

Name: _____

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Remember to also CODE your computer scan sheet with your Social Security Number.

Oceanography 201
Spring 2003 Section I
Exam #1

Answer questions 1-60 on the computer scan sheet. **Use a dark (#2) pencil** to mark the circles neatly. **DO NOT** use pen or ink. If you change an answer, make sure that all other marks are completely erased.

PART I. Multiple Choice: 1 point each.

Read all the possible answers before making your choice.

1. The scientific method involves:
 - a. formulating hypotheses
 - b. making predictions
 - c. asking questions
 - d. making observations
 - e. all of the above

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

3. We can learn about Earth's past history (i.e., climate change, oceanic circulation, sedimentation, etc.) from:
 - a. current and future measurements of atmospheric CO₂
 - b. the Earth's magnetic field
 - c. deep cores recovered from the seafloor
 - d. the Earth's gravitational field
 - e. all of the above

4. Scientists can estimate the distance the Earth is from a star by using:
 - a. red shifting
 - b. gravity measurements
 - c. paleomagnetism
 - d. radioactive decay
 - e. parallax

5. Which of the following lists particles from smallest to largest size
 - a. sand-silt-clay-cobble-pebbles -boulders
 - b. boulders-cobbles-pebbles-sand-clay-silt
 - c. boulders-cobbles-pebbles-sand-silt-clay
 - d. clay-silt-sand-cobbles-pebbles-boulders
 - e. clay-silt-sand-pebbles-cobbles-boulders

6. Free oxygen in the Earth's atmosphere has been produced mainly by:
- change in sea level
 - photosynthesis and burial of organic carbon
 - photodissociation of water and loss of hydrogen to outer space
 - nucleosynthesis in the stars
 - formation of the Earth's core
7. The Wadati-Benioff Zone is the:
- "shadow" area where no P or S waves are detected after an earthquake
 - area where a subducting lithospheric plate enters the asthenosphere and characterized by strong shallow- to deep-focus earthquakes
 - site where two plates are being pulled apart and new oceanic lithosphere is being created
 - the boundary between the crust and the mantle, marked by an increase in S-wave velocity
 - both (b) and (d)
8. Calcareous sediments found on the ocean floor consist of remains of:
- foraminifera and radiolaria
 - radiolaria and diatom
 - foraminifera and coccolithophore
 - coccolithophore and diatom
 - both (b) and (c)

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 terms consistently describe a subduction zone?
10. Which of the above terms consistently describe the mid-ocean ridge, a zone of seafloor spreading?
11. Alfred Wegener was the principal proponent of the theory of
- the Big Bang
 - formation of atolls
 - mantle plumes
 - continental drift
 - plate tectonics
12. What is the most recently accepted estimate for the age of the Universe?
- 20,000 years
 - 4.5 million years
 - 13.7 billion years
 - 13.7 million years
 - 4.5 billion years

13. The reaction $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{CH}_2\text{O} + \text{O}_2$ represents:
- photodissociation
 - respiration and decay
 - chemical weathering
 - photosynthesis
 - formation of petroleum
14. The density of oceanic and continental crusts are, respectively:
- about 2.7 g/cm^3 and 2.9 g/cm^3
 - about 4.5 g/cm^3 and 2.9 g/cm^3
 - about 2.9 g/cm^3 and 2.7 g/cm^3
 - about 16 g/cm^3 and 4.5 g/cm^3
 - about 12 g/cm^3 and 16 g/cm^3
15. The region where plates move past each other is called a:
- fracture zone
 - spreading center
 - guyot
 - transform fault
 - abyssal hill
16. Features that can be found in both the Atlantic and Pacific Oceans are:
- continental shelf, mid-ocean ridge, sediments
 - continental shelf, hotspot, trench
 - mid-ocean ridge, transform fault, sediments
 - abyssal hills, fracture zone, trench
 - all of the above
17. The two dominant types of sediment in the deep sea are:
- glacial sediments and hydrothermal vent deposits
 - hydrogenous material and sand
 - terrigenous silt and manganese nodules
 - biogenic ooze and clay
 - clay and ferro-manganese nodules
18. The leading theory for the origin of the Earth's Moon is:
- formation in the same manner as Earth, by accretion
 - condensation from the Solar nebula
 - impact by a large planetesimal, about the size of Mars, which spun off the Moon
 - gravitational capture of a large planetesimal
 - fission due to rapid rotation
19. The oceanic crust is composed mainly of:
- andesite
 - sediments
 - granite
 - basalt
 - calcium carbonate

20. The carbonate compensation depth or CCD is
- the depth below which the rate of dissolution of calcium carbonate is greater than its deposition rate
 - the depth at which calcium carbonate dissolves in the oceans
 - the depth where the rate of delivery of calcium carbonate is equal to the rate at which it dissolves
 - the depth at which calcium carbonate sediment is replaced by siliceous ooze
 - both (a) and (c)
21. 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
22. Most of the sediment on the continental shelves...
- is actively mobilized on a regular basis
 - was deposited there during the last glacial period about 18,000 years ago
 - is biogenic, derived from organisms secreting siliceous exoskeletons
 - is currently being deposited by transport down drowned river mouths
 - was originally deposited by advancing glaciers during the last glacial period about 18,000 years ago
23. Planktonic animals whose silica-rich shells may be found on the ocean floor are called:
- diatoms
 - radiolaria
 - foraminifera
 - coccolithophores
 - phosphorites
24. The major forces driving the plates in the theory of plate tectonics are:
- inertia and mass balance
 - thermal convection, slab pull and mantle drag
 - centrifugal force and attraction between the Earth and the Sun
 - isostatic balance and chemical differentiation
 - none of the above
25. Which of the following supports the hypothesis of seafloor spreading?
- absence of sediment along the mid-ocean ridge
 - evidence of earthquakes and volcanism along the mid-ocean ridge axis
 - age of oceanic crust increases with distance from the mid-ocean ridge axis
 - elevated topography of mid-ocean ridges
 - all of the above
26. Continents are built by:
- outgassing of volatiles from the Earth's interior
 - andesitic volcanism at subduction zones
 - basaltic volcanism at mid-ocean ridges
 - accretion of exotic terranes onto their margins
 - both (b) and (d)

27. The three major types of plate boundaries are:
- constructive, destructive, regenerative
 - divergent, convergent, conservative
 - conservative, transform, slipslide
 - continental-continental, oceanic-oceanic, continental-oceanic
 - both (a) and (b)
28. In 1966, Vine and Matthews presented evidence that finally convinced geologists that seafloor spreading is occurring. This evidence involved:
- direct sampling of ocean floor crustal rocks
 - age of oceanic crust increases with distance from mid-ocean ridge axis
 - patterns of coral reef growth and development
 - earthquake patterns at deep-sea trenches
 - magnetic patterns measured at oceanic ridges
29. The Mariana-type of continental margin consists of:
- shelf, slope, rise, trench
 - shelf, slope, hotspot, volcanic island arc
 - continental crust, oceanic crust, mid-ocean ridge
 - shelf, slope, marginal basin, volcanic island arc, trench
 - Asia, Japan Sea, Hawaiian hotspot, East Pacific rise
30. The Earth's atmosphere is considered secondary in origin. This means that:
- it formed exclusively by outgassing of the Earth's interior
 - it formed by the interaction of living things with the environment
 - cold planetesimals, which aggregated rapidly to form the Earth, lost all their primary atmospheres
 - it formed by the reaction between an earlier atmosphere and crustal rocks
 - both b and d
31. We know that the outer core of the Earth is liquid in part because:
- the deep sea drilling project drilled there
 - seismic "s" waves do not travel through it
 - no earthquakes occur there
 - the increased pressure melts the rock into a liquid
 - the continents are drifting
32. The three main settings on Earth where active volcanism occurs are:
- mid-ocean ridges, subduction zones, and hotspots
 - Azores, the Cascade Mountains, and Hawaii
 - abyssal plains, abyssal hills, and continental shelf
 - Mariana Trench, Puerto Rico Trench, and Yellowstone Park
 - convergent, divergent, and conservative plate boundaries
33. The main factor causing present sea level to rise is:
- increased penetration of fossil fuel CO₂ into the ocean
 - thermal expansion of water combined with melting of the polar ice caps
 - increased cosmic bombardment
 - increased erosion on land
 - increased volcanism

34. The Principle of Isostasy states that:
- 25% of the continental crust presently lies below sea level
 - if the Earth were perfectly smooth, it would be covered by nearly 3,000 m of ocean water
 - the lithosphere is in gravitational equilibrium through a buoyancy mechanism, with compensation occurring in the asthenosphere
 - crust is produced by differentiation from the mantle, by upwelling and solidification of molten rock
 - the Earth's surface is dominated by 2 levels: the continents and the oceans
35. The San Andreas Fault in California is an example of a:
- spreading center
 - transform fault
 - passive margin
 - hotspot
 - continental-continental plate convergence

PART II. True/False: 1 point each.

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

36. The Hawaiian Islands are an example of Island Arc Volcanism.
37. Sea level changes have been modest throughout Earth's history, never exceeding more than about 2 meters up or down.
38. Armoring of beaches with seawalls helps stabilize both the beach and the land behind the seawall.
39. All elements heavier than iron in our solar system are derived from a supernova explosion.
40. Throughout the Earth's geological history, free oxygen has always been an important component of the Earth's atmosphere.
41. The bend in the Hawaii-Emperor Seamount chain is thought to result from the inability of India to subduct under Asia about 40 My ago.
42. The Earth's core is believed to have formed after the Earth was fully accreted.
43. A piston corer is an oceanographic device used to sample deep ocean sediments.
44. The amount of continent exposed above sea level has varied over the past 600 million years.
45. Sedimentary fans are typically found on continental shelves at the head of large submarine canyons.
46. The most recently revised age of the Universe is based on microwave photographs obtained from a satellite orbiting the sun about one million miles farther out than the Earth.
47. Polynesians relied on the height of a series of stars in the sky at midday to navigate.
48. Atlantic-type continental margins are not plate boundaries.
49. Oahu is a good example of a guyot.

50. Both the oceanic and continental crust is produced by chemical differentiation from the mantle.
51. Eustatic sea level change occurs as a result of local effects.
52. The oldest rocks from the seafloor are as old as the oldest rocks from the continents.
53. The Curie Point is the temperature at which the magnetic field of iron-bearing minerals in magma aligns with the Earth's magnetic field.
54. A scientific theory is a hypothesis that has been proven correct.
55. The oceanic crust includes all parts of the Earth's surface that lie below sea level.
56. To determine latitude, one does not need to be able to tell time.
57. The modern atmospheres of the Earth and its neighbors, Venus and Mars, are similar.
58. Longshore transport is a method used to deliver sand from the beaches of Kauai to Waikiki Beach.
59. A hypsometric curve shows two surface elevation levels on Earth and only one on Venus.
60. Some mineral deposits on land were formed by ancient hydrothermal vents on the seafloor.

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 might be marked wrong.

61. List the four major causes of sea level change. State whether each is a global or local effect and whether sea level goes up or down (5 points)

62. Draw a cross-section of a typical continent-ocean convergent plate boundary. For full credit, (a) label 5 major features; (b) if a part is moving, label its direction of movement; (c) name a geographical location where such a boundary occurs (10 points).