

Unit 4 - Geology (Earth Formation) - Teacher Notes

Astronomy

The science that studies the universe that deals with: properties of objects in space & laws under which the universe operates

Kepler's Laws

1st Law - Describes that the motion of a planet is movement in an ellipse

2nd Law - Describes how that a planet closer to the sun moves faster and a planet farther away moves slower

3rd Law - Describes the path of multiple planets in comparison to one another based on a proportion.

The Big Bang Theory

At one time, the entire universe was confined to a dense, hot, super-mass ball. About 13.7 billion years ago a violent explosion occurred, hurling this material in all directions

Nebula Theory

Theory of how the bodies of our solar system evolved from an enormous rotating cloud called the solar nebula. Made up of Hydrogen and Helium and theory how the planets were formed.

Expanding Universe Theory

States that the space between galaxies is expanding, so that they appear to recede from us at velocities that increase with their distance.

Types of Galaxies

Spiral	Elliptical	Irregular
<ul style="list-style-type: none">● Disk-shaped with concentration of stars in the center and “arms” extending from the center● Contain old and young stars● Ex) Milky Way Galaxy	<ul style="list-style-type: none">● Round to oval in shape● Contain old stars● Ex) giant diffuse galaxies - largest	<p>No definite shape Composed of young stars Ex) Large and Small Magellanic Clouds (closest neighbor galaxies)</p>

Earth's Motion

1. Precession - Slight movement over a period of 26,000 years where Earth's axis points in different directions. This occurs due to our revolution around the sun.
2. Nutation - Oscillatory movement of the axis of a rotating body (wobble) This is observed during precession.
3. Barycenter - The point between two objects where they balance each other. The center of mass where two or more celestial bodies orbit each other.

Rock Cycle

Rock: mineral-like matter that occurs naturally as part of our planet

Types of rocks:

1. Igneous: cooled magma, can be melted to become magma
2. Sedimentary: compacted sediments
3. Metamorphic: heat/pressure added to igneous and sedimentary creates them into metamorphic rocks (can be melted to become magma)
4. Sediments: all rock types eroded

Driven by heat and mechanical energy

Vocabulary:

1. Weathering - to break down or make smaller
2. Compaction - to create a new larger item by small pieces
3. Melting - using high temperature to transfer an object from solid to liquid
4. Cementation - to use "glue" to make compaction

Plate Tectonics -Proposed by Alfred Wegener

Stated that the continents had once been joined to form a single supercontinent

Wegener's Theory

Pangaea broke apart 200 MY

Continents "drifted" and "broke" through the oceans

Evidence of Continental Drift

1. Shorelines look like they fit together
2. Fossil organisms found on different landmasses
3. Several mountain belts end at one coastline, only to reappear on a landmass across the ocean

The Theory of Plate Tectonics

Proposes that Earth's outer shell consist of **individual plates** that interact in various ways and thereby **produce earthquakes, volcanoes, mountains, and the crust itself**

Plate Boundaries and Features

Cause of Plate Motion: **Mantle Convection**

Basic driving force for plate movement

The unequal distribution of heat within Earth causes thermal convection the drives plate motion

Motion causes: Seismic activity – Earthquakes!, Volcanism, Mountain Building & Sea Floor Spreading

Divergent	When two plates move apart Creates new seafloor (seafloor spreading) Causes ocean ridges and rift valleys
Convergent Boundaries	Oceanic-Continental boundaries -----Causes subduction zones, trenches, continental volcanic arcs Continental-Continental Boundaries -----Two plates collide - Forms mountains Oceanic-Oceanic boundaries One oceanic plate goes beneath another oceanic plate Creates volcanic island arcs
Transform Boundaries	Two plates grind past each other without production and destruction of lithosphere Ex: San Andreas Fault in California

Evidence of Plate Tectonics

Paleomagnetism: the permanent magnetization acquired by rock that can be used to determine the location of the magnetic poles at the time it became magnetized

Earthquake patterns

Ocean Drilling: younger oceanic crust is at the ridge crest and oldest oceanic crust is at the continental margins

Hot Spots: supports that the plates move over Earth's surface

Faults

Faults are formed by fractures in rocks

Parts of a Fault

Hanging wall: rock above the fault line

Foot Wall: rock **below** the fault line

Normal: Occurs when the hanging wall block moves **down** relative to the footwall block

Reverse: A fault in which the hanging wall block moves **up** relative to the footwall block

Thrust: Reverse fault with dips of less than 45 degrees

Strike-Slip: Faults in which the movement is horizontal and parallel to the trend

Earthquakes

Definition: Vibration of Earth produced by a **sudden release of energy**, Movements along the **fault line**.

Focus – point within the Earth where the Earthquake starts

Epicenter – location on the surface of Earth directly above the focus

Fault- associated with earthquake activity where movement has occurred

Foreshock – small quake that comes before a major earthquake

Aftershock – small quake that comes after a major earthquake

Volcanoes

Pyroclastic material

Fragments ejected during eruptions

Varies in size from very fine and volcanic ash to pieces that weigh several tons