

Name: _____

Student No.: _____

Remember to also enter/code your Student Number on the computer scan sheet.

Oceanography 201
Fall 2010, Geology Section Exam

I hereby authorize the use of my student ID number for the purpose of posting my grades in OCN 201. (Please sign; your grades cannot be posted without a signature.) **Signature:** _____

Answer 1-60 on the computer-scan sheet (1 point each). Use a dark (#2) pencil only, and make marks neatly within the circles. If you change an answer, erase completely. Also, be sure your ID number is coded correctly.

PART I. Multiple Choice: 1 point each. Read all the possible answers before making your choice.

- 1) The fact that the average thickness of sediment on the ocean floor is only ~600 m implies that:
 - a) the ocean floor is relatively young
 - b) the earth is expanding
 - c) sediments are being consumed as they are being produced
 - d) sediment is only produced at certain times in Earth's history
 - e) the earth is heating up

- 2) Four elements make up 93% of Earth's mass. They are:
 - a) iron, oxygen, silicon, and magnesium
 - b) iron, oxygen, magnesium, and hydrogen
 - c) hydrogen, helium, nitrogen, and oxygen
 - d) iron, nickel, calcium, and aluminum
 - e) oxygen, nitrogen, carbon dioxide, and water vapor

- 3) The Amazon, Congo, and Mississippi rivers account for what portion of the sediment delivery to the Atlantic Ocean?
 - a) An insignificant amount
 - b) About one quarter
 - c) Slightly less than one half
 - d) Most of the input
 - e) None of the above

- 4) Which type of biogenic sediment is most soluble in the deep ocean?
 - a) Abyssal clay
 - b) Calcareous tests of foraminifera and coccolithophores
 - c) Siliceous tests of radiolarians and diatoms
 - d) Turbidites made up of mostly continental shelf sediments
 - e) None of the above

- 5) The Hawaiian-Emperor seamount chain is an example of:
 - a) a fracture zone
 - b) a hotspot trace
 - c) a mid-ocean ridge
 - d) a subduction zone
 - e) a volcanic island arc

- 6) Earthquakes associated with the divergent plate margins occur at:
- Very deep within the continent adjoining the subduction zone
 - Both at shallow depth and much deeper within the subduction zone
 - Only at relatively shallow depth
 - Shallow depth at the plate margin and much deeper a bit further away
 - 7000km
- 7) Calcareous sediments found on the ocean floor consist mostly of remains of:
- coccolithophores and diatoms
 - foraminifera and coccolithophores
 - foraminifera and radiolaria
 - radiolaria and diatoms
 - both (b) and (d)
- 8) The Wadati-Benioff Zone is the:
- area where a subducting lithospheric plate enters the asthenosphere, characterized by strong shallow- to deep-focus earthquakes
 - boundary between the oceanic crust and the lithosphere
 - “shadow” zone where no P or S waves are detected after an earthquake
 - site where two plates are being pulled apart and new oceanic lithosphere is being created
 - both (b) and (d)

The following terms are for questions 9 and 10:

- no earthquakes, no volcanism, thin crust, thick sediment
 - shallow to deep earthquakes, andesitic volcanism, older crust, thick sediment
 - shallow earthquakes, andesitic volcanism, young crust, thick sediment
 - shallow to deep earthquakes, basaltic volcanism, older crust, thin sediment
 - shallow earthquakes, basaltic volcanism, young crust, sediment absent to thin
- 9) Which of the above choices consistently describe a subduction zone?
- 10) Which of the above choices consistently describe a spreading center?
- 11) Charles Darwin was the principal proponent of the theory of the:
- Big Bang
 - Continental drift
 - Formation of atolls
 - Mantle plumes
 - Plate tectonics
- 12) What is the generally accepted scientific estimate for the age of the Earth?
- 6,000 years
 - 4.5 million years
 - 4.5 billion years
 - 13.7 million years
 - 13.7 billion years

- 13) Reversals of the Earth's magnetic field:
- Are important in understanding longitude
 - Are the basis for Arthur Holme's concept of thermal convection cells in the Earth's mantle
 - Are recorded in seafloor rocks in bands parallel to spreading centers
 - Cause the Earth to flip on its geographic axis
 - Occur in a time frame that allows dating of materials with ^{14}C
- 14) The region where plates move past each other in opposite directions is called a:
- An abyssal hill
 - A fracture zone
 - A guyot
 - A spreading center
 - A transform fault
- 15) A seismograph mounted in a submarine would not be able to detect:
- Earthquakes
 - Gravity waves
 - P-waves
 - S-waves
 - Neither P nor S waves
- 16) In the movie "Hawaii: Born of Fire", the age distribution of past lava flows on Mauna Loa was determined from:
- Biogenic ooze deposited during high sea-level sands
 - Glacial sediments near hydrothermal vents
 - Radioactive decay of Uranium and Thorium
 - Charred plant roots that were preserved as the flow(s) advanced and dated with ^{14}C
 - None of the above
- 17) The prevailing theory for the origin of the Earth's Moon is:
- Direct condensation from the Solar nebula
 - Fission due to rapid rotation
 - Formation in the same manner as Earth, by accretion
 - Gravitational capture of a large planetesimal
 - Impact by a large planetesimal, which spun off the Moon
- 18) Below the carbonate compensation depth (CCD) the:
- Calcareous matter dissolves faster than it is delivered from above
 - Calcareous sediments deposited when the area was above the CCD become buried by siliceous ooze
 - Only siliceous ooze or red clay is found at the surface of the sediment
 - Siliceous tests of planktonic organisms dissolve much slower than calcareous tests do
 - All of the above
- 19) Large volumes of ocean sediments are transported from the continental shelves to the deep ocean floor by:
- Rivers
 - Seafloor spreading
 - Tidal currents
 - Storm surges
 - Turbidity currents

- 20) Continental crust is, on average, composed mainly of:
- Andesite
 - Basalt
 - Calcium carbonate
 - Evaporites
 - Tubidites
- 21) Given that Hawaii moves along the Pacific Plate at a rate governed by seafloor spreading along the EPR and assuming that you were born in Hawaii and have lived here all along (about 20 years), the house you grew up in has moved about:
- 0.5 m to the NW
 - 0.5 m to the SE
 - 3 feet to the SW
 - 5-6 feet to the SW
 - None of the above
- 22) Which of the following lists particles from smallest to the largest size
- Boulders-cobbles-pebbles-sand-silt-clay
 - Boulders-pebbles-cobbles-sand-clay-silt
 - Clay-silt-sand-cobbles-pebbles-boulders
 - Clay-silt-sand-pebbles-cobbles-boulders
 - Sand-silt-clay-cobble-pebbles-boulders
- 23) Continents are built by:
- Andesitic volcanism at subduction zones
 - Basaltic volcanism at mid-ocean ridges
 - Outgassing of volatiles from the Earth's interior
 - Both a and b
 - Both b and c
- 24) Changes in sealevel that are observed on a global scale are called
- Cystolic
 - Diastolic
 - Eustatic
 - Hydrostatic
 - None of the above
- 25) Which of the following is not a parameter of importance in the theory of plate tectonics are:
- Conservation of mass (volume/seafloor)
 - Centrifugal force and earth tides
 - Isostatic balance and chemical differentiation
 - Slab pull and mantle drag
 - Thermal convection
- 26) Planktonic animals whose calcium carbonate tests may be found on the ocean floor are called:
- Coccolithophores
 - Diatoms
 - Foraminifera
 - Radiolaria
 - They all produce calcium carbonate tests

- 27) The Atlantis Seamount Dr. De Carlo briefly discussed in class lecture is an example of a:
- Hotspot volcano
 - On axis seamount/volcano
 - Passive margin
 - Spreading center
 - Subduction zone
- 28) The Mariana-type of margin consists of:
- Continental crust, oceanic crust, mid ocean ridge
 - Continental-continental plate convergence
 - Continental shelf, marginal sea, island arc, trench
 - Ocean basin, volcanic arc, trench
 - Volcanic arc, oceanic sea floor, trench, continental rise
- 29) The principle of isostasy is most similar to which of the following?
- Archimedes principle
 - Centrifugal force
 - Electrostatic attraction
 - All of the above
 - None of the above
- 30) The outer core of the Earth is liquid in part because:
- It is hotter than the solid inner core
 - It experiences lower pressure than in the inner core, which allows it to melt
 - No earthquakes occur there
 - The increased pressure there melts the rock into liquid
 - None of the above
- 31) The three geologic settings on Earth where active volcanism occurs are:
- Abyssal plains, continental breaks and guyots
 - Azores, Cascade Volcanoes, and Hawaii
 - Convergent margins, divergent margins and fracture zones
 - Hotspots, mid-ocean ridges, and subduction zones
 - All of the above
- 32) In 1966, Vine and Matthews presented evidence that convinced geologists that seafloor spreading is real. The evidence used to support their hypothesis was:
- Direct sampling of ocean floor crustal rocks
 - Earthquake patterns at hot spot volcanoes
 - Magnetic patterns observed on both sides of the mid ocean ridges
 - The pattern of age on continents
 - All of the above
- 33) The Earth's atmosphere is considered secondary in origin. This means that:
- Cold planetesimals aggregated rapidly to form Earth and lost their primary atmospheres
 - It formed by complete outgassing of the Earth's interior
 - It formed by the interaction of living things with their environment
 - It formed by reaction between an earlier atmosphere and crustal rocks
 - All of the above

- 34) The main factor causing present sea level to rise over the past 18,000 years is:
- Increased erosion on land
 - Increased cosmic bombardment
 - Increased penetration of CO₂ derived from burning of fossil fuels into the ocean
 - Melting of land based ice sheets and thermal expansion of seawater
 - All of the above
- 35) The Principle of isostasy states that:
- About 25% of the continental crust currently lies below sea level
 - Crust is produced by differentiation from the mantle, by upwelling and solidification of molten rock
 - If the Earth were perfectly smooth, it would be covered by nearly 3,000 m of ocean water
 - The Earth's surface is dominated by 2 levels: the continents and the oceans
 - The lithosphere is in gravitational equilibrium through a buoyancy mechanism, with compensation occurring in the asthenosphere
- 36) The Darwin Point is:
- The geographic point where seamounts become guyots
 - The point where the rate of coral growth drops to less than 5 cm/year
 - Where atolls "drown" because coral growth cannot keep up with subsidence of the edifice
 - The place where Darwin beat Sharopova in the 1898 Biological Olympics
 - None of the above
- 37) Darwin's theory of atoll development did not include which of the following?
- Barrier reefs develop as corals grow upward on a heavily eroded and subsiding island
 - Barrier and fringing reefs grow as a result of nutrient input from the island they surround
 - Fringing reefs grow upward around the edge of a young high island
 - Motu form from accretion and consolidation of storm debris along a barrier reef
 - The atoll develops fully as the underlying island has eroded and/or subsides below sea level
- 38) The continental rise is:
- A type of trench found at high latitude
 - A ridge created by the formation of new crust
 - A wedge of sediment at the base of the continental slope
 - An uplifted sedimentary basin
 - Both c and d
- 39) The density of basaltic material is:
- 2.9 g/cm³
 - 4.5 g/cm³
 - 12 g/cm³
 - 2.7 g/cm³
 - 1.0 g/cm³
- 40) Which of the following supports the hypothesis of seafloor spreading?
- Absence of sediment along the mid-ocean ridge
 - Age of oceanic crust increases with distance from the mid-ocean ridge axis
 - Elevated topography of mid-ocean ridges
 - Evidence of earthquakes and volcanism along the mid-ocean ridge axis
 - All of the above

PART II. True/False: 1 point each.

Mark (a) if the statement is **true** or (b) if the statement is **false**.

- 41) The Hawaiian Islands are not an example of Island Arc Volcanism.
- 42) The range of sea-level throughout Earth's history has been from about 250-300 m higher than now to about 100-130 m below current sea level.
- 43) Our solar system contains elements heavier than iron from a red giant expansion.
- 44) Free oxygen was not initially an important component of the Earth's atmosphere.
- 45) The newest Hawaiian Island, as seen from the submersible in "Hawaii, Born of Fire" is called Leahi.
- 46) The Earth's core is thought to have formed through differentiation exclusively after the Earth was fully formed.
- 47) A grab sampler is an oceanographic device used to sample deep ocean crust.
- 48) The amount of land (continent) exposed above sea level has been relatively constant over the past 600 million years.
- 49) Sedimentary fans are typically associated with river mouths on the landward edge of the continental shelf and with large submarine canyons at the base of the continental rise
- 50) Atlantic-type continental margins are not plate boundaries.
- 51) Armoring of beaches leads to protection of the beach and erosion of the land.
- 52) The island of Oahu is a good example of a guyot.
- 53) Both oceanic and continental crusts are produced by chemical differentiation from the mantle.
- 54) The oldest rocks from the seafloor are more than 100 times older than the oldest rocks from the continents.
- 55) The Curie point is the temperature above which the magnetic field of iron-bearing minerals in magma is able to align with the Earth's magnetic field.
- 56) The oceanic crust includes all parts of the Earth's surface that lies below sea level.
- 57) The ancient atmospheres of the Earth and its neighbors, Venus and Mars, were likely initially quite similar after the formation of our solar/planetary system.
- 58) Beach modifications such as groins lead to enhanced erosion and transport of sand.
- 59) A hypsometric curve shows one surface elevation on Venus and two on Earth.
- 60) Construction of groins along beaches prevents longshore transport of sand.

PART III: Short Essay. Answer the following questions entirely within the space provided. Think your answer through *before* starting to write. Write legibly. Use block print if your handwriting is poor, because if the grader can't read it, it has a greater chance of being marked wrong.

61) List and briefly explain five lines of evidence used by Wegener to support the hypothesis of continental drift (5 points).

62) Explain briefly why most geologists from Europe and N. America did not believe Wegener's hypothesis/theory of continental drift and why those from S. Africa and Australia did? (5 pts)

63) Draw a diagram of a typical transform fault. For full credit, (a) label the major features; (b) if a part is moving, label its direction of movement; (c) name an example of a geographical location where such a boundary occurs today (5 points).