

## Geology Core Class Assessment 2015-2016

There are two core lecture classes with accompanying labs in the Geology division of Geosciences. Both fulfill science core requirements in Fulbright College.

General Geology is a 1000-level survey course that is designed to familiarize students with the basic principles of physical geology. Earth Science is a 1000-level that builds on the basic principles covered in General Geology and focuses on the interactions of the atmosphere, hydrosphere, and geosphere and the interactions between humans and the environment.

The class goals are laid out in the syllabi and learning outcomes are assessed through a pre-test, post-test assessment system. Only the aggregate statistics are used in the assessment.

### **GEOS 1113: General Geology**

**Course Description and Goals:** The primary goal of this course is to introduce undergraduate students to the principles of physical geology, Earth's internal structure and materials, and geologic time. Emphasis is on developing close connections between Earth materials and processes within a Plate Tectonic framework.

**Course Learning Objectives:** By the end of the course, students should be able to do the following:

- Classify major rock types and rock-forming minerals
- List the major divisions of geologic time and analyze relationships between rocks to determine their relative ages
- Describe how major landforms are related to geologic processes, especially plate tectonics
- Describe the processes responsible for various geologic hazards
- Interpret 3-D geologic structures from 2-D geologic maps and cross sections
- Distinguish between hypotheses and theories
- Summarize the theory of plate tectonics and the observations that support and led to the development of the theory

## GEOS1113 Assessment results 2015-2016

The questions are appended to the end of this report.

### GEOS1113 Section 003 – Spring 2016

Question Number	Pre-Test # of Correct Answers	Post-Test # of Correct Answers	Pre-Test % Correct	Post-Test % Correct	Difference
1	104	91	95%	100%	5%
2	31	51	28%	56%	28%
3	24	83	22%	91%	69%
4	31	68	28%	75%	47%
5	73	78	67%	86%	19%
6	89	87	82%	96%	14%
7	56	77	51%	85%	34%
8	40	40	37%	44%	7%
9	43	74	39%	81%	42%
10	64	78	59%	86%	27%
11	74	85	68%	93%	25%
12	22	67	20%	74%	54%
13	26	59	24%	65%	41%
14	43	87	39%	96%	57%
15	45	59	41%	65%	24%
16	24	61	22%	67%	45%
17	19	72	17%	79%	62%
18	59	83	54%	91%	37%
19	25	67	23%	74%	51%
20	38	65	35%	71%	36%
Number of Students	109	91			

It is clear from the changes in the results from the pre test to the post-test that the students demonstrated clear knowledge increases on every question. For a few questions, notably Question 1, 5, 6 and Question 8, the increase in student knowledge is limited, either because the students already knew the material (questions 1, 5, & 6) or did not receive an adequate coverage of the material during the class to improve their knowledge (question 8). In all other cases however, it appears that the material is being taught effectively and students are leaving the class with a substantially greater knowledge of physical geology.

On the basis of these results we will consider minor modifications to the material taught.

## **GEOS1133: Earth Science**

**Course Description and Goals:** Earth Science is the study of the dynamic earth system, particularly the atmospheric, hydrospheric, and lithospheric systems that govern the environment at the surface of the earth. Following the agricultural revolution, humanity has emerged as a potent force for environmental change. This course will emphasize the cumulative human impact on environmental processes, including the energy balance of earth, surface and groundwater systems, natural resources, and landscape change. We will also examine the societal impact of natural processes such as earthquakes, floods, and extreme weather, and how anthropogenic environmental change may be aggravating the effects of these natural phenomena. We will emphasize the positive, and explore rational solutions and adaptations.

The key learning objectives of this course will be to develop a better understanding of:

1. geochemical hazards to human health;
2. physical hazards in the geological environment and the spatial distribution of human populations;
3. factors that govern modern water supply and distribution;
4. the relationship between water quality, human health, and natural ecosystem function;
5. physical meteorology and climatology;
6. the causes and consequences of global environmental change.

## **GEOS1133 Most Recent Assessment Results**

The same system of assessment is used in this class. Again the questions are appended to the end of this report.

Data for responses to individual questions are not available for past classes, but these will be collected in future classes. The overall class mean score from the most recent results for the pre-test was 9/20 or 45%, while the class mean score for the post-test was 17.4/20 or 87%, demonstrating a marked overall improvement.

## GEOS1113 General Geology – Core Assessment Test

**MULTIPLE CHOICE:** Carefully read each question and all possible answers and choose the best answer.

- The three major classes of rock are known as:
  - crustal, subcrustal, and transitional
  - sedimentary, igneous, and metamorphic
  - volcanic, plutonic, and transitional
  - weathered, eroded, and cemented
  - big rocks, small rocks, and ugly rocks
- The most dominant rock associated with our continents is known as:
  - basalt
  - granite
  - limestone
  - marble
  - rhyolite
- What are the three types of sedimentary rocks?
  - detrital, chemical, organic
  - foliated, nonfoliated, contact
  - intrusive, extrusive, felsic
  - obsidian, basalt, andesite
  - detrital, organic, porphyritic
- The most common end product of the chemical weathering of feldspar is:
  - quartz
  - hornblende
  - clay
  - pyroxene
  - calcite
- The Earth's internal heat engine causes hot rocks in the mantle to \_\_\_\_\_, whereas colder rocks tend to \_\_\_\_\_.
  - contract and rise; expand and sink
  - expand and rise; contract and sink
  - expand and sink; contract and rise
  - move laterally; stay stationary
  - none of the above
- A \_\_\_\_\_ is a scientific concept that has been highly tested and is in all likelihood true.
  - concept
  - hypothesis
  - theory
  - scenario
  - belief
- In order for an aquifer to meet the demands of heavy domestic, industrial, and agricultural water use, it must have:
  - high porosity
  - high permeability
  - low porosity
  - low permeability
  - (a) and (b)
- Fossil evidence indicates that complex life forms developed approximately \_\_\_\_\_ years before present
  - 5, 440
  - 544 thousand
  - 544 million
  - 3.5 billion
  - none of the above
- Which of the following elements is not abundant in the Earth's crust:
  - oxygen
  - uranium
  - silicon
  - calcium
  - aluminum
- The Earth's lithosphere is comprised of the:
  - crust
  - asthenosphere
  - core
  - uppermost mantle
  - (a) and (d)
- Earth is unique among terrestrial planets in that it:
  - has liquid water at its surface
  - has an atmosphere rich in nitrogen and oxygen
  - has an active system of (plate) tectonics
  - supports a biosphere
  - all of these are unique attributes of Earth

12. A Benioff earthquake zone is significant in plate tectonics theory because it:
- locates rift valleys on continents
  - coincides with mid-oceanic ridges
  - traces the descent of subducting sea-floor lithospheric slabs
  - locates major strike-slip faults
  - indicates the location of magma chambers
13. The majority of time in Earth history is associated with the:
- Cenozoic Era
  - Paleozoic Era
  - Mesozoic Era
  - Precambrian
  - Phanerozoic Eon
14. When a marine geologist collects a core of undeformed ocean-floor sediment, she knows that the youngest layer is on the top of the core and the oldest is at the bottom because of the principle of \_\_\_\_\_.
- supposition
  - suspension
  - superposition
  - inclusion
  - cross-cutting relationships
15. Slightly acidic ground water can dissolve limestone as it flows along joints and bedding planes to form caves. This reaction may then be reversed as water drips from the ceiling and splashes on the floor of an air-filled cave and minerals are precipitated to form features known as:
- stalactites
  - stalagmites
  - sinkholes
  - (a) and (b)
  - all of the above
16. The erosional removal of mass from mountainous regions underlain by thick crustal roots or the removal of weight through melting of continental scale ice sheets can result in uplift of the lithosphere. Such vertical movements to achieve gravitational equilibrium between adjacent parts of the Earth's lithosphere are known as:
- plate tectonics
  - magnetic anomalies
  - isostatic adjustments
  - compressional stresses
  - none of the above
17. The inference that the Earth's outer core is liquid comes from
- density calculations
  - studies of meteorites
  - P-wave shadow zones
  - S-wave shadow zones
  - the outer core isn't liquid
18. The principle mineral forming limestone is
- quartz
  - gypsum
  - halite
  - calcite
  - hematite
19. Eruptions of shield volcanoes fed by mafic magma tend \_\_\_\_\_.
- to be violent and potentially dangerous events
  - to be explosive but short-lived
  - not to be explosive or particularly dangerous
  - to result in the expulsion of vast amounts of tephra
  - to cover the surrounding landscape in ash
20. Reverse faults are examples of \_\_\_\_\_ that result from \_\_\_\_\_ stresses.
- dip-slip faults, tensional
  - dip-slip faults, compressional
  - strike-slip faults, tensional
  - strike-slip faults, compressional
  - transform faults

## GEOS1133 Earth Science – Core Assessment Test

**MULTIPLE CHOICE:** Carefully read each question and all possible answers and choose the best answer.

1. A potent neurotoxin that can cause blindness, kidney disease, hypertension, stroke, heart disease, and death:  
a. hard water      b. radon      c. asbestos      d. lead
2. The so-called “Cold Tongue” is located in the  
a. eastern equatorial Pacific  
b. western equatorial Pacific  
c. subpolar North Atlantic
3. A sound scientific hypothesis is:  
a. the prevailing opinion of informed experts  
b. an explanation that has been approved by the National Academy of Science  
c. a proposed explanation that includes predictions that can be observed and tested.
4. The hydrologic cycle is a static, two dimensional, and largely a theoretical concept.  
a. True      b. False
5. What is hypoxia?  
a. flesh eating bacteria responsible for massive fish kills  
b. a harmful algae bloom responsible for red tide  
c. an epidemic disease in anadromous fish like salmon  
d. extremely low levels of dissolved oxygen in natural waters
6. Which nutrient is most harmful in freshwater ecosystems (i.e., may cause eutrophication if too abundant)?  
a. calcium      b. nitrogen      c. phosphorus
7. In the USA, which sector uses the most water?  
a. Residential      b. Industrial      c. Electrical power      d. Agricultural
8. Where is the depletion of the Ogallala or High Plains aquifer the greatest?  
a. Nebraska      b. South Dakota      c. Colorado      d. Texas
9. Almost 90% of the freshwater consumed in the United States each year comes from surface reservoirs and streams.  
a. True      b. False
10. Why do we have seasonal changes in climate here on Earth?  
a. The Earth's orbit around the Sun is oval-shaped and summer comes when we're closest, winter when we're farthest from the Sun  
b. Earth's rotation axis is not perpendicular to its orbital plane (the plane of the ecliptic)  
c. Earth rotates counter clockwise around the Sun  
d. Earth spins on its axis

11. What is the principal wavelength band of solar radiation transmitted to the surface of Earth?  
a. infrared                      b. visible                      c. ultraviolet
12. What is the most important factor in the greenhouse effect?  
a. carbon dioxide (CO<sub>2</sub>)                      b. methane                      c. water vapor  
d. chloroflourocarbons (CFC's)                      e. deforestation
13. What is the most important function of stratospheric ozone?  
a. traps longwave radiation that would otherwise escape to space  
b. forms clouds in the stratosphere  
c. has a high albedo and cools the earth  
d. blocks harmful ultraviolet radiation (UVB)
14. The declination of the sun varies throughout the year from  
a. 0°N to 90°N                      b. 10°N to 10°S                      c. 23.5°N to 23.5°S                      d. 66.5°N to 66.5°S
15. Earth's major climate zones are classified primarily by  
a. temperature and precipitation  
b. cloud cover and wind systems  
c. lapse rate and the pressure gradient force
16. The movement of air (i.e., wind) is caused by  
a. differences in altitude  
b. changes in humidity  
c. gravity  
d. pressure changes
17. What is the Hadley Circulation?  
a. The paired convection cells in the lower atmosphere that straddle the equator  
b. the zonal (east-west) convection cell along the equator and over the Pacific Ocean  
c. the circulation pattern due to the gradient from the Azores high into the Icelandic low  
d. the meridional overturning of the deep ocean
18. What is the positive feedback mechanism involved in tropical cyclones?  
a. adiabatic heating in the central eye  
b. the latent heat of condensation  
c. a mesocyclone in the mid troposphere  
d. the jet stream
19. The global average temperature of earth has increased since 1900 by approximately  
a. 0.3°C                      b. 0.8°C                      c. 1.8°C                      d. 2.3°C
20. What is the current human population of the world?  
a. 3.03 billion  
b. 5.03 billion  
c. 7.03 billion  
d. 9.03 billion