

Lecture Outline Monday January 8 - 10, 2018

Key Points for today

- Syllabus
- What is Geology and how it may affect you
- Scientific method
- Principle of Uniformitarianism
- Origin of the Universe – Big Bang theory

Go over Syllabus

- course and lab administration
- grading
- class schedule

Introduction to Geology

Why study Geology?

What is Geology?

How might Geology affect you?

Chapter 1 – Building a Planet

Scientific Method A sequence of steps for systematically analyzing scientific problems in a way that leads to verifiable results. (based on objective observation and experimental testing)

- Observation - collecting observations or clues that point to an answer
- _____ a possible explanation that can explain a set of observations
Testing, revise, discard
- _____ are scientific ideas supported by an abundance of evidence, passed many tests and have failed none.
Testing, revise, discard
- Scientific Model a precise representation of how a natural process operates or how a natural system behaves. (highest level of confidence)
Testing, revise, discard

Using the scientific method, Geologists compare direct observations about processes occurring on the Earth with those preserved in the rock record.

James Hutton summarized this best

“*the present is the key to the past*” this is the **Principal of** _____

What does it really mean? Write in your own words.

Origin of the Universe

Big Bang Theory

- All matter and energy was compacted into a single dense point
- About 13-14 billion years ago the universe began with a cosmic “explosion”
- At which time the universe began to expand and is still expanding today

How are the elements we see on Earth created? Elements are formed during star _____ and _____.

Nebular hypothesis

NEBULA = an area of space dominated by “dust”

- A nebula starts to collapse under its own gravity. Stars form in the center.
- The collapse of the nebula causes the nebula to spin faster
- As the nebula spins faster, it flattens out into a disk.
- The dust starts to clump up into larger pieces “ _____ ”

Lecture Outline Wednesday January 10, 2018

Assignment 1 Due Friday – Syllabus assignment and information sheet with a question you have about some aspect of Geology

Key Points for today

- Origin of our Solar system
- How the moon formed
- Why the Earth is stratified (structured)
- Possible origin of Earth’s continents, oceans and atmosphere
- Earth’s energy sources

How does the earth compare to the other planets? (list some observations)

Origin of our Solar System

The Earth

- ~ _____ years old
- Formed by accretion of colliding chunks of matter in the solar system.
- Chunks are attracted to one another (gravity).

Earth undergoes impacts with moving bodies (asteroids, planetismals, etc.) Energy as motion is converted into _____.

Additional heat is added by decay of radioactive elements like uranium
Heat causes the earth to melt and separate into layers of different densities, a process called _____.

How was the moon formed?

Sometime during late stages of accretion a Mars-sized body _____ – Resulting in:

- 1) Ejecta of debris into space forming our Moon
- 2) Speed up the Earth’s rotation
- 3) _____ of Earth’s orbital plane to 23 degrees

How does the asteroid belt form?

Small planet orbit is too close to a larger planet and the planet _____ – evidence is gathered by looking at the different types of meteorites formed

- Iron-Nickel: from the core
- Stony: from the mantle
- Carbonaceous Chondrite: from crust

Structure of the Earth (the exact depths are not important but the order is)

Continental
Oceanic

Upper mantle
Lower mantle

Core

_____ outer core
_____ inner core

There are three main rock types which make up the Earth

- Igneous
- Sedimentary
- Metamorphic

Each forms from a different process.

What makes the Earth unique?

- _____
- _____
- _____

Did the other planets have these features?

How did Earth's continents, atmosphere and oceans form?

Continents - formed from the _____ molten materials rising to the surface due to differentiation and _____ as it cools

Oceans and Atmosphere – 2 hypotheses

- resulted from impact of _____ impacting Earth from space early after it was formed such as comets. Remember the large planets like Jupiter are largely formed from frozen gases.
- resulted from volatile tied up in planetesimals which formed the Earth. Volatiles released later by _____

Which one? Probably a combination of both.

Earth Systems – 2 basic energy sources

- External heat engine - Solar Energy from the sun is the driving force powering the weather and climatic conditions. Solar energy affects the Atmosphere, Hydrosphere, and Biosphere
- Earth's internal heat engine - is powered by _____ during planetesimal bombardment and heat generated by radioactive element decay deep within the Earth

The Earth is an open system which exchanges mass and energy with outer space.