

Name _____

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Remember to also CODE your computer scan sheet with your Student ID Number and only use a #2 pencil.

Multiple Choice: 1 Point each. Make sure to read all the answers before you choose one. Also make sure to mark your answers clearly on the scan-tron. If they are not marked clearly, the computer will grade them wrong. We also encourage you to mark the answer to each question on your exam paper in case there are questions about the scan-tron sheets.

1. Hydrogen and helium account for about _____ of the composition of the universe.
 - a) 2%
 - b) 50%
 - c) 98%
 - d) 99.8%
 - e) none of the above

2. The continental rise is:
 - a) A type of trench found at high latitude
 - b) A ridge created by the formation of new crust
 - c) A wedge of sediment at the base of the continental slope
 - d) An uplifted sedimentary basin
 - e) None of the above

3. Free Oxygen in the Earth's atmosphere is thought to have accumulated **mainly** through:
 - a) Photodissociation of water and loss of hydrogen to outer space
 - b) Change in sea level
 - c) Formation of the earth's core
 - d) Photosynthesis and burial of a small fraction of the organic carbon
 - e) Nucleosynthesis in stars

4. The Earth, from the center outward, is composed of the following layers:
 - a) Inner core, outer core, mantle, crust
 - b) Inner core, outer core, mesosphere, lithosphere
 - c) Core, mantle, asthenosphere, crust
 - d) Core, mantle oceanic crust, continental crust
 - e) Core, mantle, asthenosphere, troposphere

5. The Hawaiian-Emperor seamount chain is thought to have been created by:
 - a) A subduction zone
 - b) A mid-ocean ridge
 - c) A hot-spot
 - d) A transform fault
 - e) None of the above

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6. Continents are built by:

- a) Basaltic volcanism at subduction zones
- b) Volcanism in large igneous provinces
- c) Accretion of terranes onto the margins of existing continental masses
- d) Andesitic volcanism at spreading centers
- e) Both b and c

7. We know that the outer core of the earth is liquid in part because:

- a) No earthquakes occur there
- b) The plates move
- c) Seismic "s" waves do not propagate through it
- d) Mantle plumes start there
- e) The increased pressure melts the rock into a liquid

8. In approximately 50 My, plate tectonics is predicted to result in which of the following:

- a) The Atlantic Ocean will be larger than it is now
- b) The Mediterranean Sea will be closed (i.e., Africa will be connected to Europe)
- c) The Pacific Ocean will have closed
- d) Both a and b
- e) Both b and c

9. 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 of the mantle, upwelling and solidifying of molten rock
- d) If the earth were perfectly smooth, it would be covered by nearly 3000 m of ocean water
- e) As you move north along the Hawaiian island chain, islands get smaller until they are below sea level

10. Evidence that the earth has two kinds of crust comes from

- a) Seismology
- b) The hypsometric curve
- c) The moon
- d) Both a and b
- e) All of the above

11. In 1966, Matthews & Vine presented evidence that finally convinced geologists that sea-floor spreading is real. This evidence involved:

- a) Direct sampling of ocean floor crustal rocks
- b) Earthquake patterns at deep-sea trenches
- c) Magnetic patterns measured at oceanic ridges
- d) Patterns of coral reef growth and development
- e) Gravity measurements taken at sea

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12. The main proponent of the theory of continental drift was:
- a) Joseph Banks
 - b) Charles Darwin
 - c) Harry Hess
 - d) John Tuzo-Wilson
 - e) None of the above
13. The rock type associated with mid ocean ridges is
- a) Andesite
 - b) Basalt
 - c) Marble
 - d) Pyrite
 - e) Sandstone
14. The major forces driving the plates in the theory of plate tectonics are:
- a) Inertia and mass balance
 - b) Convection currents and centrifugal force
 - c) Slab pull and convection currents in the mantle
 - d) Refraction and isostasy
 - e) Diagenesis and blue shift.
15. The San Andreas Fault, in California is an example of a:
- a) Back arc basin
 - b) Good spot to buy real estate
 - c) Passive margin
 - d) Spreading center
 - e) Transform fault
16. After the earth formed, the distribution of matter changed with:
- a) Andesite going to the mantle and basalt to the core
 - b) Denser material going inward and lighter material towards the surface
 - c) Nickel and iron remaining in the crust, and silica and basalt sinking.
 - d) Oxygen sinking into the mantle, to be released later through degassing.
 - e) None of the above
17. The element gold is thought to have formed
- a) During nuclear fusion in our Sun
 - b) During the "Big Bang"
 - c) During Super Nova explosions
 - d) In the center of the Earth
 - e) All of the above

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18. The fact that the average thickness of sediment on the ocean floor is only ~600 m implies that:

- a) The earth is expanding
- b) The ocean floor is relatively young
- c) The earth is heating up
- d) Sediments are dissolving nearly as quickly as they are being produced
- e) None of the above

19. The Wadati-Benioff Zone:

- a) Is the high velocity layer between the lithosphere and the asthenosphere
- b) Is the “shadow area” where p waves do not appear after an earthquake
- c) Is the “shadow area” where s waves do not appear after an earthquake
- d) Is an area of earthquakes associated with a subducting lithospheric plate as it enters the asthenosphere
- e) Is the zone of seismic and volcanic activity that encircles the Atlantic Ocean.

20. Nebulae are:

- a) Found in the ring of meteors between Earth and Mars
- b) Formed during Supernovas
- c) Large clouds of dust and gas
- d) Siliceous organisms that settle to the ocean floor to form siliceous ooze
- e) The first forms of life to appear on earth, and can be found in fossils in Northern Canada

21. Continental crust is most likely formed:

- a) At the core-mantle boundary and requires the addition of liquid water.
- b) By a single stage of differentiation of molten material from the outer core
- c) By a single stage of differentiation of upper mantle material
- d) By two stages of differentiation in mantle wedges above subducting oceanic crust
- e) By volcanism at hot spots

22. The following particle sizes are in order of smallest to largest

- a) Boulder, pebble, cobble, clay
- b) Clay, sand, granule, cobble
- c) Clay, granule, sand, silt
- d) Pebble, cobble, silt, clay
- e) None of the above

23. Terrigenous material can reach the ocean by

- a) Rivers
- b) Wind
- c) Glaciers
- d) Turbidity currents
- e) All of the above

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24. Cosmogenic sediments:

- a) Are composed of belemnites, granite, and tektites
- b) Are abundant in the sedimentary record at the permo-jurassic boundary
- c) Are from outer space
- d) Are found almost exclusively in the Pacific Ocean
- e) A, b and c

25. Most atolls in the Pacific are believed to have formed by

- a) Coral growth on banks built up by sediments
- b) Coral growth on subsiding volcanic foundations
- c) Global Thermal Subsidence
- d) Nuclear testing
- e) All of the above

26. Earthquakes associated with the descending plate at a convergent plate margins can occur as deep as:

- a) 7-10 km
- b) 70-100 km
- c) 300-700 km
- d) Up to 1000 km
- e) All of the above

27. A typical depth for deep-sea abyssal plains is approximately:

- a) 130 m
- b) 4000-5000 ft
- c) 4000-5000 m
- d) 7 km
- e) 35 km

28. Turbidity currents lead to the formation of:

- a) Graded deposits
- b) Sediment fans
- c) Submarine canyons
- d) All of the above
- e) None of the above

29. In which of the following do earthquakes not generally occur?

- a) At fracture zones
- b) At transform faults
- c) At mid ocean ridges
- d) At Wadati-Benioff zones
- e) They occur in all of the above

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30. The transition between a continental shelf and slope is known as:

- a) An abyssal plain
- b) A bank
- c) The continental rise
- d) The shelf break
- e) None of the above

31. The density of oceanic crust material is approximately:

- a) 4.5 g/cm^3
- b) 2.9 g/cm^3
- c) 12.9 g/cm^3
- d) 2.7 g/cm^3
- e) None of the above

32. The Curie point is:

- a) The direction to which magnetic minerals in rocks point
- b) The place where Marie Curie discovered radioactivity
- c) The temperature at which basalt freezes during the formation of oceanic crust
- d) The temperature below which the orientation of magnetic minerals in rocks is fixed.
- e) The temperature at which magma begins to circulate in convection cells in the mantle

33. The largest volcanic edifice in the world is:

- a) Fujiyama
- b) Kilauea
- c) Mount Pinatubo
- d) Mount St Helens
- e) None of the above

34. The determination of longitude requires an accurate knowledge of:

- a) Latitude
- b) Ship speed
- c) Time
- d) Water depth
- e) None of the above

35. The age of the universe is estimated to be about:

- a) 6000 years
- b) 4.5 million years
- c) 4.5 billion years
- d) 13.8 million years
- e) 13.8 billion years

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36. A seismograph mounted in a submarine would not be able to detect:

- a) Earthquakes
- b) Electromagnetic waves
- c) Gravity waves
- d) P-waves
- e) S-waves

37. Which of the following helped Captain Cook navigate more accurately than many of his predecessors?

- a) An accurate compass
- b) A better navigator
- c) A chronometer
- d) Better charts
- e) None of the above

38. Overall, the Pacific plate moves at approximately which speed?

- a) 1-2 cm/yr
- b) 2-4 cm/yr
- c) 8-10 cm/yr
- d) 15-20 cm/yr
- e) None of the above

39. Continental crust is approximately how thick?

- a) 6 km
- b) 11 km
- c) 35 km
- d) 70-100 km
- e) None of the above

True and False Questions. 1 Point Each mark A=True OR B=False

40. Scientific theories are always subject to challenge and may be overturned.

41. Yellowstone is an example of a hot spot.

42. Lava exits from Kilauea volcano vents at temperatures exceeding 2000 °F

43. The bend in the Hawaii-Emperor seamount chain is due to a reversal of the magnetic field of the earth, which occurred 20 million years ago.

44. Erosion from continents is a significant source of sediment in the oceans.

45. Turbidity currents help carve submarine canyons and take sediment from the continental shelf to the deep sea floor.

46. The age of the earth, the moon, and meteorites is nearly the same, within error margins of our dating methods

47. Early Polynesian navigators were able to navigate accurately by excellent observation of stars, waves, winds, and current patterns and did not use magnetic compasses.
48. Explosive volcanism is associated with Pacific type continental margins.
49. The island of Oahu was once a guyot.
50. Solar luminosity has increased over the last 4 billion years.
51. The lithosphere is usually described as “plastic” and is about 7-35 km thick.
52. Atlantic type continental margins are lithospheric plate boundaries.
53. The oldest rocks on the seafloor are much older than the oldest rocks from the continents.
54. Continental crust is the thinnest below large mountain ranges.
55. The Pacific Ocean is deeper (on average) than the Atlantic Ocean.
56. Sediments are much thicker in the Atlantic Ocean than in the Pacific Ocean.
57. Turbidity currents are a kind of landslide.
58. Hot spots provide a measure of absolute plate motion relative to the mantle
59. The Molokai Fracture zone is the line dividing West Molokai Volcano from East Molokai Volcano
60. Radioactivity in the deep Earth is one potential source of heat driving mantle plumes.

Fill in the blanks (1 point for each question).

61. Provide one of the three main causes of global sea level change: _____
62. Changes in the extent of volcanism on our planet over the past 500-600 million years have been associated with major _____.
63. The majority of the sediment in the Atlantic Ocean is located on the _____.
64. _____ is a method that scientists can use to estimate the distance the Earth is from a nearby star.
65. The _____ River and the _____ River account for about 25% of the freshwater discharge into the world oceans.

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Essay Questions. Please answer in the spaces provided.

66. What were some of the lines of evidence used by Wegener and other proponents of continental drift to support this theory?

Please be very clear. (5 pts).

67. Draw a typical convergent plate boundary between continental and oceanic crust. Label the major parts, show directions of movement, and provide the name a specific geographical location on earth where the boundary you sketched can be found (5 pts).

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For Version two of the exam and use the following essay questions:

66. What were some of the reasons that North American and European scientists discounted Wegener's theory of continental drift? (5pts)

67. Sketch a divergent plate boundary. Label the major parts, show directions of movement and provide the name a specific geographical location on earth where the boundary you sketched occurs (5 pts).