

Grade 8

Earth and Space Science **ESS**

- 1 The composition and properties of Earth's interior are identified by the behavior of seismic waves. The refraction and reflection of seismic waves as they move through one type of material to another is used to differentiate the layers of Earth's interior. Earth has a core, a mantle, and a crust. Impacts during planetary formation generated heat. These impacts converted gravitational potential energy to heat. Earth's core is also able to generate its own thermal energy because of decaying atoms. This continuously releases thermal energy. Thermal energy generated from Earth's core drives convection currents in the asthenosphere. Note 1: Radioactive decay is not the focus; this will be discussed in physical science and chemistry. Note 2: At this grade level, analyzing seismograms (e.g., amplitude and lag time) and reading a travel time curve are not the focus. At this grade, the properties of seismic waves should be addressed. **8.ESS.1****

Complexity b

Complexity c

b Identify Earth's core, mantle, outer core, and inner core. **8.ESS.1B**

c Recognize that the inside of the Earth is made up of distinct layers. **8.ESS.1C**

Learning Progression

- Model how waves travel through solids and liquids using a spring toy. **8.ESS.1.LP.A**
- Recognize that seismic waves travel through the Earth. **7.ESS.1.LP.B**
- Recognize that waves travel differently in solids and liquids. **7.ESS.1.LP.C**
- Match the composition to each layer (crust, mantle, inner and outer core). **7.ESS.1.LP.D**
- Recognize that the layers are composed of different materials (solids and liquids/molten material). **7.ESS.1.LP.E**
- Identify the layers of the Earth. **7.ESS.1.LP.F**
- Engage with a model of the Earth and its layers. **7.ESS.1.LP.G**

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- 2 Earth's lithosphere consists of major and minor tectonic plates that move relative to each other. Historical data and observations such as fossil distribution, paleomagnetism, continental drift, and sea-floor spreading contributed to the theory of plate tectonics. The rigid tectonic plates move with the molten rock and magma beneath them in the upper mantle. Convection currents in the asthenosphere cause the movement of the lithospheric plates. The energy that forms convection currents comes from deep within the Earth. There are three main types of plate boundaries: divergent, convergent, and transform. Each type**

of boundary results in specific motion and causes events (such as earthquakes or volcanic activity) or features (such as mountains or trenches) that are indicative of the type of boundary. 8.ESS.2

Complexity a

- a** Identify the different types of plate boundaries (e.g., convergent, divergent, transform). 8.ESS.2A

Complexity b

- b** Recognize that the crust is broken into plates that move. 8.ESS.2B

Complexity c

- c** Identify the layer of Earth that we live on as the crust. 8.ESS.2C

Learning Progression

- Identify the plate movements that produce specific landforms (e.g. volcanoes, earthquakes, mountains, trenches, rift valleys) 8.ESS.2.LP.A
- Match plate boundaries with their movement. (Use a video or simulation to show plate movement by means of convection currents.) 8.ESS.2.LP.B
- Recognize that convection currents (movement in the mantle caused by uneven heating inside the Earth) in the mantle cause movement of the plates. 8.ESS.2.LP.C
- Recognize the crust is made up of plates that move. 8.ESS.2.LP.D
- Recognize patterns of the location and formations of various types of landforms (e.g., mountains at the edges of continents). 8.ESS.2.LP.E
- Identify the landforms that exist on the crust. 8.ESS.2.LP.F
- Engage with a topographic map to see and feel the changes in landforms at various locations. 8.ESS.2.LP.G

3 A combination of constructive and destructive geologic processes formed Earth's surface. Earth's surface is formed from a variety of different geologic processes, including but not limited to plate tectonics. 8.ESS.3

Complexity a

- a** Categorize geologic processes as constructive (e.g., depositions, volcanoes spreading new layers) or destructive (e.g., flooding, volcanoes forming craters). 8.ESS.3A

Complexity b

- b** Identify destructive and constructive processes that change Earth's surface. 8.ESS.3B

Complexity c

- c** Identify a destructive process that changes Earth's surface. 8.ESS.3C

Learning Progression

- Match pictures of landforms to the events that formed them. **8.ESS.3.LP.A**
- Model the motion of the plates by moving pieces of paper to replicate plate motion and see how it impacts the paper. Relate the changes in the paper to actual landforms on Earth. **8.ESS.3.LP.B**
- Model a change in Earth's surface using various means and materials (sand and water, fan to represent wind, watch videos or use simulations that illustrate constructive and destructive processes). **8.ESS.3.LP.C**
- Engage with a stream table to demonstrate erosion and deposition. **8.ESS.3.LP.D**

4 Evidence of the dynamic changes of Earth's surface through time is found in the geologic record. Earth is approximately 4.6 billion years old. Earth history is based on observations of the geologic record and the understanding that processes observed at present day are similar to those that occurred in the past (uniformitarianism). There are different methods to determine relative and absolute age of some rock layers in the geologic record. Within a sequence of undisturbed sedimentary rocks, the oldest rocks are at the bottom (superposition). The geologic record can help identify past environmental and climate conditions. 8.ESS.4

Complexity a

- a** Explain how fossils indicate Earth's history and environment changes. **8.ESS.4A**

Complexity b

- b** Explain that fossils are millions of years old. **8.ESS.4B**

Complexity c

- c** Identify that humans can study Earth's past by looking at layers of rocks and fossils. **8.ESS.4C**

Learning Progression

- Determine what layer/rock is the oldest/youngest given a geologic cross section. **8.ESS.4.LP.A**
 - Match fossils with pictures of the environments in which they formed. **8.ESS.4.LP.B**
 - Identify that fossils in lower undisturbed rock layers are older than the fossils in rock layers above them (e.g., add a layer of sand, discuss organisms that lived there, discuss that over time another layer can be deposited, etc. and discuss which layer/fossil is oldest). **8.ESS.4.LP.C**
 - Recognize that some fossils are millions of years old. **8.ESS.4.LP.D**
 - Recognize that a rock layer's age can be different from other layers based on location. **8.ESS.4.LP.E**
 - Engage with a geologic cross section (exposed rock on the side of a highway) to show layers of rock and their composition. **8.ESS.4.LP.F**
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Complexity a

Match properties to the correct layer of Earth. 8.ESS.1A

Complexity a

a Match properties to the correct layer of Earth. 8.ESS.1A

Life Science LS

1 Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. The fossil records provide evidence that changes have occurred in number and types of species. Fossils provide important evidence of how life and environmental conditions have changed. Changes in environmental conditions can affect how beneficial a trait will be for the survival and reproductive success of an organism or an entire species. Throughout Earth's history, extinction of a species has occurred when the environment changes and the individual organisms of that species do not have the traits necessary to survive and reproduce in the changed environment. Most species (approximately 99 percent) that have lived on Earth are now extinct. Note: Population genetics and the ability to use statistical mathematics to predict changes in a gene pool are reserved for high school biology. 8.LS.1

Complexity a

a Explain how fossils indicate how traits have changed over Earth's history. 8.LS.1A

Complexity b

b Identify how a trait could be helpful or harmful to the animal's survival after a change in an environmental condition. 8.LS.1B

Complexity c

c Explore animal traits and how they are useful for survival. 8.LS.1C

Learning Progression

- Predict what would happen if a particular trait of an organism changed (how does it impact survival in the environment). 8.LS.1.LP.A
- Predict what would happen to a group of organisms if the environment changed. (i.e., Looking at the traits in the group identify individuals most likely to survive environmental changes based on their given traits.) 8.LS.1.LP.B
- Identify changes that occurred in an organism given a set of fossils for that ancestry (e.g. horses). 8.LS.1.LP.C
- Identify how various traits help an organism to survive. 8.LS.1.LP.D
- Identify the various traits that exist within a population of organisms (breed of dog, type of fur, length of fur, coloring) 8.LS.1.LP.E
- Engage with visual representations of organisms with specific, special traits. 8.LS.1.LP.F

2 Every organism alive today comes from a long line of ancestors who reproduced successfully every generation. Reproduction is the transfer of genetic information from one generation to the next. It can occur with mixing of genes from two

individuals (sexual reproduction). It can occur with the transfer of genes from one individual to the next generation (asexual reproduction). The ability to reproduce defines living things. 8.LS.2

Complexity a

- a** Explain a survival benefit of sexual reproduction and a survival benefit of asexual reproduction. 8.LS.2A

Complexity b

- b** Describe that asexual reproduction results in the exact same traits as the parent and that sexual reproduction results in a mixing of traits from both parents. 8.LS.2B

Complexity c

- c** Identify the number of parents required for sexual and asexual reproduction. 8.LS.2C

Learning Progression

- Trace the genetic contribution of each parent for sexual reproduction. 8.LS.2.LP.A
- Recognize that genetic information is passed on from one generation to the next. 8.LS.2.LP.B
- Given pictures of parents and their offspring sort them by sexual and asexual reproduction (asexual will all be identical to the parent, sexual will vary from the parent and each other). 8.LS.2.LP.C
- Recognize that sexual reproduction requires 2 parents, and asexual reproduction requires 1. 8.LS.2.LP.D
- Recognize that all living things come from a previous generation, parent(s). 8.LS.2.LP.E
- Engage with photos of parents and offspring of a variety of species (plants and animals). 8.LS.2.LP.F

3 The characteristics of an organism are a result of inherited traits received from parent(s). Expression of all traits is determined by genes and environmental factors to varying degrees. Many genes influence more than one trait, and many traits are influenced by more than one gene. During reproduction, genetic information (DNA) is transmitted between parent and offspring. In asexual reproduction, the lone parent contributes DNA to the offspring. In sexual reproduction, both parents contribute DNA to the offspring. Note 1: The focus should be the link between DNA and traits without being explicit about the mechanisms involved. Note 2: The ways in which bacteria reproduce is beyond the scope of this content statement. Note 3: The molecular structure of DNA is not appropriate at this grade level. 8.LS.3

Complexity a

- a** Communicate how characteristics are a result of the DNA inherited from parents. 8.LS.3A

Complexity b

b Identify DNA as the source of traits. **8.LS.3B**

Complexity c

c Identify an inherited trait. **8.LS.3C**

Learning Progression

- Recognize the environment can influence traits (thick fur in cold regions, nutrition affects growth) **8.LS.3.LP.A**
- Use a pedigree with pictures of the resulting organisms to trace traits that are passed on from one generation to the next (several generations of puppies or kittens). **8.LS.3.LP.B**
- Recognize that traits are passed on from one generation to the next by DNA. **8.LS.3.LP.C**
- Recognize similarities and differences of traits in one generation to the next. **8.LS.3.LP.D**
- Name an inherited trait in a given species. **8.LS.3.LP.E**
- Engage with family photos or photos of a species family. **8.LS.3.LP.F**

Physical Science **PS**

1 Objects can experience a force due to an external field such as magnetic, electrostatic, or gravitational fields. Magnetic, electrical, and gravitational forces can act at a distance. **8.PS.1**

Complexity a

a Given an interaction, determine what type of force is acting on the object. **8.PS.1A**

Complexity b

b Determine the type of interaction between objects (e.g., magnetic, electrostatic, or gravitational fields). **8.PS.1B**

Complexity c

c Recognize that an object has experienced a force from an external field (e.g., magnetic, electrostatic, or gravitational fields). **8.PS.1C**

Learning Progression

- Sort pictures into categories of magnetic, electrostatic and gravitational situations. **8.PS.1.LP.A**
- Using provided models, determine the force that was used to cause a change (e.g., rub a balloon on hair and stick it to the wall, identify that electrostatic forces are holding it to the wall; drop an object from different heights and see how large a hole it makes in sand, predict what will happen if you dropped it from even higher). **8.PS.1.LP.B**
- Engage or experiment with various objects to model different forces (e.g., magnets, dropping objects, socks rubbed on carpet). **8.PS.1.LP.C**

2 Forces can act to change the motion of objects. The motion of an object is always measured with respect to a reference point. Forces can be 8.PS.2

Complexity a

a Complete a force diagram. 8.PS.2A

Complexity b

b Predict the result of an application of force in a particular direction. 8.PS.2B

Complexity b

c Show how a force on an object can change its direction. 8.PS.2C

Learning Progression

- Create force diagrams to illustrate motion (arrows with various sizes and direction). 8.PS.2.LP.A
- Identify ways to increase or decrease an object's motion. 8.PS.2.LP.B
- Identify ways to change the direction of an object's motion. 8.PS.2.LP.C
- Predict what will happen to a moving object if an additional force acts on it (wind gust, hits a bump, brakes are applied). 8.PS.2.LP.D
- Engage with objects by manipulating their motion in a variety of ways. (Watch videos of objects exposed to a force and predict the motion that will result.) 8.PS.2.LP.E