Earth Science Review Ch 1 & 2

Chapter 1 - Introduction to Earth Science

Lesson I - What is Earth Science

Topic 1- Branches of Earth Science
Earth Science - the study of Earth, its oceans, atmosphere, and the universe

While there are four primary branches of Earth science, the systems they study are interconnected. There is frequent overlap between branches (planetary geologists) and there are numerous specialties within each branch (i.e. geology - seismologists, vulcanologists, ...)

event - an occurrence that causes change (i.e. earthquakes, volcanoes, tornadoes, meteorites, ...)

Topics 2 - Activities of Today's Geologists
geology - study of the origin, history, and structure of the Earth (minerals & rocks, earthquakes, volcanoes, ...)

Topic 3 - What Astronomers Do
astronomy - Study of the universe beyond Earth (stars, planets, comets, asteroids, .., using tools such as telescopes, satellites, and
space probes -- *Mariner*, *Pioneer*, *Viking*, *Voyager*, ...)

Topic 4 - What Meteorologists Do

meteorology - study of the Earth's atmosphere (weather, climate, air pollution, solar energy, ...); the atmosphere extends hundreds of km above the Earth's surface

climate - long-term weather patterns for a specific area

Topic 5 - What Oceanographers Do

oceanography - study of the world's ocean (ocean floor, ocean currents, movement of icebergs, plant and animal life of the ocean, ...)

Earth's Systems: (*FYI — not on test*)

- **lithosphere** – solid Earth
- **hydrosphere** – Earth's waters including oceans, streams, lakes, glaciers, ground water, ...
- **atmosphere** – gases surrounding the Earth and extending hundreds of km above its surface
- **biosphere** – all life on Earth and the parts of the lithosphere, hydrosphere, and atmosphere in which living organisms can be found
- **universe** – stars, planets, and other objects and phenomenon beyond the earth

Lesson II - The Origin of Earth

Topic 6 - The Solar System

solar system - the sun and its family of planets, moons (natural satellites) asteroids, meteoroids, and comets

Six facts about our solar system:

1. all planets move around the sun (revolve) in the same direction
2. The paths, or orbits, of the planets around the sun are all nearly circular
3. most of the orbits are in nearly the same flat surface (plane)
4. the sun turns on its axis (rotates) in almost the same plane as the planets and in the same direction that the planets revolve
5. most of the planets rotate (turn on axis) in the same direction as the sun
6. ~~seven~~ six of the ~~nine~~ eight planets have moons; most of the moons revolve around the planets in the same direction that the planets revolve around the sun

hypothesis - an informed guess that tries to explain how or why an event occurs. A good hypothesis explains known facts

Topic 7 - Protoplanet Hypothesis

protoplanet hypothesis - great clouds of gas and dust, rotating in space, gradually transformed into planets and satellites

protoplanets - compact masses that became planets and moons

Topic 8 - Origin of the Oceans

Three sources of heat as Earth formed: compression, radioactive minerals, bombardment by meteorites

Model of events leading to the formation of oceans:

1. protoplanet earth lacked oceans and atmosphere;
2. heat caused elements to melt;
3. dense materials such as iron sank;
4. materials formed layers;
5. steam and gases escaped to the surface during volcanic eruptions;
6. steam condensed into water that accumulated as oceans

Topic 9 - Origin of the Atmosphere

Earth's atmosphere today: 78% free nitrogen; 21% free oxygen -- (free means not combined with other elements); 1% other gases such as argon, carbon dioxide, helium, water vapor, ...)

Earth's original atmosphere is thought to be similar to volcanic eruptions -- 50% water vapor, large amounts of carbon dioxide and sulfur, but **no** free oxygen

Original source of oxygen -- breakup of water molecules by sunlight in the upper atmosphere

photosynthesis - process by which green plants manufacture sugars and starches from carbon dioxide and water in the presence of sunlight; excess oxygen is released into the atmosphere as free oxygen

Topic 10 - Structure of the Solid Earth

model - representation (picture, diorama, ...) that shows a concept, event, or object that cannot be seen in its natural state.

Three primary layers:

- **crust** - thin outer layer of relatively light rock; 10 km below oceans - 65 km below continents
- **mantle** - layer of heavy rock; 2900 km thick
- **core** - layer of iron and nickel; liquid outer core is 2250 km thick; solid inner core is a sphere 1200 km in diameter

Earth's layers formed as Earth's temperature increased, melting iron and nickel in the rock; the dense liquid mineral sank toward the Earth's center; the lighter rock material was force upward to form the Earth's crust

Topic 11 - How the Continents Formed

The continents are thought to have formed either from light rock that was forced to Earth's surface or by great lava flows from erupting volcanoes

Over the years the continents have undergone many changes

We live on a dynamic planet!!

Chapter 2 - Earth's Shape, Dimensions, and Internal Heat

Lesson 1 - Earth's Shape and Size

Topic 1 - Earth Is Spherical

Evidence that the Earth was spherical -

the mast of ships appearing/disappearing over the horizon; changes in the nighttime sky; during eclipse of the moon, earth's shadow casts an arc

photographs of Earth from space now reveal its spherical form

sphere - a round object whose surface is at all points equidistant from the center; like a round ball

Topic 2 - The Sphere is Not Perfect

Oblate spheroid - a sphere that's flattened at its poles and bulges at its equator

Spherical evidence based on weight -

the weight of an object (measured in Newtons) is the force with which gravity pulls an object toward Earth's center; this weight changes with the distance from the center; a given object is almost the same everywhere on Earth's surface

Oblate evidence based on weight -

the weight of an object is not exactly the same all over Earth;
an object weighs slightly less at the equator than at the poles;
the earth is an oblate spheroid

Topic 3 - Measuring Earth's Circumference

The first scientific measurement of Earth's circumference was probably made by the Greek astronomer Eratosthenes

> Eratosthenes took the distance between Syene and Alexandria, calculated what part of the whole circumference this was based on the difference in the shadows created by the sun's rays at a given time, and multiplied the measured distance by the parts needed to make the whole circle.

circumference - the distance around a circle

Topic 4 - Earth's Dimensions

Circumference at Equator 40, 074 km
Circumference at Poles. 40, 007 km
Diameter at Equator..... 12, 756 km
Diameter at Poles.....12, 714 km

~ circumference ..... 40,000 km
~ radius ..... 6,400 km

Percentages of Earth's surface area

- Water/ocean 71%
- Land 29%

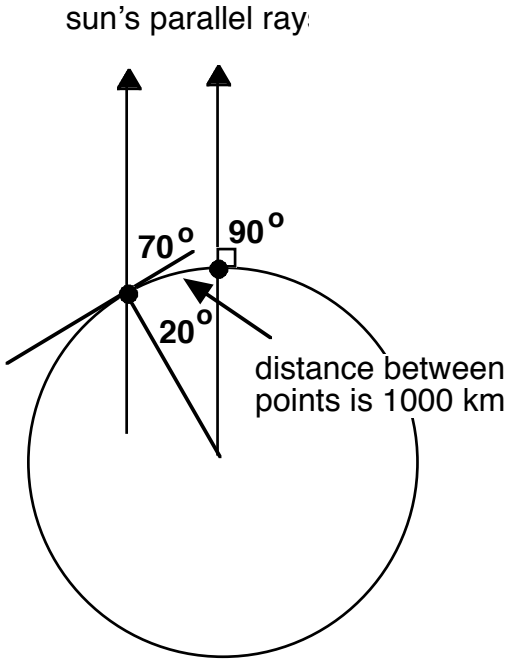
Eratosthenes Method:

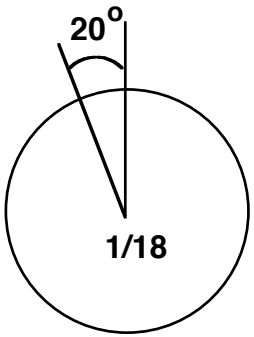
Multiply the distance between two points on a circle by an amount determined by comparing the angle at which the sun's rays strike the surface at those two points.

For example, if the angle formed by two points on the circumference of a circle and the center of the circle is 20º, then the fraction of the circumference between those two points is 20º/360º = 1/18.

Finally, multiply the distance between the two points by 18 to determine the circumference:

1000 km X 18 = 18,000 km





360 degrees in a circle
20º/ 360º = 1/18

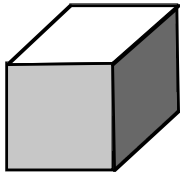
Lesson 2 - Earth's Density and Temperature

Topic 5 - Earth's Density

Density = measure of the amount of material in a given space

density = mass/volume (g/cm^3)

Earth's average density = 5.5 g/cm^3
Earth's crustal density = 2.8 g/cm^3



Volume = length x width x height

Materials inside Earth must have densities greater than 5.5 g/cm^3
Iron and nickel have densities of ~ 8.0 g/cm^3

Topic 6 - Temperatures Below the Surface

Sun's energy can warm the Earth's surface to a depth of approximately 20 meters. At 20 meters, underground caves maintain a temperature equal to the average yearly temperature for that location

Below 20 meters, temperature in the ground begins to rise at an average rate of one degree Celsius for every 40 meters in depth -- some variations may occur.

This rise in temperature becomes more gradual somewhere below the first few thousand meters of Earth's crust. The inner core is probably no hotter that 7000 degrees C.

Topic 7 - What Makes the Crust Hot?

Most heat in the Earth's rocks appears to come from radioactive elements. Other possible sources of heat include friction between rock masses and heat left over from the original heat of the Earth's interior.

Heat loss from the Earth's interior is uneven: some rocks lose heat more quickly than others; the thickness of the rock crust varies; the % of radioactive elements is not the same in all rocks

Vocabulary

astronomy
atmosphere
climate
circumference
continental crust
crust
density
event
geology
gravity
hypothesis
inner core
iron
mantle
mass
meteorology
model
nickel
oblate/oblate spheroid
oceanic crust
oceanography
outer core
photosynthesis
protoplanet
radioactive
solar
sphere
weight