

# GEOSCIENCE 105

## THE DYNAMIC EARTH



### FIRST ONE-HOUR EXAMINATION

Tuesday, October 20, 1998

NAME \_\_\_\_\_

STUDENT # \_\_\_\_\_

#### **Instructions:**

1. Answer all questions legibly.
2. Put your name and student number on this front page.
3. There are at least two different versions of this exam
4. Check that you have 5 questions on 10 pages before beginning.
5. All five questions are of equal weight (20 points)
6. If you want your grade posted by your student number, you must sign below (otherwise it will not be posted).

Signature \_\_\_\_\_

#### **GOOD LUCK!**

1. Indicate which of the following statements are **TRUE** or **FALSE**.

- (a) The radioactive decay of the isotope rubidium-87 to strontium-87 is used for the radiometric age determination of rocks. \_\_\_\_\_
- (b) All volcanoes are located along convergent plate margins \_\_\_\_\_
- (c) During periods of reverse magnetic polarity a compass needle will point to the south. \_\_\_\_\_
- (d) The spreading-rate at mid-ocean ridges is the same throughout the entire world-wide ocean ridge system. \_\_\_\_\_
- (e) Alfred Wegener was the first to introduce the hypothesis of continental drift. \_\_\_\_\_
- (f) The Himalayas are a mountain range produced by volcanic activity where two plates have collided. \_\_\_\_\_
- (g) The North American continent was once part of Gondwanaland. \_\_\_\_\_
- (h) The earth is thought to be about 4.5 to 4.6 billion ( $4.5-4.6 \times 10^9$ ) years old. \_\_\_\_\_
- (i) Lavas erupted at the same time in Hawaii and Iceland will have the same magnetic inclination. \_\_\_\_\_
- (j) Since tin has more isotopes than any other element in the periodic table it is the best element to use for radiometric age determinations. \_\_\_\_\_

2. The following questions are all concerned with identifying places, or regions, where plate tectonic processes are taking place today. Answer the questions in the space provided.

- a) Which of the following are examples of island arcs?
- A) the Galapagos islands
  - B) the Hawaiian Islands
  - C) Iceland
  - D) the Aleutian islands
  - E) none of the above
  - F) all of the above

**ANSWER** \_\_\_\_\_

- b) Which of the following is thought to be a newly forming ocean basin?
- A) the Mediterranean Sea
  - B) the Red Sea
  - C) the Atlantic Ocean
  - D) the Black Sea
  - E) the Caribbean Sea

**ANSWER** \_\_\_\_\_

- c) Which of the following major plates does **NOT** contain significant amounts of continental crust?
- A) Pacific plate
  - B) Antarctic plate
  - C) African plate.
  - D) South American plate
  - E) North American plate.

**ANSWER** \_\_\_\_\_

- d) Where is a spreading mid-ocean ridge exposed above the surface of the ocean?
- A) Hawaii
  - B) Greenland
  - C) Iceland
  - D) Ellis Island
  - E) none of the above
  - F) nowhere

**ANSWER** \_\_\_\_\_

- e) The island of Hawaii reflects the present day location of:-
- A) a mid-ocean ridge

- B) a subduction zone
- C) a hot spot
- D) an island arc
- E) an oceanic trench

**ANSWER** \_\_\_\_\_

- f) Which of the following localities do you think best represents the present day subduction of an oceanic plate beneath a continent.
- A) the Andes of South America
  - B) the Himalayas
  - C) Iceland
  - D) the Aleutian Islands
  - E) the west coast of Africa

**ANSWER** \_\_\_\_\_

- g) Which of the following are examples of a mountain range produced by the recent collision of two continents?
- A) the Andes of South America
  - B) the Himalayas of Asia
  - C) the Cascade Range of North America
  - D) the Rocky Mountains of North America
  - E) all of the above.

**ANSWER** \_\_\_\_\_

- h) Where are the Earth's magnetic poles located?
- A) their location changes drastically with time
  - B) the position of the poles migrates with the continents
  - C) near the equator
  - D) near the north and south rotational poles
  - E) their positions vary with sunspot activity

**ANSWER** \_\_\_\_\_

- i) The East Pacific Rise (the ocean ridge in the Pacific Ocean) represents which of the following?
- A) earthquakes along a Beniof zone
  - B) a transform plate boundary
  - C) the eruption of lavas with high magnetic inclinations
  - D) the slow (<2 cms/yr) separation of two plates
  - E) the rapid (>6 cms/yr) separation of two plates

**ANSWER**

- j) Where are most of the Earth's deep trenches found?-
- a) along the margins of the Pacific Ocean
  - b) in the Mediterranean Ocean
  - c) running parallel with ocean ridges
  - d) in the middle of the Atlantic Ocean
  - e) cutting across mid-ocean ridges

**ANSWER**

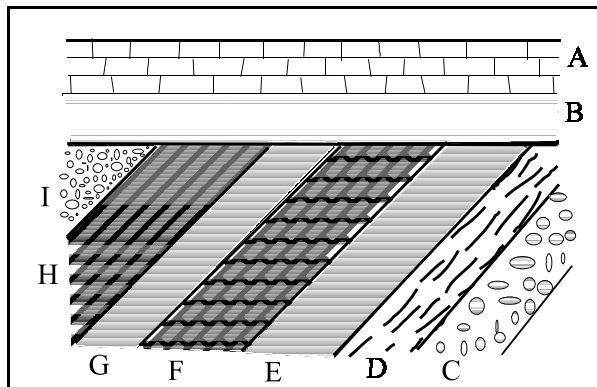
- 3 a). The radioactive isotope U-235 decays to the stable daughter isotope Pb-207 with a half-life of 713 million years. If you analyze a rock in the laboratory and find that it contains 50 parts of U-235 and 750 parts of Pb-207, how many half-lives have passed since the rock was formed? You are assuming that there was no Pb-207 initially present in the rock and that neither U-235 or Pb-207 have been lost from the rock over time.
- A) 1 half-life
  - B) 2 half-lives
  - C) 3 half-lives
  - D) 4 half-lives
  - E) 5 half-lives

**ANSWER** \_\_\_\_\_

- b). Which of the following ages is closest to the radiometric age of the rock discussed above?
- A) 214 million years
  - B) 713 million years
  - C) 2,140 million years
  - D) 2,850 million years
  - E) 4,280 million years

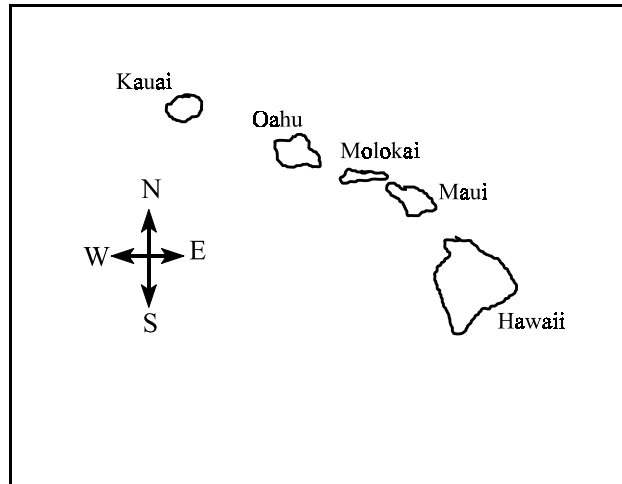
**ANSWER** \_\_\_\_\_

Below is a sketch of a geological outcrop showing several layers (A - I) of rock.



- c) Which layer is the oldest? \_\_\_\_\_
- d) Which layer is the youngest? \_\_\_\_\_
- e) What is the name given to the boundary between the horizontal layers and the steeply inclined layers? \_\_\_\_\_

4. Below is a sketch map of the Hawaiian Islands. Answer the following questions in the spaces provided.



- a) The volcanic rocks on the Island of Kauai are about 5 million years old, whereas the volcanic rocks on the island of Hawaii are much less than a million years old. If the island of Kauai is about 450 km from the island of Hawaii, what is the spreading rate of the Pacific plate?

**ANSWER** \_\_\_\_\_

- b) In what direction is the Pacific plate moving?
- A) South West
  - B) North West
  - C) North
  - D) South
  - E) North East
  - F) It is not possible to figure out from the information given

**ANSWER** \_\_\_\_\_

5. Answer the following multiple choice questions in the space provided.

- a) The earth's core is thought to be made of:-
- A) an alloy of iron and nickel
  - B) the same material as the mantle
  - C) the same material as stony meteorites
  - D) Phlogiston
  - E) primordial soup

**ANSWER** \_\_\_\_\_

- b) Which of the following individuals is credited with first recognizing that the earth was many millions of years old?
- A) Charles Darwin
  - B) James Hutton
  - C) Isaac Newton
  - D) Copernicus
  - E) Aristotle

**ANSWER** \_\_\_\_\_

- c) The name of the scientific drill ship that replaced the "Glomar Challenger" was:-
- A) Discovery
  - B) Fram
  - C) Santa Maria
  - D) Joides Resolution
  - E) Andrea Doria

**ANSWER** \_\_\_\_\_

- d) The thickness of the oceanic crust is about:-
- A) 5-7 kilometers
  - B) 40-50 kilometers
  - C) 670 kilometers
  - D) 29000 kilometers
  - E) unknown

**ANSWER** \_\_\_\_\_



- e) The principle behind determining the relative ages of layered rock is known as:-
- A) The theory of probability
  - B) The law of decreasing expectations
  - C) The principle of uniformitarianism
  - D) The law of the indestructibility of matter
  - E) The law of superposition

**ANSWER** \_\_\_\_\_

- f) The depth to the floor of the ocean (its bathymetry) is usually measured by:-
- A) dredging
  - B) using weighted lead lines (plumb-lines)
  - C) underwater photography
  - D) the return time of sound waves (echo sounding)
  - E) satellite global positioning (GPS)

**ANSWER** \_\_\_\_\_

- g) James Hutton is often regarded as the "Father of Geology". His most important contribution to science was:-
- A) the discovery of phlogiston
  - B) the theory of continental drift
  - C) the discovery of reversals in the earth's magnetic field
  - D) pioneering work in radiometric age determination
  - E) the recognition that the earth is many millions of years old

**ANSWER** \_\_\_\_\_

- h) Scientists attribute reversals in the earth's magnetic field to:-
- A) sunspot activity
  - B) radioactive isotopes
  - C) convection in the mantle
  - D) collision of continents
  - E) no satisfactory explanation

**ANSWER** \_\_\_\_\_

- i) "Tethys" is the name given to:-
- A) a shallow sea between Laurasia and Gondwanaland
  - B) a character from the Greek myths
  - C) an ancient super-continent
  - D) a form of Hawaiian lava
  - E) the hot, plastic mantle beneath the lithosphere

**ANSWER** \_\_\_\_\_

- j) Which of the following was the name given to Wegener's hypothesis?
- a) Sea-floor spreading
  - b) Continental drift
  - c) The origin of species
  - d) the law of conservation of matter
  - e) The theory of uniformitarianism
  - f) The law of superposition

**ANSWER** \_\_\_\_\_