equipment in the laboratory and the field safely and appropriately a. Preparation, use, storage, and disposal of materials b. Use and calibration of equipment c. Safety procedures d. Value and limitations of investigative technology – computer as a tool (e.g., modeling, Internet) – data gathering and collection of evidence (e.g., ground-based versus space-based telescope)						
5. Ocean and space exploration and the use of various technologies to gather data a. Satellites, space probes, remote sensing b. Telescopes, spectroscopy c. Search for water and life on other planets d. Submersibles, research ships, sonar						
6. Historical roots of the Earth and Space Sciences a. How current concepts in Earth and Space Science developed over time b. Major historical figures and their contributions						

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B. Basic Principles of Matter and Energy						
1. Structure of matter a. Atoms, molecules, ions, elements, and compounds b. Mixtures, solutions, and precipitates c. Solids, liquids, gases, plasmas d. Kinetic molecular theory of gases and the ideal gas laws						
2. Relationships between energy and matter a. Conservation of matter in chemical processes b. Conservation of energy c. Forms of energy d. Methods of thermal energy transfer e. Specific heat capacity f. Energy required for phase transitions g. Temperature scales h. Thermal expansion and contraction						
3. Nuclear reactions a. Radioactive decay processes (e.g., isotopes, half-life) b. Fusion and fission c. Heat production in nuclear reactions						

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<p>4. Biological, chemical, and physical processes</p> <p>a. Chemical and physical properties and changes (e.g., solubility, pH, oxidation, phase changes)</p> <p>b. Chemical bonding</p> <p>c. Wave properties and phenomena (e.g., wavelength, frequency, amplitude, reflection, refraction)</p> <p>d. Electromagnetic spectrum (e.g., visible, infrared, ultraviolet, gamma)</p> <p>e. Photosynthesis and respiration</p> <p>f. Forces and motion (e.g., gravity, friction)</p>						
<p>C. Science, Technology, and Society</p>						
<p>1. Impact of science and technological advancements on the environment</p> <p>a. Interrelationships between humans and the hydrosphere (e.g., water pollution and treatment, acid rain, impact of sea level rise on populations, availability of water resources, irrigation, desalinization)</p> <p>b. Interrelationships between humans and the atmosphere (e.g., air pollution, greenhouse gases, importance of UV absorption by stratospheric ozone, ozone layer depletion)</p> <p>c. Impact of human activity on the natural</p>						

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fluctuations in global systems (e.g., rate of climate change, rate of sea level change, rate of depletion of aquifers)						
2. Issues associated with the use of various energy sources a. Renewable and nonrenewable energy sources b. Energy conservation c. Pros and cons of power production based on various types of sources, such as fossil fuel, nuclear, hydro, solar, wind, and geothermal						
3. Issues associated with the use and extraction of various Earth resources a. Mining-related effects b. Increased erosion c. Deforestation d. Degradation of soils (e.g., agricultural practices)						
4. Importance of Earth and Space Sciences to everyday life a. Conservation of resources (e.g., recycling, sustainable technology) b. Waste management c. Technology (e.g., satellites, GPS) d. Human health (e.g., radon in basements of homes) e. Identification and prediction of natural hazards (e.g., tsunamis, earthquakes, hurricanes, coastal erosion)						
II. Tectonics and Internal Earth Processes						

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(17%)						
<p>1. Theory of plate tectonics and its supporting evidence</p> <ul style="list-style-type: none"> a. Plate movement b. Convergent, divergent, and transform boundaries c. Hot spots d. Potential driving forces (e.g., mantle convection) e. Seismic, magnetic, fossil, and other evidence for plate tectonics f. Geographic features (e.g., trenches, mountains, rift zones) 						
<p>2. Deformation of Earth’s crust and resulting features</p> <ul style="list-style-type: none"> a. Folds and faults b. Mountain building and rifting c. Compression, tension, and shear stresses d. Isostasy (e.g., postglacial rebound) 						
<p>3. Characteristics of earthquakes and how they provide information about Earth’s interior</p> <ul style="list-style-type: none"> a. Distribution and types (deep versus shallow) b. Magnitude and intensity c. Seismic waves and seismograms 						

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d. Epicenter, focus e. Causes of earthquakes						
4. Layered structure of Earth and related processes a. Characteristics and composition of the crust, mantle, and core b. Properties of the lithosphere and asthenosphere c. Evidence from seismic waves d. Shape and size of Earth e. Magnetic field and geomagnetic reversals						
5. Volcanic characteristics and processes a. How volcanoes are formed b. Features of volcanoes (e.g., vent, magma chamber) and eruptive products (e.g., pyroclastics, gases) c. Types of volcanoes and their characteristics d. Distribution (e.g., ring of fire, hot spots)						
III. Earth Materials and Surface Processes (23%)						
1. Identification of minerals a. Definition of a mineral b. Physical properties (e.g., density, streak, cleavage, luster, crystal structure) c. Identification tools (e.g., Mohs' hardness scale)						
2. Cycling of Earth materials a. Rock cycle b. Water cycle c. Carbon cycle						

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<p>3. Characteristics and formation of igneous, sedimentary, and metamorphic rocks</p> <p>a. Rock identification and classification</p> <p>b. Formation and characteristics of the following:</p> <ul style="list-style-type: none"> – intrusive and extrusive igneous rock – clastic, chemical, and biological sedimentary rocks – regional and contact metamorphic rocks 						
<p>4. Earth’s surface changes over time</p> <p>a. Chemical and physical weathering</p> <p>b. Erosion and deposition</p> <p>c. Uplift</p> <p>d. Interaction between the biosphere and the geosphere (e.g., weathering caused by plants, nutrient uptake from soil by plants)</p> <p>e. Interaction between the hydrosphere and the geosphere (e.g., cave formation, ocean salinity, streams, and drainage systems)</p> <p>f. Processes of soil formation and resulting characteristics (e.g., soil profiles, factors such as geology, climate, time)</p>						

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IV. History of the Earth and its Life-Forms (14%)						
1. Rocks are used to determine geologic time and provide a record of Earth’s history a. Principle of uniformitarianism (e.g., definition, applications, limitations) b. Principles of relative age dating including: – principle of original horizontality – principle of superposition – principle of cross-cutting relationships – principle of fossil succession – stratigraphic correlation – unconformities c. Principles of absolute (radiometric) age dating d. Geologic time scale (e.g., Earth’s age, scope of time)						
2. Fossil record as evidence of the origin and development of life a. Origin of major groups of life-forms b. Fossilization methods c. Mass extinctions d. Fossil evidence for major divisions of the geologic time scale						
3. Theories of Earth’s formation and development of its systems including the history of the following: a. Earth’s atmosphere b. Earth’s hydrosphere c. Earth’s landmasses						

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V. Earth’s Atmosphere and Hydrosphere (19%)						
1. Unusual properties of water and effect on Earth systems a. Density changes (e.g., ice floats in water) b. Excellent solvent c. High specific heat and heat of vaporization d. Exists as solid, liquid, and gas on Earth						
2. Water cycle and the energy transfers involved a. Phase changes (e.g., vaporization, condensation, sublimation) b. General structure of the water cycle c. Distribution of water on Earth						
3. Basic structure and composition of the atmosphere a. Chemical composition b. Various layers and their physical properties (e.g., stratosphere, troposphere, thermosphere) c. Interaction of the atmosphere with hydrosphere/biosphere/geosphere (e.g., respiration, transpiration, photosynthesis, nitrogen fixation, evaporation, precipitation, effect of the atmosphere on weathering)						

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<p>4. Basic physical principles and processes involved in meteorology</p> <ul style="list-style-type: none"> a. Variations in atmospheric temperature, pressure, and density b. Energy budget (e.g., energy absorption and reflection) c. Processes involving greenhouse gases d. Circulation, Coriolis effect e. Cloud formation f. Origin of wind g. Absolute and relative humidity h. Dew point and frost point i. Daily/seasonal/annual variations in meteorology (e.g., sea breezes, monsoons, El Niño) 						
<p>5. Development and movement of weather systems</p> <ul style="list-style-type: none"> a. Cloud types b. Formation of various types of precipitation c. Air masses, fronts, storms, and severe weather such as hurricanes and tornados d. Development and movement of weather patterns e. Interpretation of atmospheric data (e.g., dew point, isobars) f. Fundamentals of weather forecasting 						

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<p>6. Factors and processes that influence climate and lead to climate zones</p> <p>a. Effects of the following:</p> <ul style="list-style-type: none"> – latitude, geographical location, and elevation – atmospheric circulation (e.g., trade winds, jet stream) – ocean circulation <p>b. Characteristics and locations of climate zones</p> <p>c. Effect of the Earth’s tilt on seasons</p>						
<p>7. Effects of natural phenomena on climate change</p> <p>a. Volcanic eruptions</p> <p>b. Asteroid impacts</p> <p>c. Variations in solar radiation</p>						
<p>8. Characteristics and processes of surface water and groundwater</p> <p>a. Streams (e.g., erosion, deposition, channel migration)</p> <p>b. Lakes and wetlands</p> <p>c. Geysers and springs</p> <p>d. Groundwater, aquifers, water table</p> <p>e. Runoff and infiltration</p> <p>f. Porosity and permeability</p> <p>g. Hazards (e.g., flooding, sinkholes)</p>						

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h. Human interactions (e.g., wells, levees, diversion for irrigation, saltwater intrusion)						
9. Characteristics of glaciers and polar ice and how they move and change over time a. Characteristics of continental and mountain glaciers b. Glacial-interglacial cycles, advance and retreat c. Depositional and erosional features d. Icebergs e. Sea ice						
10. Physical and chemical characteristics and processes of the oceans a. Salinity, temperature, and density b. Surface currents, deep-ocean circulation c. El Niño, la Niña d. Wave formation e. Seafloor topography						

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11. Interrelationships between the oceans and the solid Earth a. Tidal effects (e.g., tidal range, tidal patterns) b. Wave effects (e.g., coastal erosional and depositional processes) c. Tsunamis d. Island formation and change (e.g., barrier islands, volcanic islands, atolls) e. Hydrothermal vents f. Estuaries (e.g., characteristics, formation) g. Marine sediments (e.g., origin, rate of deposition) h. Sea level changes						
12. Interrelationships between the hydrosphere and the biosphere/atmosphere a. Light penetration and photosynthesizers in oceans b. Upwelling of nutrients c. Coral reefs d. Organisms around hydrothermal vents						
VI. Astronomy (15%)						
1. Earth's motions and their characteristics and consequences a. Rotation and revolution b. Time zones c. Effect of axial tilt (e.g., seasons, solstices, and equinoxes) d. Long-term changes in Earth's motions						

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2. Relationships within the Earth-Moon-Sun system a. Tides (e.g., causes, cycles, spring, neap) b. Eclipses (solar, lunar) c. Phases of the Moon d. Effect of solar wind on Earth						
3. Characteristics of the components of our solar system and how they formed a. Laws of motion b. Theories of the formation of the solar system c. Location, orbits, and characteristics of the planets d. Structure and characteristics of the Sun e. Structure, characteristics, and orbit of the Earth's moon f. Natural satellites g. Characteristics of asteroids, meteoroids, comets, dwarf/minor planets						
4. Characteristics of stars and the processes that occur within them a. Stages in the life cycle of stars (e.g., protostar, main sequence, white dwarf, supernova) b. Color, temperature, apparent brightness, and luminosity, including Hertzsprung-Russell diagram c. Formation of elements (e.g., carbon, iron)						

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5. Characteristics of the Milky Way and other galaxies a. Structure and classification of galaxies (e.g., spiral, elliptical) b. Relative distances and motions c. Supermassive black holes d. Dark matter						
6. Theories and observations that relate to the origin and development of the universe a. Theories about the origin of the universe b. Redshift and background radiation						