OCEANOGRAPHY 201; Spring, 2019

Exam #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 1: True/False (1 point each = 20 points). Mark (a) for "true" and (b) for "false".

1. The idea that the planets revolved around the sun was introduced as early as 280 BC
2. The Polynesian first settled Hawaii around 500 BC
3. The most common element on Earth is Silicon (Si)
4. The Earth is estimated to be about 4.5 billion years old
5. Posidonius conducted the first bathymetric studies in 85 BC
6. In the early 20th century most thought that the continents moved over the sea floor
7. The Earth’s magnetic field is an example of a geodynamo
8. Transform faults occur because the Earth is round and spreading centers tend to be straight
9. Continental margins are only ~21% of the ocean area, but have ~87% of the seafloor sediments
10. Transgression in marine geology means progressive draining of land
11. Wave erosion works to straighten coastlines
12. The biological pump transports nutrients from the surface ocean to the ocean interior
13. Prior to the industrial revolution, the ocean was a net sink for CO2
14. An ion is any element or compound with a charge
15. Slow spreading ridges are tall and narrow, with a well-defined central rift valley
16. Rip currents occur when water forced up the beach returns out to sea
17. Chlorine is primarily introduced to the ocean by rivers
18. Three quarters of the world’s mega-cities are on the coast
19. Sea level changes reflect both local and global changes
20. Continental crusts are generally made of basalt
PART 2: Multiple Choice (1 point each = 40 points).

21. A well-substantiated explanation of some aspect of the natural world that includes observations, inferences and experimental evidence (i.e. the endpoint of science) is:

A) hypothesis  
B) theory  
C) fact  
D) prediction

22. Scientific advancement was set back 1000 years by this event in ~400 AD.

A) The introduction of a theory that suggested the earth was the center of the universe with the planets and the stars circling around the Earth  
B) The spread of the Christian religion  
C) The fall of the Roman Empire and the burning of the Alexandria library  
D) The dismissal of the theory of continental drift

23. The Polynesian navigation techniques were:

A) a tightly guarded secret  
B) shared among the Ali‘i to ensure the knowledge was not lost  
C) recorded in ancient petroglyphs  
D) discussed with trade partners to develop improved techniques

24. The two types of referencing systems for navigating back to your home village were:

A) star-guided and wave-guided  
B) home-centered and self-centered  
C) dead reckoning and reference points  
D) wave refraction/reflection and island indicators (e.g. birds and cloud formations)

25. The element produced from hydrogen fusion is:

A) oxygen  
B) tritium  
C) helium  
D) carbon

26. Which theory for how Earth’s moon formed is thought to be correct today.

A) formation as a result of collision  
B) spin off a piece of Earth because of rapid rotation  
C) simultaneous formation by accretion  
D) capture into orbit by gravity

27. Seismic P waves are:
A) compressional waves  
B) Faster than S waves  
C) can travel through solid or liquid  
D) all of the above

28. The ocean is estimated to have formed about:

A) 4 million years ago  
B) 4 billion years ago  
C) 400 million years ago  
D) 40 billion years ago

29. The lithosphere is composed of:

A) the rigid crust  
B) plastic mantle  
C) the rigid upper mantle  
D) A and C

30. Which of the following statements is NOT true about the Pacific Ocean seafloor:

A) split nearly symmetrically by mid-ocean ridge  
B) deepest of all the major ocean basins  
C) has the most trenches, including the deepest spot in the ocean  
D) has relatively narrow continental shelves

31. The supercontinent proposed by Alfred Wegner was called:

A) Gondwana  
B) Panthalassa  
C) Pangaea  
D) Laurasia

32. Radiometric dating of the seafloor in the 1970s revealed that the ocean floor was surprisingly:

A) deep  
B) rough  
C) young  
D) old

33. Harry Hess and Robert Dietz in the early 1960s proposed the idea of:

A) mantle convection driving seafloor spreading  
B) paleomagnetic stripes in the seafloor from magnetic pole reversals  
C) using the edge of the continental shelves to match up the shapes of the continents  
D) continental drift

34. Slow spreading ridges have:
A) broad, gentle slopes and poorly defined central rift valleys
B) tall, narrow slopes and well defined central rift valleys
C) fewer transform faults than fast ridges
D) deeper slope faces than fast ridges

35. Which of the following is NOT a major lithospheric plate?

A) Pacific
B) Eurasian
C) Arctic
D) Antarctic

36. Which is NOT true of the Hawaiian Islands:

A) The islands are formed as the Pacific plate moves over a mantle hot spot
B) The islands get progressively older toward the north
C) As the islands move off the hot spot they cool and sink
D) The Hawaiian Island-Emperor seamount chain documents that the Pacific plate has been moving in the same direction for at least the last 75-81 million years

37. Most marine sediments are made up of the following size classifications:

A) sand, silt, clay
B) sand, granule, pebble
C) cobble, pebble, granule
D) pebble, sand, clay

38. The carbonate compensation depth is:

A) the depth below which corals that produce carbonate reefs can no longer grow
B) the depth where the rate that carbonate particles are delivered to the seafloor equals the rate that these particles dissolve in the sediments
C) the depth where carbonate particles start to be preserved in seafloor sediments
D) the depth where carbonate sediments dominate over silica sediments

39. Which is NOT a step in the terrigenous sediment cycle?

A) transport
B) deposition
C) aggregation
D) erosion

40. Biostratigraphy is based on:

A) age of the materials in the rocks
B) identification of physical boundaries in rocks
C) stable isotope composition in the rocks
D) identification of fossil species in the rocks

41. Which is NOT typically a feature of an erosional coast?

A) sea stack  
B) barrier island  
C) wave-cut platform  
D) sea cliff

42. A salt wedge estuary is characterized by:

A) Rapidly flowing river, low to moderate tidal range  
B) slow river flow, tidal range moderate to high  
C) deep U shaped valley where river water flows at the surface with little mixing with seawater  
D) deep estuary with high river flow and high tidal range

43. Which is NOT a major ion in seawater?

A) chlorine  
B) sodium  
C) potassium  
D) magnesium

44. Seawater density increases with:

A) increasing salinity and decreasing temperature  
B) decreasing salinity and decreasing temperature  
C) increasing salinity and increasing temperature  
D) increasing particle loads and increasing temperature

45. AOU stand for:

A) alternative ocean units  
B) apparent oxygen utilization  
C) advanced organic usage  
D) apparent over use

46. Who developed the idea of stoichiometric ratios in ocean nutrients in 1934?

A) Henry Hess  
B) John Martin  
C) Alfred Redfield  
D) James Hutton

47. On time-scales of a few hundred years, the primary sink for fossil fuel CO₂ is:

A) the ocean  
B) the atmosphere
C) terrestrial biosphere  
D) rocks  

48. Ocean acidification is the lowering of ocean pH because of:  

A) the warming of ocean waters  
B) the addition of sulfur from the burning of fossil fuels  
C) the addition of HCl from hydrothermal vents  
D) the addition of CO₂ from burning fossil fuels  

49. What is the residence time of Calcium ($\text{Ca}^{+}$) in seawater? Note that the mass of $\text{Ca}^+$ in the ocean is $574 \times 10^9$ g and the mass entering the ocean each year through river water (the only input for this calculation) is $555 \times 10^3$ g.  

A) $\sim 1,000$ years  
B) $\sim 1,000,000$ years  
C) 10,000,000 years  
D) 100,000,000 years  

50. Oceanic trenches are most abundant in the:  

A) Pacific Ocean  
B) Atlantic Ocean  
C) Indian Ocean  
D) they are equally abundant in all oceans  

51. This feature marks the transition between continental and oceanic crust:  

A) continental shelf  
B) continental slope  
C) shelf break  
D) continental rise  

52. Which does NOT describe what happens with the death of a massive star?  

A) elements heavier than iron are created  
B) a planetary nebula is formed  
C) there is a supernova  
D) the hydrogen fuel runs out after just a few million years  

53. Most terrigenous sediments are transported to the ocean by:  

A) ice rafting  
B) rivers  
C) wind  
D) turbidity currents
54. Areas where tectonic plates slide past each other are called:

A) spreading centers  
B) transform faults  
C) converging centers  
D) block faults

55. The Micronesian stick chart was used to understand:

A) the direction of the wind at different times of year  
B) the physical location of all the islands  
C) reflection and refraction of waves off the islands  
D) the location of the stars

56. Which is NOT a step in the scientific method?

A) make observations  
B) formulate hypothesis  
C) gather data to test predictions  
D) publish results

57. The theory that the planets revolve around the Sun is called:

A) Heliocentric system  
B) Epicycle system  
C) Central fire system  
D) Aristotle’s Universe

58. Who developed the theory of atoll formation?

A) Alfred Wegner  
B) Charles Darwin  
C) Arthur Holmes  
D) James Hutton

59. How many mass extinction/ocean acidification events have occurred over geologic time?

A) 1  
B) 10  
C) 20  
D) 5

60. The great ocean conveyor belt refers to:

A) when organisms take up nutrients in the deep ocean and transport it to the deep ocean
B) ocean currents that move water down into the ocean interior in the Atlantic, along the deep sea, then rising in the North Pacific, then returning to the Atlantic via surface currents
C) the movement of dust from land to the ocean where it provides essential micronutrients
D) the network of currents that circulate water within an ocean basin

PART 3: Short-Answer Questions. Answer the two questions on the following pages entirely within the space provided. Think your answer through before starting to write. Write legibly—print if your handwriting is poor, because if the grader can't read it, it will be marked wrong.
61. The figure below shows a wedge of Earth with two different classifications on the left and right. Please label all of the blank lines on the figure with the letter of the appropriate item listed on the bottom left of the figure. Note that all items will be used at least once, but some items may be used more than once (10 points).
62. Briefly describe Wegener’s theory of Continental Drift. Be sure to provide the various lines of evidence he used in support of his theory, but be careful not to list lines of evidence that were developed after he published his theory. Also give the major flaw in this theory (5 points).