

Name (print, last name first): _____

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OCEANOGRAPHY 201

Fall, 1998

Exam #1: Section 1

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: True/False (1 point each = 25 points).

Mark (a) for "true" and (b) for "false".

1. The scientific method is a systematic way of asking and answering questions about the natural world.
2. In science complex theories are preferred over simple ones.
3. Scientific theories are always subject to challenge and may be overturned.
4. Latitude can be told from the declination of the Pole Star, whereas longitude requires an accurate clock.
5. Polynesian navigation relied on the height of the stars in the sky at midday. T/F*
6. Refractory elements are those that tend to form gases, even at relatively low temperature.
7. The Earth is believed to have originated by accretion from planetesimals.
8. The atmospheres of Earth and its nearest neighbors, Venus and Mars, are similar.
9. All the elements heavier than iron (#26) were formed during the condensation of the solar nebula from which our solar system arose.
10. The age of the Earth is indistinguishable from that of the Moon and meteorites: about 4.5 billion years.
11. Free oxygen has always been an important component of the Earth's atmosphere.
12. The oldest rocks from the seafloor are much older than the oldest rocks from the continents.

13. The amount of land exposed above sea level has remained about the same for the last 600 million years.
14. Earth is massive enough to retain all of its constituent chemical elements.
15. The crust is the same thing as the lithosphere.
16. Both the oceanic and continental crust are produced by chemical differentiation from the mantle.
17. Most rivers in North America empty into the Pacific Ocean.
18. The seafloor-spreading hypothesis was confirmed by the Deep Sea Drilling Project, which determined that the age of the oceanic crust increases monotonically with distance from the ridge axis.
19. Hotspots can occur both at plate boundaries and in the middle of plates, and both in the oceans and on the continents.
20. The Hawaiian Islands are an example of island arc volcanism.
21. A guyot is a flat-topped seamount whose peak was once above sea level.
22. Beaches are normally very stable in shape and width unless disturbed by human activities.
23. Seawalls are usually effective in preventing beach erosion.
24. Worldwide, sea level is falling today.
25. The greatest volume of sediment in the oceans is found in the deep sea, far from the continents.

PART 2: Multiple Choice (1 point each = 35 points).

26. The scientific method involves
 - a) making observations
 - b) asking questions
 - c) formulating hypotheses
 - d) making predictions
 - e) all of the above.
27. If the Sun is overhead one hour later than at some fixed point to the east of you, how many degrees are you to the west of this position?
 - a) 5°
 - b) 15°
 - c) 20°
 - d) 25°
 - e) 30°
28. Scientists can estimate the distance Earth is from a star using:
 - a) Latitude
 - b) Paleomagnetism
 - c) Parallax
 - d) Radioactive decay
 - e) Epicycles.

29. What is the most recent scientific estimate for the age of the Universe?
- a) 10 thousand years
 - b) 14 million years
 - c) 1 billion years
 - d) 3 billion years
 - e) 14 billion years
30. The Sun's energy comes from
- a) gravity
 - b) nuclear fusion
 - c) red-shifting
 - d) accretion
 - e) photosynthesis.
31. The Earth is relatively depleted in noble gases because
- a) its present mass is too small to hold them.
 - b) they have been removed by reaction with surface rocks.
 - c) they were vaporized and lost when the Earth melted.
 - d) they were lost early on from the planetesimals that eventually accreted to form the Earth.
 - e) they have never outgassed from the Earth's interior.
32. The leading theory for the origin of Earth's Moon is
- a) gravitational capture of a large planetesimal.
 - b) fission due to rapid rotation.
 - c) impact by a large planetesimal, about the size of Mars, which spun off the Moon.
 - d) formation in the same manner as Earth, by accretion.
 - e) condensation from the Solar nebula.
33. A "runaway greenhouse" refers to
- a) what happened on Mars
 - b) what happened on Venus
 - c) a process involving a positive feedback between the amount of carbon dioxide in a planetary atmosphere and the temperature of that atmosphere.
 - d) both b) and c)
 - e) all of the above.
34. The Earth's oceans and atmosphere are considered to be secondary in origin. This means that
- a) they formed directly by condensation from the Solar nebula.
 - b) they formed by outgassing of the Earth's interior.
 - c) they formed by reaction between an earlier atmosphere and crustal rocks.
 - d) they formed by the interaction of living things with their environment.
 - e) all of the above.

35. Unlike the other planets, the Earth has oceans of liquid water. This is because
- Earth was bombarded by water-rich comets early in its history.
 - Earth inherited a primitive, water-rich atmosphere from the Solar nebula, which condensed into oceans as the Earth's surface cooled.
 - Earth formed rapidly from cold, water-rich planetesimals, and this water subsequently outgassed from Earth's interior.
 - Earth is the proper distance from the Sun, such that water can exist in the liquid state.
 - both c) and d).
36. Free oxygen in the Earth's atmosphere has been produced mainly by
- photodissociation of water and loss of hydrogen to outer space.
 - change in sea level.
 - formation of the Earth's core.
 - photosynthesis and burial of organic carbon.
 - nucleosynthesis in stars.
37. Sea level can change as a result of
- change in the rate of seafloor spreading, which produces a change in the volume of the ocean basins.
 - change in the volume of ice stored on land.
 - local, tectonically induced vertical motions of the crust.
 - change in the temperature of ocean water.
 - all of the above.
38. Most of the CO₂ ever outgassed on Earth can be found in:
- seawater
 - the atmosphere
 - rocks
 - living plants and animals
 - none of the above.
39. The reaction $\text{CO}_2 + \text{H}_2\text{O} = \text{CH}_2\text{O} + \text{O}_2$ represents:
- photodissociation
 - chemical weathering
 - photosynthesis
 - formation of petroleum
 - none of the above.
40. Four elements make up 93% of Earth's mass. They are
- iron, oxygen, silicon, and magnesium
 - iron, oxygen, magnesium, and hydrogen
 - hydrogen, helium, nitrogen, and oxygen
 - iron, nickel, calcium, and aluminum
 - oxygen, nitrogen, carbon dioxide, and water vapor.

41. From outside to inside, the Earth consists of
- a) rocky crust, brittle lithosphere, plastic asthenosphere, solid metal outer core, liquid metal inner core.
 - b) rocky crust, rocky mantle, liquid metal outer core, solid metal inner core.
 - c) rocky crust, liquid mantle, plastic asthenosphere, solid outer core, solid inner core.
 - d) rocky crust, liquid asthenosphere, plastic mantle, liquid outer core, solid inner core.
 - e) none of the above.
42. The principal of isostasy states that
- a) the Earth's surface is dominated by two levels: the continents and the oceans.
 - b) the lithosphere is in gravitational equilibrium through a buoyancy mechanism, with compensation occurring in the asthenosphere.
 - c) crust is produced by differentiation from the mantle, by upwelling and solidification of molten rock.
 - d) if the Earth were perfectly smooth, it would be covered by nearly 3000 m of ocean water.
 - e) 25% of the continental crust presently lies below sea level.
43. The oceanic crust is composed mainly of
- a) deep-sea ooze
 - b) andesite
 - c) basalt
 - d) granite
 - e) calcium carbonate.
44. The Earth would probably have no continents if it did not have
- a) life
 - b) an atmosphere
 - c) oceans and subduction
 - d) both a and b
 - e) all of the above
45. The three main settings on Earth where active volcanoes occur are
- a) abyssal plains, abyssal hills, and continental margins
 - b) Hawaii, Iceland, and the Andes
 - c) mid-ocean ridges, subduction zones, and hotspots
 - d) convergent, divergent, and conservative plate boundaries
 - e) Indonesia, Japan, and eastern Australia
46. Atolls are
- a) formed by coral reefs built on a submarine volcano
 - b) ring-shaped islands of coral reefs and reef-derived sediment
 - c) submerged seamounts with flat tops, cut off by wave action
 - d) both a and b
 - e) a, b, and c

47. Alfred Wegener was the chief proponent of the theory of
- a) the shrinking Earth
 - b) seafloor spreading
 - c) continental drift
 - d) plate tectonics
 - e) mantle plumes
48. Continental drift theory experienced a revival in the 1950's as a result of new evidence that
- a) animals had crossed from Africa to South America via land bridges.
 - b) the Earth's magnetic poles had apparently wandered through time, but the paths inferred were different for different continents.
 - c) the Earth's magnetic field had reversed polarity repeatedly in the past.
 - d) the Earth was rotating on its axis, which corresponds to the geographic and magnetic poles.
 - e) all of the above.
49. The continents drift because
- a) they "plow through" the ocean basins in response to "polflucht".
 - b) of convection in the Earth's outer core.
 - c) they ride passively on the lithospheric plates, which are moving relative to one another and the mantle.
 - d) the Earth's magnetic field reverses its polarity.
 - e) all of the above.
50. Which of the following supports the hypothesis of seafloor spreading?
- a) the elevated topography of mid-ocean ridges.
 - b) absence of sediment along the mid-ocean ridge axis.
 - c) evidence for earthquakes and volcanism along the mid-ocean ridge axis.
 - d) a valley along the mid-ocean ridge axis, formed by normal faulting and extension.
 - e) all of the above.
51. The theory of plate tectonics
- a) is a unifying theory for the Earth sciences
 - b) holds that the Earth's surface consists of a dozen or so rigid plates
 - c) holds that most mountain-building occurs along plate boundaries
 - d) holds that the lithospheric plates ride on the asthenosphere
 - e) all of the above
52. The three major types of plate boundaries are
- a) conservative, transform, slipslide
 - b) continental-continental, oceanic-oceanic, continental-oceanic
 - c) divergent, convergent, conservative
 - d) constructive, destructive, conservative
 - e) both c) and d).

53. Which of the following terms consistently describe a mid-ocean ridge?
- a) shallow earthquakes, basaltic volcanism, young crust, sediment absent to thin
 - b) shallow earthquakes, andesitic volcanism, young crust, thick sediment
 - c) shallow to deep earthquakes, andesitic volcanism, older crust, thick sediment
 - d) shallow to deep earthquakes, basaltic volcanism, older crust, thin sediment
 - e) no earthquakes, no volcanism, older crust, thick sediment
54. Continents are built by
- a) andesitic volcanism at subduction zones
 - b) basaltic volcanism at mid-ocean ridges
 - c) accretion of exotic terranes onto their margins
 - d) outgassing of volatiles from the Earth's interior
 - e) both a and c
55. Recent studies have shown that the main driving force for the Pacific Plate is
- a) ridge push.
 - b) slab pull.
 - c) gravity sliding.
 - d) drag at the base.
 - e) push by mantle plumes.
56. Plate tectonics has important implications for
- a) global patterns of ocean circulation
 - b) global sea level
 - c) global climate
 - d) distribution of living and fossil organisms
 - e) all of the above
57. The main theory that explains hotspots is
- a) the shrinking Earth
 - b) seafloor spreading
 - c) continental drift
 - d) plate tectonics
 - e) mantle plumes
58. Continent-continent collisions
- a) result when the ocean basin between them is consumed by subduction.
 - b) cause the crust to thicken locally, as continental crust is too thick and buoyant to subduct.
 - c) cause the subducting lithospheric slab to break off, after which it continues to descend on its own.
 - d) can cause a reorganization of plate motions.
 - e) all of the above.

59. Regarding its origin, most sediment in the oceans, including the continental margins, is

- a) terrigenous.
- b) biogenic.
- c) volcanogenic.
- d) cosmogenic.
- e) none of the above.

60. The carbonate compensation depth, or CCD, is

- a) the depth at which calcium carbonate dissolves in the oceans.
- b) the depth at which calcium carbonate sediment is replaced by siliceous ooze.
- c) the depth at any point in the oceans where the rate of delivery of calcium carbonate is equal to the rate at which it dissolves.
- d) the depth above which calcium carbonate can accumulate, and below which it cannot.
- e) both c) and d).

