

**EAS 100 – Planet Earth**  
**Lecture Topics Brief Outlines**

**II. Earth Science (Geology) Section (2/10/2011)**

**1. Interior of the Earth**

**Learning objectives: Understand the structure of the Earth's interior – crust, mantle, core (chemical classification); and lithosphere, asthenosphere (mechanical classification). Learn about the properties of Earth materials – physical/mechanical, chemical, conditions (temperature, pressure).**

**Reading: Text, pages 188-190**

**Figures to study: Text, Figures 6.25, 6.26**

**Topics:**

Introduction to Earth science (geology) – Earth is dynamic, impact on people, effects of people on the Earth

Main features of planet Earth

Physical (density, elastic, mechanical properties), chemical (chemical composition, minerals) and condition (temperature, pressure, time) properties of rocks

Earth's interior structure

Chemical classification – crust, mantle, outer core, inner core

Mechanical classification – lithosphere, asthenosphere

## 2. Chemistry of the Earth

**Learning objectives:** Learn the definitions of minerals and rocks, and rock types – igneous, metamorphic and sedimentary. Understand how we know about the composition of the Earth's deep interior. Recognize the significance of the silica tetrahedron.

**Reading:** Text, pages 22-69

**Figures to study:** Text, Figures 1.1, 1.2, 1.3, 1.4, 1.8, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.16, 1.17, 1.21, 1.22, 1.23, 1.26, 2.2, 2.9, 2.10, 2.19, 2.21, 2.29, 2.30, 2.33

**Topics:**

Mineral – naturally occurring, inorganic, solid, distinct chemical composition, regular crystal structure, characteristic properties

Rocks – aggregate of minerals

Average (bulk) composition of the Earth (how do we know what's in the Earth's deep interior)

The Silica tetrahedron ( $\text{SiO}_2$ ) – silicate minerals

### 3. Plate Tectonics 1

**Learning objectives:** Learn about the properties of the lithosphere (the plates) and asthenosphere, plate boundaries and basic plate tectonic settings of the world. Understand sea floor spreading, continental drift and the Earth features and processes associated with plate tectonics.

**Reading:** Text, pages 142-164, 189-202

**Figures to study:** Text, Figures 5.2, 5.3, 5.4, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.16, 5.17, 5.18, 5.19, 5.22, 5.24, 5.25, 5.26, 5.27, 5.28, 5.29

**Topics:**

Properties of the lithosphere (plates) and asthenosphere

Mechanical properties – elastic, brittle, ductile

Plate boundaries – divergent, convergent, transform

Plate tectonic processes at the plate boundaries – sea floor spreading, subduction, continental collision, associated earthquake and volcanic activity

Continental drift

## **4. Plate Tectonics 2**

**Learning objectives:** Examine the evidence for plate tectonics. View examples of plate processes at divergent, convergent and transform boundaries. Compare the hypotheses for the “driving mechanism” for plate tectonics.

**Reading:** Text, pages 158-167, 192-202

**Figures to study:** Text, Figures 5.20, 5.22, 5.24, 5.25, 5.26, 5.27, 5.28, 5.30, 6.36, 6.41, 6.42

**Topics:**

Evidence supporting the theory of plate tectonics

Examples of plate boundaries and associated features (topography, age, etc.) and processes (volcanism, earthquake activity, etc.)

The driving mechanism of plate tectonics, hypotheses – ridge push, slab pull, mantle convection, mantle plumes – all due to heat within the Earth

## **5. Geological Hazards, Earthquakes 1**

**Learning objectives: What are earthquakes?**

**Understanding the connection between plate tectonics and the cause of earthquakes – the elastic rebound theory.**

**Learn about earthquake waves, basic earthquake statistics, and seismicity (where and how often do earthquakes occur).**

**Reading: Text, pages 172-188**

**Figures to study: Text, Figures 6.1, 6.2, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.11, 6.12, 6.13, 6.14, 6.15**

**Topics:**

Why study earthquakes?

What are earthquakes?

The elastic rebound theory

Earthquake (seismic) waves

<http://www.eas.purdue.edu/~braile/edumod/waves/WaveDemo.htm>

Earthquakes at plate boundaries – examples from California (transform boundary), mid-ocean ridge earthquakes (divergent boundary) and collision zones (convergent, subduction boundary)

## **6. Geological Hazards, Earthquakes 2**

**Learning objectives: Understanding earthquake magnitude and intensity. Evaluating the earthquake hazard – Where do earthquakes occur? How often do earthquakes occur? What is the maximum magnitude and intensity of shaking expected? View examples of earthquake damage and hazards.**

**Reading: Text, pages 172-188**

**Figures to study: Text, Figures 6.15, 6.16, 6.19, 6.22, 6.23**

**Topics:**

Earthquake magnitude and intensity; earthquake shaking

The frequency-magnitude relation (how often do earthquakes occur?)

Effect of location (how close to a fault zone?)

Effects of geology – attenuation, soil conditions, liquefaction

Effects of building design

Examples of earthquake damage; earthquake safety

Paleoseismology, earthquake prediction

## **7. Geological Hazards, Volcanoes, Hawaiian Volcanism**

**Learning objectives:** Learn of the significance of volcanoes in Earth history, the relationship to plate tectonics, and as natural hazards. Understand the properties that control the eruption intensity (“explosiveness”) of a volcano. Examine volcanic activity and characteristics of two classic volcano systems – the Hawaiian Islands and Mt. St. Helens.

**Reading:** Text, pages 208-233

**Figures to study:** Text, Figures 7.1, 7.2, 7.3, 7.5, 7.8, 7.9, 7.10, 7.11, 7.14, 7.16, 7.17, 7.18, 7.20, 7.22, 7.26, 7.29, 7.30, 7.32

**Topics:**

Importance of volcanoes in Earth history

Relationship to plate tectonics

Main types of volcanoes – shield and composite volcanoes are most important

\*\*\*\*\* Two major types of volcanism – basaltic and rhyolite/andesite (differences in composition, volcano shape, density, tectonic setting, melting point, viscosity)

Examples: Hawaiian volcanism and Mt. St. Helens