AVENTA LEARNING

Alignment Document
State of Missouri and Aventa Learning Earth Science

# Earth Science

2005-2007 Benchmark Blueprint

| Strand | Goals | Standards | Benchmarks | Unit Name | Course Topic Description |
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| **5** Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere) | **5.1** Earth's systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures | **5.1.A** The Earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties | Not assessed at this level | | |
| | | **5.1.B** The hydrosphere is composed of water (a material with unique properties) and other materials | **5.1.B.a** Recognize the importance of water as a solvent in the environment as it relates to karst topography (cave formation), acid rain, and water pollution | Weathering, Erosion, and Deposition; Glaciers and Deserts | Hydraulic action, Chemical Weathering, Acid Precipitation |
| | | **5.1.C** The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles | **5.1.C.a** Relate the composition of gases and temperature of the layers of the atmosphere (i.e., troposphere, stratosphere, ionosphere) to cloud formation and transmission of radiation (e.g., ultraviolet, infrared) | Atmosphere & Climate | Structure of Atmosphere |
| | | | **5.1.C.b** Describe the causes and consequences of observed and predicted changes in the ozone layer | | |
| | | **5.1.D** Climate is a description of average weather | **5.1.D.a** Provide evidence (e.g., melting glaciers, fossils, desertification) that supports theories of climate change due | Atmosphere & Climate | The Greenhouse Effect |

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| | | conditions in a given area over time | to natural phenomena and/or human interactions | | |
| | | | **5.1.D.b** Explain how climate and weather patterns in a particular region are affected by factors, such as proximity to large bodies of water or ice/ocean currents, latitude, altitude, prevailing wind currents, and amount of solar radiation | Atmosphere & Climate | Heat and Energy |
| | **5.2** Earth's systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes | **5.2.A** The Earth's materials and surface features are changed through a variety of external processes | **5.2.A.a** Explain the external processes (i.e., weathering, erosion, deposition of sediment) that result in the formation and modification of landforms | Weathering, Erosion, and Deposition; Glaciers and Deserts | Erosion, Deposition, and Landscape Development |
| | | | **5.2.A.b** Describe the factors that affect rates of weathering and erosion of landforms (e.g., soil/rock type, amount and force of run-off, slope) | | |
| | | **5.2.B** There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates | **5.2.B.a** Describe the internal source of energy on Earth that results in uneven heating of the mantle (i.e., decay of radioactive isotopes) | Plate Tectonics | What drives the plates? |
| | | | **5.2.B.b** Illustrate and explain the convection currents that result from the uneven heating inside the mantle and cause movement of crustal plates | Plate Tectonics | What drives the plates? |
| | | | **5.2.B.c** Describe how the energy of an earthquake travels as seismic waves and provides evidence for the layers of the geosphere | | |
| | | | **5.2.B.d** Relate the densities of the materials found in continental and oceanic plates to the processes that result in each type of plate boundary (i.e., diverging, converging, transform) | Plate Tectonics | Section 1 Part A, Part H (no other title listed) |
| | | | **5.2.B.e** Describe the effects of the | | |

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| | | | movement of crustal plates (i.e., earthquakes, sea floor spreading, mountain building, volcanic eruptions) at a given location on the planet | | |
| | | | **5.2.B.f** Articulate the processes involved in the Theory of Plate Tectonics (i.e., uneven heating of the mantle due to the decay of radioactive isotopes, movement of materials via convection currents, movement of continental and oceanic plates along diverging, converging, or transform plate boundaries) and describe evidence that supports that theory (e.g., correlation of rock sequences, landforms, and fossils; presence of intrusions and faults; evidence of sea-floor spreading) | Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics<br>Plate Tectonics | Continental Drift – In search of a theory<br>Developing the theory<br>Ocean floor mapping<br>Magnetic striping and polar reversals<br>Seafloor spreading<br>Earthquake activity<br>Divergent boundaries<br>Convergent Boundaries<br>Transform Boundaries<br>Plate Boundary Zones<br>Rates of Plate Motion<br>Hot Spots<br>What drives the plates? |
| | | **5.2.C** Continual changes in the Earth's materials and surface that result from internal and external | Not assessed at this level | | |

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| | | processes is described by the rock cycle | | | |
| | | **5.2.D** Changes in the Earth over time can be inferred through rock and fossil evidence | **5.2.D.a** Use evidence from relative and real dating techniques (e.g., correlation of trace fossils, landforms, and rock sequences; evidence of climate changes; presence of intrusions and faults; magnetic orientation; relative age of drill samples)) to infer geologic history | Geologic Time | Relative Time Scale, Numeric Time Scale |
| | | **5.2.E** Changes in the form of water as it moves through Earth's systems are described as the water cycle | Not assessed at this level | | |
| | | **5.2.F** Constantly changing properties of the atmosphere occur in patterns which are described as weather | **5.2.F.a** Predict the weather at a designated location using weather maps (including map legends) and/or weather data (e.g., temperature, barometric pressure, cloud cover and type, wind speed and direction, precipitation) | | |
| | | | **5.2.F.b** Discover and evaluate patterns and relationships in the causes of weather phenomena and regional climates (e.g., circulation of air and water around the Earth, movement of global winds and water cycles due to solar radiation) | | |
| | | **5.2.G** The geosphere, hydrosphere, and atmosphere are continually interacting through processes that | **5.2.G.a** Explain how global wind and ocean currents are produced on the Earth's surface (e.g., effects of unequal heating of the Earth's land masses, oceans, and air by the Sun due to latitude and surface material type; effects of gravitational forces acting on | World of Weather | Wind |

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| | | transfer energy and Earth's materials | layers of air of different densities due to temperature differences; effects of the rotation of the Earth; effects of surface topography) | | |
| | | | **5.2.G.b** Describe the effects of natural phenomena (e.g., burning organic material, volcanic eruptions, lightning, changes in global wind and ocean currents) on the properties of the atmosphere | | |
| | **5.3** Human activity is dependent upon and affects Earth's resources and systems | **5.3.A** Earth's materials are limited natural resources affected by human activity | **5.3.A.a** Distinguish between renewable and nonrenewable energy resources | | |
| | | | **5.3.A.b** Recognize the finite availability of fresh water for use by living organisms | | |
| | | | **5.3.A.c** Identify human activities that adversely affect the composition of the atmosphere, hydrosphere, or geosphere | | |
| | | | **5.3.A.d** Predict the effect of change on the other sphere when given a scenario describing how the composition of the atmosphere, hydrosphere, or geosphere is altered | | |
| | | | **5.3.A.e** Recognize how the geomorphology of Missouri (i.e., different types of Missouri soil and rock materials such as limestone, granite, clay, loam; land formations such as karst (cave) formations, glaciated plains, river channels) affects the development of land use (e.g., agriculture, recreation, planning and zoning, waste management) | | |
| | | | **5.3.A.f** Recognize the limited availability of major mineral deposits in the United States (e.g., lead, petroleum, coal, | | |

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| | | | copper, zinc, iron, gravel, aluminum) and the factors that affect their availability | | |
| | | | **5.3.A.g** Recognize the economic, political, social, and ethical constraints associated with obtaining and using natural resources (e.g., mining and use of different types of Missouri mineral resources such as lead mining, gravel dredging, strip mining, coal burning, production of fertilizers and explosives; use of fossil fuels versus renewable resources) | | |
| **6** Composition and Structure of the Universe and the Motion of the Objects Within It | **6.1** The universe has observable properties and structure | **6.1.A** The Earth, Sun, and moon are part of a larger system that includes other planets and smaller celestial bodies | **6.1.A.a** Describe and relate the positions and motions of the Sun-Earth solar system, the Milky-Way galaxy, and other galaxies within the universe (i.e., it is just one of several solar systems orbiting the center of a rotating spiral galaxy; that spiral galaxy is just one of many galaxies which orbit a common center of gravity; the expanding universe causes the distance between galaxies to increase) | Astronomy | Astronomical Distances |
| | | **6.1.B** The Earth has a composition and location suitable to sustain life | **6.1.B.a** Explain how Earth's environmental characteristics and location in the universe (e.g., atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment | | |
| | | | **6.1.B.b** Compare the environmental characteristics and location in the universe of Earth and other celestial bodies (e.g., planets, moons) to determine ability to support life | | |

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| | | **6.1.C** Most of the information we know about the universe comes from the electromagnetic spectrum | **6.1.C.a** Identify information that the electromagnetic spectrum provides about the stars and the universe (e.g., chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies) | Astronomy | Looking into Space |
| | | | **6.1.C.b** Evaluate the advantages/disadvantages of using different tools (e.g., spectroscope, different types of telescopes, probes) to gather information about the universe (e.g., background radiation, magnetic fields, discovery of previously unknown celestial bodies) | Astronomy | Looking into Space |
| | **6.2** Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces | **6.2.A** The apparent position of the Sun and other stars, as seen from Earth, changes in observable patterns | Not assessed at this level | | |
| | | **6.2.B** The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns | Not assessed at this level | | |
| | | **6.2.C** The regular and predictable motions of the Earth and moon relative to the Sun explain natural phenomena on Earth, such as day, month, year, shadows, moon | **6.2.C.a** Relate units of time (i.e., day, month, year) to the regular and predictable motion of the planets and moons and their positions in the Solar system | Astronomy | Earth, Moon and Sun |
| | | | **6.2.C.b** Explain seasonal phenomena (i.e., weather, length of day, temperature, intensity of sunlight) as a consequence of a planet's axial tilt as it | Astronomy | Earth, Moon and Sun |

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| | | phases, eclipses, tides, and seasons | rotates and a planet's orbital position as it revolves around the Sun | | |
| | | | **6.2.C.c** Provide evidence that can be observed from Earth that supports the fact Earth rotates on its axis and revolves around the Sun | | |
| | | | **6.2.C.d** Predict the moon rise/set times, phases of the moon, and/or eclipses when given the relative positions of the moon, planet, and Sun | | |
| | | | **6.2.C.e** Explain how the gravitational forces, due to the relative positions of a planet, moon, and Sun, determine the height and frequency of tides | Astronomy | Earth, Moon and Sun |
| | | **6.2.D** Gravity is a force of attraction between objects in the solar system that governs their motion | **6.2.D.a** Explain orbital motions of moons around planets, and planets around the Sun, as the result of gravitational forces between those objects | Astronomy | Earth, Moon and Sun |
| **7** Scientific Inquiry | **7.1** Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking | **7.1.A** Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation | **7.1.A.a** Formulate testable questions and hypotheses | | |
| | | | **7.1.A.b** Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment | | |
| | | | **7.1.A.c** Design and conduct a valid experiment | | |
| | | | **7.1.A.d** Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature) | | |
| | | | **7.1.A.e** Acknowledge some scientific explanations (e.g., explanations of | Planet Earth | Think Like an Earth Scientist |

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| | | | astronomical or meteorological phenomena) cannot be tested using the standard experimental "scientific method" due to the limits of the laboratory environment, resources, and/or technologies | | |
| | | | **7.1.A.f** Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations | Planet Earth | Think Like an Earth Scientist |
| | | | **7.1.A.g** Evaluate the design of an experiment and make suggestions for reasonable improvements | | |
| | | **7.1.B** Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations | **7.1.B.a** Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders) | | |
| | | | **7.1.B.b** Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second | | |
| | | | **7.1.B.c** Determine the appropriate tools and techniques to collect, analyze, and interpret data | | |
| | | | **7.1.B.d** Judge whether measurements and computation of quantities are | | |

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| | | | reasonable | | |
| | | | **7.1.B.e** Calculate the range, average/mean, percent, and ratios for sets of data | | |
| | | | **7.1.B.f** Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results) | | |
| | | **7.1.C** Evidence is used to formulate explanations | **7.1.C.a** Use quantitative and qualitative data as support for reasonable explanations (conclusions) | | |
| | | | **7.1.C.b** Analyze experimental data to determine patterns, relationship, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable) | | |
| | | | **7.1.C.c** Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions) | | |
| | | **7.1.D** Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings) | **7.1.D.a** Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories) | | |
| | | | **7.1.D.b** Evaluate the reasonableness of an explanation (conclusion) | | |
| | | **7.1.E** The nature of science relies upon communication of | **7.1.E.a** Communicate the procedures and results of investigations and explanations through: | | |

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| | | results and justification of explanations | **7.1.E.a.1** oral presentations | | |
| | | | **7.1.E.a.2** drawings and maps | | |
| | | | **7.1.E.a.3** data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities) | | |
| | | | **7.1.E.a.4** graphs (bar, single, and multiple line) | | |
| | | | **7.1.E.a.5** equations and writings | | |
| | | | **7.1.E.b** Communicate and defend a scientific argument | | |
| | | | **7.1.E.c** Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work) | Planet Earth | Communicate the Results |
| **8** Impact of Science, Technology and Human Activity | **8.1** The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs | **8.1.A** Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all | Not assessed at this level | | |
| | | **8.1.B** Advances in technology often result in improved data collection and an increase in scientific information | **8.1.B.a** Recognize the relationships linking technology and science (e.g., how technological problems may create a demand for new science knowledge, how new technologies make it possible for scientists to extend research and advance science) | | |

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| | | **8.1.C** Technological solutions to problems often have drawbacks as well as benefits | **8.1.C.a** Identify and evaluate the drawbacks (e.g., design constraints, unintended consequences, risks) and benefits of technological solutions to a given problem (e.g., damming a river for flood control, using pesticides to eliminate mosquitoes, genetic engineering of cells, use of satellite communications to gather information) | | |
| | **8.2** Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time | **8.2.A** People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations | **8.2.A.a** Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups | | |
| | | | **8.2.A.b** Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology | | |
| | | **8.2.B** Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity | **8.2.B.a** Identify and describe how explanations (hypotheses, laws, theories) of scientific phenomena have changed over time as a result of new evidence (e.g., model of the solar system, basic structure of matter, structure of an atom, Theory of Plate Tectonics, Big Bang and nebular theory of the Universe, explanation of electric current) | Plate Tectonics | Developing the Theory |
| | | | **8.2.B.b** Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones (e.g., Theory of Evolution, theories of extinction, global warming) | | |

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| | **8.3** Science and technology affect, and are affected by, society | **8.3.A** People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done | Not assessed at this level | | |
| | | **8.3.B** Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology | **8.3.B.a** Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges) | | |
| | | | **8.3.B.b** Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research) | | |
| | | | **8.3.B.c** Analyze and evaluate the social, political, economic, ethical, and environmental factors affecting progress toward meeting major scientific and technological challenges (e.g., limitations placed on stem-cell research or genetic engineering, introduction of alien species, deforestation, bioterrorism, nuclear energy, genetic | | |

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| | | | counseling, computer technology) | | |
| | | **8.3.C** Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent | **8.3.C.a** Identify and evaluate the need for informed consent in experimentation | | |
| | | | **8.3.C.b** Identify the ethical issues involved in experimentation (i.e., risks to organisms or environment) | | |
| | | | **8.3.C.c** Identify and evaluate the role of models as an ethical alternative to direct experimentation (e.g., using a model for a stream rather than pouring oil in an existing stream when studying the effects of oil pollution) | | |
| | | **8.3.D** Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible | **8.3.D.a** Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness", a scientist speaking within or outside his/her area of expertise) | | |
| | | | **8.3.D.b** Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society | | |