Secondary Earth Science 1 Endorsement Specs

Purpose

This endorsement, when attached to a current Secondary Education License, verifies that the individual has the skills and knowledge necessary to teach students in a secondary earth science classroom and is required to teach High School (9-12) General Earth and Space Science Course and High School Astronomy, Environmental Science, Geology, and Meteorology Elective Courses. This endorsement is required as a prerequisite to earn Secondary Earth Science 2 which is required for Advanced courses (AP Environmental Science) and other high school earth science elective courses.

Endorsement Prerequisites

To be eligible for this endorsement, candidates must meet the following prerequisites:

- Have a Secondary Education License
- Have the Secondary Science Core Endorsement

Endorsement Requirement Areas

The Science Core Endorsement has the following 5 requirement areas:

1. Earth's Place in the Universe Content Knowledge
2. Earth's Systems: Geologic Systems and Processes Content Knowledge
3. Earth's Systems: Weather and Climate Content Knowledge
4. Earth's Systems: Biogeology Content Knowledge
5. Earth and Human Activity Content Knowledge

Endorsement Type

A professional endorsement will be awarded when all of the requirement areas have been met. An associate endorsement will be awarded if the applicant holds a professional Science Core endorsement **OR** has completed at least 2 of the 5 requirement areas.

Requirement Area Options

The different options available to complete each of the requirement areas are described below. Quick links to the requirement area competencies are linked in parentheses.

Requirement Area 1: Earth's Place in the Universe Content Knowledge (ES1.1)

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Any 3+ credit university course (passed with a grade of C or higher) in Astronomy (e.g., General Astronomy, The Solar System, The Universe, Astrophysics)
    - Lab course is not required but recommended

College Major or Minor (Meets Requirement Areas 1-5 for this endorsement)

- College Major or Minor in Earth Science, Earth Science Education, Physical Science Education, or an Earth Science Variation (e.g., Environmental Science, Geology, Meteorology, Astronomy)

- Other College Majors or Minors may be approved for this endorsement with approval of USBE Science Specialist based on a transcript review

Praxis Exam (Meets Requirement Areas 1-5 for this endorsement)

- Earth and Space Sciences Praxis (5572) with score of 148 or higher
- Other equivalent state or national exams that meet competencies and approved by USBE

Requirement Area 2: Earth's Systems: Geologic Systems and Processes Content Knowledge (ES1.2.A-C)

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Any 3+ credit university course (passed with a grade of C or higher) in Geology (e.g., General Geology, Physical Geology, Historical Geology, Mineralogy, Dynamic Earth)
    - Lab course is not required but recommended

College Major or Minor (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Praxis Exam (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Requirement Area 3: Earth's Systems: Weather and Climate Content Knowledge (ES1.2.D)

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Any 3+ credit university course (passed with a grade of C or higher) in Meteorology (e.g., General Meteorology, Weather, Climate, Climate Change, Severe and Hazardous Weather)
    - Lab course is not required but recommended

College Major or Minor (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Praxis Exam (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Requirement Area 4: Earth's Systems: Biogeology Content Knowledge (ES1.2.E)

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Any 3+ credit university course (passed with a grade of C or higher) in Ecology (e.g., General Ecology, Field Ecology, Marine Ecology, Stream Ecology, or Wildlife Biology)
    - Lab course is not required but recommended
    - A course in Environmental Science does not meet this requirement

College Major or Minor (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Praxis Exam (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Requirement Area 5: Earth and Human Activity Content Knowledge (ES1.3.A-D)

Complete one of the following options to show evidence of competency in this Requirement Area

University Courses

- Any 3+ credit university course (passed with a grade of C or higher) in Environmental Science (e.g., Environmental Science, Conservation Biology, Natural Resources, Natural Energy)
    - Lab course is not required but recommended

College Major or Minor (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Praxis Exam (Meets Requirement Areas 1-5 for this endorsement)

- As described in Requirement Area 1 description

Requirement Area Competencies

The Secondary Biology 1 competencies are organized into 1 section:

1. **Earth Science 1 Core Ideas** – The Utah Secondary Earth Science 1 qualifies teachers to teach the core High School (9-12) General Earth and Space Science course focused specifically in the High School Earth and Space Science disciplinary core ideas:
   ES1.1 Earth's Place in the Universe
   ES1.2 Earth's Systems
   ES1.3 Earth and Human Activity

Each of the requirement area competencies are described below. Quick links to each requirement area options are provided in the parentheses.

Requirement Area 1 - Earth's Place in the Universe Content Knowledge (Options)

Requirement Area ES1.1: Earth's Place in the Universe

Area ES1.1.A: The Universe and its stars

- ES1.1.A.a The star called the Sun is changing and will burn out over 10 billion years.
- ES1.1.A.b The Sun is just one of more than 200 billion stars in the Milky Way galaxy, and the Milky way is just one of hundreds of billions of galaxies in the Universe.
- ES1.1.A.c The study of star's light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.

Area ES1.1.B: Earth and the Solar System

- ES1.1.B.a Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.
- ES1.1.B.b Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the orientation of the planet's axis of rotation, both occurring over tens to hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on Earth. These phenomena cause cycles of ice ages and other gradual climate changes

Area ES1.1.C: History of Planet Earth

- ES1.1.C.a Radioactive decay lifetimes and isotopic content in rocks provide a way of dating rock formations and thereby fixing the scale of geological time.
- ES1.1.C.b Continental rocks, which can be older than 4 billion years, are generally much older than rocks on the ocean floor, which are less than 200 million years old. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches.
- ES1.1.C.c Although active geological processes, such as plate tectonics, and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of

years. Studying these objects and provide information about Earth's formation and early history

Requirement Area 2 - Earth's Systems: Geologic Systems and Processes Content Knowledge (Options)

Requirement Area ES1.2: Earth's Systems

Area ES1.2.A: Earth Materials and Systems

- ES1.2.A.a Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. A deep knowledge of how feedbacks work within and among Earth's systems is still lacking, thus limiting scientists' ability to predict some changes and their impacts.
- ES1.2.A.b Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. The top part of the mantle, along with the crust, forms structures known as tectonic plates.
- ES1.2.A.c Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and the gravitational movement of denser materials toward the interior.
- ES1.2.A.d The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.

Area ES1.2.B: Plate Tectonics and Large-Scale System Interactions

- ES1.2.B.a The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle providing the primary source of the heat that drives mantle convection.
- ES1.2.B.b Plate tectonics can be viewed as the surface expression of mantle convection.

Area ES1.2.C: The Roles of Water in Earth's Surface Processes

- ES1.2.C.a The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks.

Requirement Area 3 - Earth's Systems: Weather and Climate Content Knowledge (Options)

Requirement Area ES1.2: Earth's Systems

Area ES1.2.D: Weather and Climate

- ES1.2.D.a The foundation for Earth's global climate system is the electromagnetic radiation from the sun as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems and this energy's re-radiation into space.
- ES1.2.D.b Climate change can occur when certain parts of Earth's systems are altered. Geological evidence indicates that past climate changes were either sudden changes caused by alterations in the atmosphere; longer term changes (e.g., ice ages) due to variations in

solar output, Earth's orbit, or the orientation of its axis; or even more gradual atmospheric changes due to plants and other organisms that captured carbon dioxide and released oxygen. The time scales of these changes varied from a few to millions of years.

- ES1.2.D.c Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.

Requirement Area 4 - Earth's Systems: Biogeology Content Knowledge (Options)

Requirement Area ES1.2: Earth's Systems

Area ES1.2.E: Biogeology

- ES1.2.E.a The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Requirement Area 5 - Earth and Human Activity Content Knowledge (Options)

Requirement Area ES1.3: Earth and Human Activity

Area ES1.3.A: Natural Resources

- ES1.3.A.a Resource availability has guided the development of human society. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks, as well as benefits.
- ES1.3.A.b New technologies and regulations can change the balance of these factors

Area ES1.3.B: Natural Hazards

- ES1.3.B.a Natural hazards and other geological events have shaped the course of human history by destroying buildings and cities, eroding land, changing the course of rivers, and reducing the amount of arable land. These events have significantly altered the sizes of human populations and have driven human migrations.
- ES1.3.B.b Natural hazards can be local, regional, or global in origin, and their risks increase as populations grow. Human activities can contribute to the frequency and intensity of some natural hazards.

Area ES1.3.C: Human Impacts on Earth Systems

- ES1.3.C.a The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. Scientists and engineers can make major contributions— for example, by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
- ES1.3.C.b When the source of an environmental problem is understood and international agreement can be reached, human activities can be regulated to mitigate global impacts (e.g., acid rain and the ozone hole near Antarctica).

Area ES1.3.D: Global Climate Change

- ES1.3.D.a Global climate models are often used to understand the process of climate change because these changes are complex and can occur slowly over Earth's history.
- ES1.3.D.b Though the magnitudes of humans' impacts are greater than they have ever been, so too are humans' abilities to model, predict, and manage current and future impacts.
- ES1.3.D.c Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities, as well as to changes in human activities. Thus science and engineering will be essential both to understanding the possible impacts of global climate change and to informing decisions about how to slow its rate and

consequences—for humanity as well as for the rest of the planet.