**Solution Set to Online Homework for Sections 4.1 and Interior of the Earth Handout (Print and put in the homework log section of your notebook.)**

Geology 1P Mr. Traeger

**Section 4.1 Online Homework**

**Answers are bolded and underlined.**

What is the reason for Earth's magnetic field? *

- There is a large bar magnet in the center of the Earth
- Moving electric currents of molten iron in Earth's inner core induce a magnetic field
- **Moving electric currents of molten iron in Earth's outer core induce a magnetic field**
- Solar wind coming from the Sun creates our magnetic field

Describe the Nebular Hypothesis as seen in the graphic on pages 70-71 and the link above. *

**The nebular hypothesis describes the formation of our solar system from a nebular cloud of gas and dust. This gas and dust is the remains of previous star birth and death and has the chemistry that was originally produced in star formation and supernovae implosions of very large stars more than 8X the mass of our Sun. This cloud of gas and dust came together gravitationally and spun faster as the mass was attracted toward the center. This attraction and revolution of material caused compression of hydrogen gas and nuclear fusion to form the Sun. The remaining material in the nebular cloud formed the planetesimals, moons, meteoroids, and comets. The continual bombardment of these bodies led to the formation of planets and solar system bodies as we know them today. The planet Jupiter played a large role in attracting mass to it so that life could take hold and evolve on Earth without the heavy bombardment of meteoroids and comets. Comets and meteoroids still continued to impact our planet, but not as much. Major extinctions on Earth were much less frequent and this allowed life to evolve.**

The Earth is a _____ _____ because of its _____. *

- perfect sphere, revolution
- perfect sphere, rotation
- **oblate spheroid, rotation**
- oblate spheroid, revolution

What major pieces of evidence have led us to the nebular hypothesis? *

- **meteorites that have landed on Earth: We date planet Earth's age and the age of the solar system using radioactive decay of radioactive elements inside the meteorite like Uranium-238.**
- pieces of Mars that have landed on the Earth.
- the geologic history of the Grand Canyon.
- the formation of the Moon

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Use the periodic table on pages 698-699 in your textbook to answer the following. When the Big Bang occurred 13.7 billion years ago, the most common element in the Universe was *

- Lithium
- Iron
- Boron
- **Hydrogen**
- Helium

Use the periodic table on pages 698-699 in your textbook to answer the following. All of the elements up to atomic # _____ were formed when super massive stars turn in to a supernova. *

- 14
- **92: All natural elements between atomic # 26, Iron and atomic #92, Uranium, were formed in Supernovae implosions of massive stars 8X or greater in mass than our Sun. All elements up to atomic #26 were formed in nuclear fusion inside of stars. The original base element of the periodic table is Hydrogen, atomic #1.**
- 26
- 99
- 53

What is the difference between the lithosphere and the asthenosphere? *

**Lithosphere and asthenosphere is a differentiation of Earth's layers due to differences in physical behavior, not chemical differentiation. The lithosphere (part of the chemically differentiated crust) is solid and brittle. The asthenosphere (part of the chemically differentiated upper mantle) is solid, but yet has a plastic type of flow to it similar to silly putty. Geologists think that the lithosphere floats on top of the asthenosphere and acts as a base for plate tectonics, the motion of earth's lithospheric plates, to occur. Results of this motion are seen in earthquake activity, volcanic activity, and mountain formation and the natural hazards that result from these phenomena.**

An object at the North or South Pole would weigh _____ than an object at the Equator. *

- **more: The North and South Pole are slightly closer to the center of the Earth, so objects there would weigh slightly more. Remember that objects farther away from their host body weigh less and that Earth bulges out in the center due to rotation. We call this an oblate spheroid.**
- less
- equal to
- This question makes no sense. There is no gravity in these places.

Describe the three things that generate Earth's internal heat? *

**The three things that generate Earth's internal heat are: 1) Pressure from overlying layers increasing temperature. 2) Radioactive decay of elements like Uranium-238, and 3) Heat leftover from the heavy bombardment in the early days of the solar system.**

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Assume that the crust temperature increases by 30 degrees Kelvin for each kilometer below Earth's surface, where the temperature at the surface is 300 Kelvin. Remember that 273 degrees Kelvin equals 0 degrees Celsius. Calculate what the temperature would be at Earth's center (radius 6,378 Km) if the rate of increase of temperature were the same below the crust as in it. Compare your result with the actual inner-core temperature. Why is it different? *

**Multiply 6,378 km times 30 degrees Kelvin per kilometer. This gives 191,340 Kelvin. Add this to 300 Kelvin, the temperature at the surface. This would give 191,640 Kelvin. This assumes that the geothermal gradient, the increase of temperature with depth is linear. It is not due to changes in rock density and changes in material chemistry. This puts the actual temperature at Earth's core at around 6,000 Kelvin. See this link http://earthguide.ucsd.edu/eoc/teachers/t_tectonics/p_geotherm.html for an image of the geothermal gradient graph.**

**Interior of Earth Handout Homework Answers**

**Answers are bolded and underlined.**

Our current information about the materials inside of the Earth come from *

- study of the paths and characteristics of earthquake waves travelling through the Earth
- lab experiments on surface minerals and rocks at high pressure and temperature
- Earth's motions in the Solar System
- Earth's gravity and magnetic fields
- the flow of heat from inside the Earth
- **All of the above are correct**

Which compositional layer of Earth occupies 84% of Earth's volume? *

- Inner Core
- Outer Core
- **Mantle**
- Crust

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Although this layer only constitutes 1% of Earth's volume, it will constitute the majority of our studies in Geology this semester. *

- Inner Core
- Outer Core
- Mantle
- **Crust**

Look at Figure 1 and the accompanying text. What are the major differences between continental crust and oceanic crust?

**Continental crust (granite) is much thicker and less dense. Oceanic crust (basalt) is thinner and more dense.**

Where do the majority of earthquakes and volcanoes occur? *

- **near the edges of crustal plates**
- in the middle of crustal plates
- in the lower mantle
- in the core

Approximately how many lithospheric plates make up Earth's crust and upper mantle? *

- 24
- 5
- 38
- **12**
- 19

What is the Moho (Mohorovicic discontinuity) and how do downward seismic waves behave at this boundary? *

**The Moho is a boundary between the crust and the upper mantle where there is a rapid increase in the speed of a downward seismic wave. This implies that there are great changes in physical behavior at this boundary. Its name is short for Mohorovicic discontinuity, as it is named after Andrija Mohorovicic, the Croatian scientist who studied it. Keep in mind that the Moho is a boundary and NOT a layer. It is the cookie, not the cream if your think about the Oreo analogy.**

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What is the deepest that humans have ever drilled into the Earth? *

- 200 kilometers
- 6378 kilometers
- 1000 kilometers
- **12 kilometers: This was the deepest that the Russians every drilled on the Kola Peninsula. The cost of drilling significantly increases with depth.**

Look at the diagram in Figure 2. Why do earthquake wave paths curve as they go deeper in the Earth? *

**Seismic earthquake waves curve as they go deeper in to the Earth. This is due to refraction, a consequence in the change of speed in a wave as it goes through material of changing density. Waves will travel faster in higher density solids and slower in lower density liquids. This is one of the things that enables us to detect what is beneath the surface of the Earth without actually going there.**

Look at "Data on the Earth's Interior." How does the chemistry of Earth change as you go deeper in to the planet?

**The chemistry of the Earth changes from lighter Silicon and Oxygen composition to heavier Magnesium Iron silicates in the mantle to heavier nickel and iron composition in the Earth's core. This chemical differentiation was put in place by density differences in the materials when the Earth formed. The heaviest materials sank to the center of the planet during formation when the material was molten.**

Why is the outer core of our planet probably the most important layer with respect to allowing life to take hold?

**The liquid outer core of our planet is extremely important because it is where the Earth's magnetic field is produced through motion of molten nickel and iron. Earth would be bombarded by high energy solar radiation if it weren't for the magnetic field produced in the liquid outer core. This would cause oceans to be boiled away, the atmosphere to be blown away, and life on this planet to cease due to the high energy radiation.**