

Earth & Space Science Standards

ESS1 Earth's place in the Universe

ESS1.1

- Life span of the sun
- Nuclear fusion
- Convert matter to energy making radiation

ESS1.2

- Red shift of light from galaxies (expanding universe)
- Cosmic microwave background radiation
- Observed composition of ordinary matter in stars and gases

ESS1.3

- Nucleosynthesis makes different elements
- Elements created dependent on mass of star and stage of its lifetime

ESS1.4

- Newtonian gravitational laws governing orbital motions
- These motions apply to human satellites and planets and moons

ESS1.5

- Plate tectonics explains past and current movements of Earth's surface
- Plate tectonics provides framework to understand geological history

ESS1.6

- Reconstruct early history of Earth
- The Earth formed along with the rest of the solar system
- Absolute ages of ancient material from radiometric dating

ESS2 Earth Systems

ESS2.1

- Feedback effects and increase or decrease changes
- Plate movements are responsible for most continental and ocean floor features

ESS2.2

- Earth's global climate system is mostly from electromagnetic radiation, reflection, absorption, storage, and redistribution among the atmosphere, ocean and land systems

ESS2.3

- Several forms of evidence suggest Earth has a hot solid inner core, liquid outer core, and solid mantle and crust
- Motions of the mantle and its plates are mostly from thermal convection (cycling of matter)
- Radioactive decay of isotopes generates new energy from Earth's crust and mantle

ESS2.4

- Changes to global and regional climate can be caused by interactions among several things
- Climate changes due to sun output, Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities.
- Foundation for Earth's global climate is electromagnetic radiation from the sun
- Reflection, absorption, storage and redistribution of radiation also contribute to changes
- Cyclical changes in shape of Earth's orbit and changes in the tilt of axis (over hundreds of thousands of years) have altered intensity and distribution of sunlight – these effect ice ages and other climate changes

ESS2.5

- Lots of water from its unique combination of physical and chemical properties are central to the planet's dynamics
- Water can absorb, store, and release a lot of energy
- Water transmits sunlight, expands on freezing, dissolves and transports material, lowers viscosity and melting points of rock.

ESS2.6

- Gradual atmospheric changes were due to plants and other organisms that capture carbon dioxide and release oxygen
- Gases in atmosphere due to human activities have increased carbon dioxide concentrations and thus affect climate

ESS2.7

- Many dynamics between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and life

ESS3 Earth and Human Activities

ESS3.1

- Resource development has guided the development of human society
- Natural hazards and other geologic events have shaped the course of human history

ESS3.2

- All forms of energy production and other resources extraction have associated economic social etc. risks and benefits
- When evaluating solutions, it is important to take into account a range of benefits and risks

ESS3.3

- Most elements exist in Earth's crust at concentrations too low to be extracted – but in some locations they are concentrated

All bullet points in order (sequence) from above

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Key Concepts

Sun age

Nuclear fusion

$E=mc^2$

Red shift

Cosmic radiation

Star composition

Nucleo synthesis

Creation of elements

Newtonian gravity

Motions of satellites

Earth surface

Geologic time

Earth history

Earth formation

Radiometric dating

Feedback effects

Plate's changes

Climate and radiation

Inner and outer core

Thermal convection

Radioactive decay

Climate change global and regional

Climate change factors

Climate and the sun

Climate change factors and contribution

Climate and Earth's position

Water and Earth's dynamics

Water's effect on energy

Water's chemical and physical effects

Carbon cycle and the atmosphere

Human impact on climate

Biosphere and Earth interactions

Resources and human development

Natural hazards impact on humans

Energy and resource cost/benefit

Resource usage evaluations

Distribution and concentration of elements

Prerequisite Skills from Prior Grades

6th / 7th grade science

Rock strata and geological time

Relative ages of rock

Water cycle

Weathering and erosion

Maps of ancient lands

Latitude and longitude

Density's impact on ocean currents

Kinetic energy

Energy transfer

Physical Science 9th Grade

Physics

Electromagnetic radiation

Energy

Mass

Gravity

Matter

Waves

Repulsive and attractive forces

Chemistry

Periodic Table

Water as a solvent

Fusion

Ionization

Exothermic / endothermic

Homeostasis

Biology 10th Grade

Evolution

Biosphere

Carbon cycle