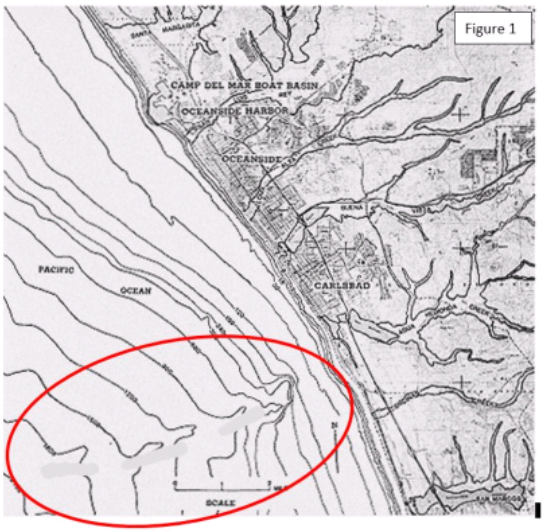
1. (1.00 pts)



What feature is shown in the above map (in the region circled)?

Submarine Canyon

2. (1.00 pts) Choose the answer that you think answers the question best:

2) Which of the following is true about the feature shown in figure 1?

a) They are only formed along active margins

b) They only form in regions with mountains directly along the coast

c) They occur in regions where there is a high sediment burden that could lead to turbidity currents

d) They can be as large as the Grand Canyon is on land

e) A and C above

f) B and D above

g) C and D above

h) All of the above

i) None of the above

G

3. (1.00 pts) 3) Select all of the following that are shallow water waves:

(Mark **ALL** correct answers)

- [ ] A) a) A wave with a wavelength of 20 m in water 15 meters deep
- [x] B) b) A tsunami with a wave height of 3 meters
- [x] C) c) The tides
- [x] D) d) A wave with a wavelength of 200 m in water 50 meters deep

4. (1.00 pts) Select the best option to answer the question and fill it in the blank:

4) Which of the following is not true about mid-ocean ridges?

a) Because of subduction, not all ridges have the symmetric magnetic anomalies exposed

b) All mid-ocean ridges include a central rift valley that is lower than the highest points in the ridge

c) Fracture zones surround mid-ocean ridges where inactive strike-slip faults mark offsets in magnetic anomalies

d) The youngest oceanic crust is the world is found near the center of mid-ocean ridges

e) Mid-ocean ridges can be associated with black smokers

f) None of the above is false

g) All of the above are false

B

5. (1.00 pts) 5) Select all of the following that are among the 7 ions that make up over 90% of the dissolved solids in seawater.

(Mark **ALL** correct answers)

- [x] A) Chloride
- [ ] B) Iron (+2)
- [x] C) Sulfate
- [x] D) Bicarbonate
- [ ] E) Bromide
- [x] F) Potassium

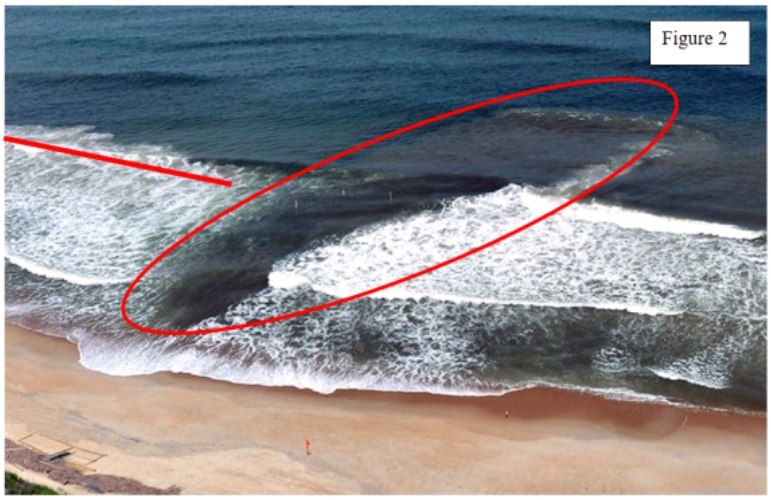
6. (1.00 pts) 6) Why is the concentration of some nutrients (Such as NO3-) extremely low in the uppermost portions of the water column?

- ( ) A) a) The source of those nutrients is found at the bottom of the ocean and they don't percolate up the water column very well because of the ocean's stratification
- (•) B) b) The high biologic activity in the uppermost portion of the water columns leads to them rapidly being depleted
- ( ) C) c) Although sourced at a shallow depth, they are significantly heavier than the surrounding sea water, causing them to sink out of the upper portions of the water column
- ( ) D) d) The nutrients are lost to the atmosphere in the uppermost portion of the water column
- ( ) E) none of the above

7. (1.00 pts) 7) The formation of which water mass near Greenland is thought to be in danger as global climate change continues? (give the full name)

North Atlantic Deep Water

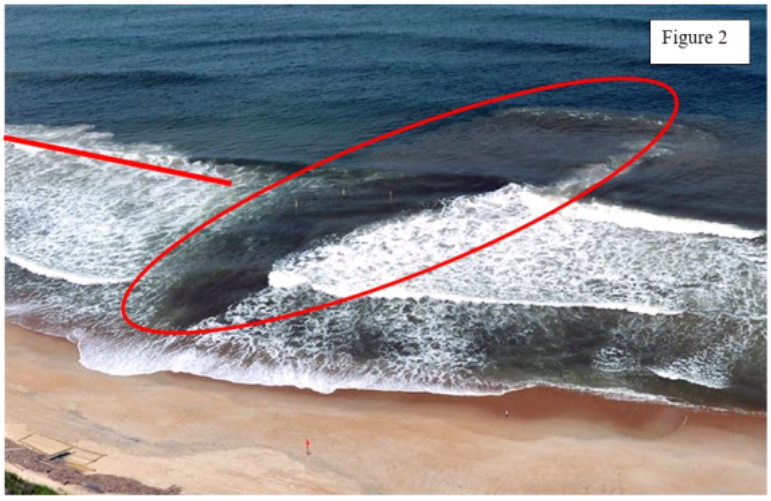
8. (1.00 pts)



8) Based on the image in figure 2, what is likely found in the circled portion of the image?

Rip Current

9. (1.00 pts) 9)



Based on the above image, what is likely along the sea floor roughly along the line in figure 2?

- [x] A) a) A sand bar or reef
- [ ] B) b) A trough in the offshore sediment deposits
- [ ] C) c) The shelf break
- [ ] D) d) A shipwreck
- [ ] E) e) The above image gives no indication of what might be under the line in figure 2

10. (1.00 pts) At which of the following locations would fishing be the most advantageous and why?

- [ ] A) a) In a zone of coastal downwelling because the warm surface water would extend deeper allowing increased plant growth
- [ ] B) b) In a zone of coastal upwelling because fish would be forced by the current to come to the surface
- [ ] C) In a zone of coastal downwelling because the surface nutrients would be better spread through the water column
- [x] D) d) In a zone of coastal upwelling because nutrients are brought up to the surface along with the water spurring growth
- [ ] E) e) In the center of a sub-tropical gyre because the open ocean and slight upwelling provides needed space for growth along with nutrients
- [ ] F) None of the above

11. (1.00 pts) 11) All energy input into the ocean is eventually output. When radiation occurs out of the ocean, it is most likely to fall in which of the following wavelengths?

- [ ] A) Ultraviolet Light
- [ ] B) Visible Light
- [x] C) Infrared waves
- [ ] D) Radio waves
- [ ] E) Microwaves
- [ ] F) All of these occur in equal proportion

12. (1.00 pts)
12) In which type of estuary is the difference between the strength of the freshwater input and the strength of the saltwater input the largest (with the freshwater input being stronger)?

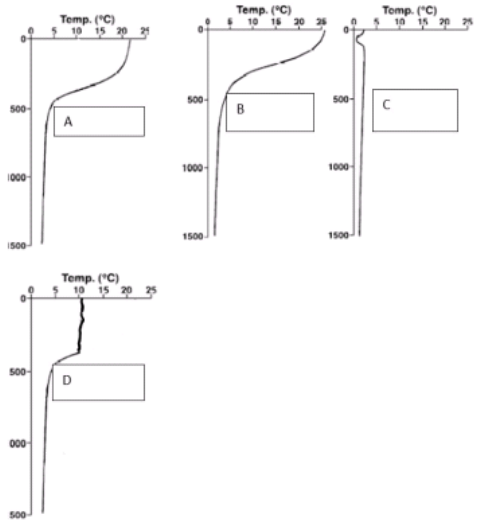
- [ ] A) Well mixed estuary
- [ ] B) Partially mixed estuary

C) Salt wedge estuary

D) Fjord

E) e) There are no estuaries where the freshwater input is stronger than the saltwater input

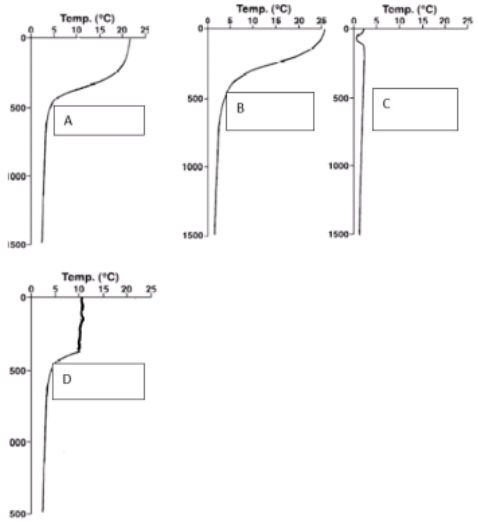
13. (1.00 pts) Which profile is most likely to have been the temperature profile taken at 40 degrees North? (Give the letter)



Profiles were collected in July

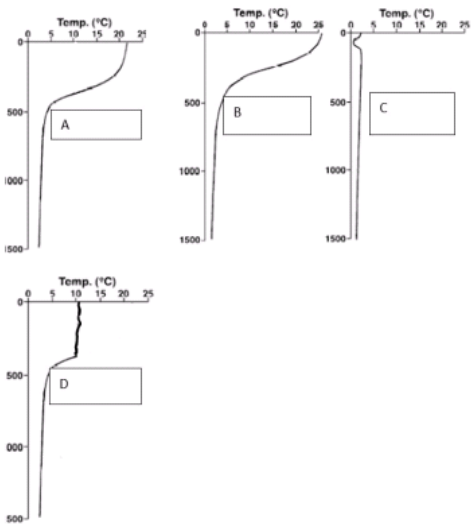
A

14. (1.00 pts) Which profile is most likely to have been the temperature profile taken at 80 degrees North?



C

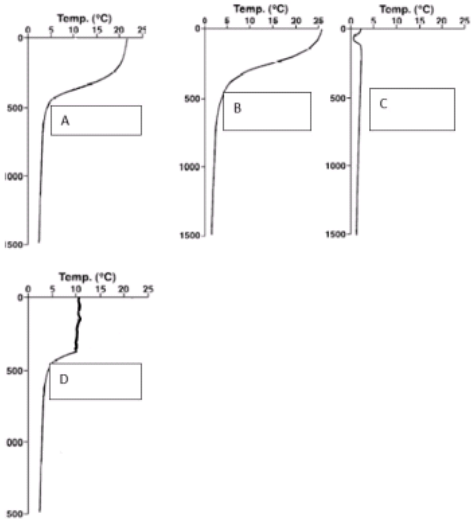
15. (1.00 pts) Which profile is most likely to have been the temperature profile taken at 10 degrees North?



Profiles were collected in July

B

16. (1.00 pts) Which profile is most likely to have been the temperature profile taken at 40 degrees south?



Profiles were collected in July

D

17. (1.00 pts) 17) Why does the majority of the US Pacific coast experience mixed tides while most of the US Atlantic Coast experiences semi-diurnal tides?

- A) The US Atlantic coast has a broad continental shelf, leading to its semi-diurnal tides
- B) The oscillation that occurs in the Atlantic basin aligns on a period that is roughly the same as the semi-diurnal tides, amplifying both high tides, while the Pacific basin's oscillation is aligned with only one high tide a day
- C) The difference in the size of the Pacific basin means that there is an increased time for waves to cross the Pacific basin compared to the Atlantic leads to the difference
- D) The US Atlantic coast is largely a depositional coast while the US Pacific coast is largely an erosional coast, this difference changes the reaction to the tidal bulges
- E) None of the above

18. (1.00 pts)

18) In the above diagram, which letter most closely approximates the location of the center of rotation for a gyre like the North Atlantic gyre (point B is meant to be the exact center of the basin, and north is up)?

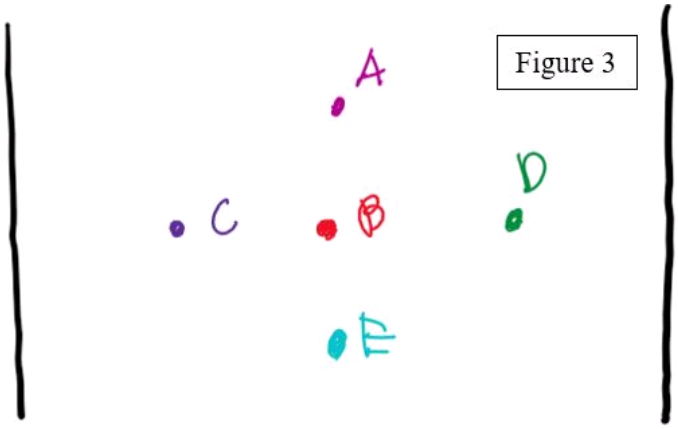


Figure 3

- A) A
- B) B
- C) C
- D) D
- E) E

19. (1.00 pts) 19) Which of the following could be dangerous to fisheries and could show up on an image of an ocean gathered by a satellite colorimeter?

- A) a) High concentrations of dissolved CO2
- B) b) Harmful algal blooms
- C) c) Decreased currents
- D) d) Changes in wind patterns
- E) e) Low levels of nutrients

20. (1.00 pts) Select the best answer:

20) The central lagoon of an atoll is not filled in with coral over because of which of the following

a) The central lagoon can get too hot for the coral to grow

b) The central lagoon can periodically become too fresh after rain for coral growth

c) The central lagoon becomes too acidic for coral growth

d) There are fewer feeding options for the coral in the middle of the lagoon

e) A and B

f) A and C

g) All of the above

h) None of the above

E

21. (1.00 pts) 21) The oldest oceanic crust in the ocean is significantly younger than the oldest continental crust found on land. Why is this?

- A) a) Oceanic crust is not as chemically stable as continental crust, so it breaks down more quickly
- B) b) Subduction zones recycle oceanic crust more efficiently than continental crust
- C) c) Continental crust isn't actually older than oceanic crust, it just looks like it is because of the isotopic systems used to determine the ages in the rock
- D) d) The continents existed before the ocean, so continental crust is older than oceanic crust
- E) e) None of these

22. (1.00 pts) 22) Which of the following explains why 80% of tsunamis occur in the Pacific Ocean Basin?

A) a) The Pacific Ocean contains 80% of the global ocean's earthquakes, so it naturally has 80% of the ocean's tsunamis

B) b) The Pacific Ocean's wider basin allows for more space for tsunamis to form and spread out

C) c) The Pacific Ocean is surrounded by a ring of subduction zones, which result in an increased risk of tsunamis

D) d) The Atlantic Ocean and Indian Ocean are shallower and can't support as much tsunami generation

E) e) None of the above

23. (1.00 pts) 23) The coastline of an atoll is considered a:

A) a) Primary coastline

B) b) Secondary coastline

C) c) Tertiary coastline

D) d) Any of the above, it depends on where the atoll is in relation to a plate boundary

E) e) None of the above

24. (1.00 pts) 24) Which of the following is the explanation of the relatively low salinity in the ocean near the equator?

A) a) The converging atmospheric circulation near the surface causes air to subside lowering the occurrence of precipitation along the equator and decreasing the cloud cover

B) b) The converging atmospheric circulation near the surface causes air to rise increasing the occurrence of precipitation along the equator and increasing the cloud cover

C) c) The diverging atmospheric circulation near the surface causes air to subside lowering the occurrence of precipitation along the equator and decreasing the cloud cover

D) d) The converging atmospheric circulation near the surface causes air to rise increasing the occurrence of precipitation along the equator and increasing the cloud cover

E) e) The equator is a region wit the largest input from rivers, lowering the salinity

F) f) None of these

25. (1.00 pts) 25) Fringing reefs tend to form preferentially on the _____ side of tropical islands

A) a) Northern

B) b) Southern

C) c) Leeward

D) d) Windward

E) e) Rainy

26. (1.00 pts) The abrupt bend to the north of the Hawaii-Emperor seamount chain is believed to have been caused by

A) a) A change in the motion of hotspot under the Pacific plate caused by the collision of India with Eurasia

B) b) The hotspot jumping from one source to another

C) c) A change in the motion of the Pacific plate believed to be caused by the collision of India with Eurasia

D) d) A change in the motion of Pacific plate motion believed to be caused by the start of motion on the San Andreas fault

E) e) None of these would cause such a large disruption of the Hawaii-Emperor seamount chain

27. (2.00 pts)
For the following questions, fill in the blanks with the term or phrase that is most appropriate.

Humans often construct a series of _____ along the shore to protect beach areas that they wish to remain where they are. However, this disrupts the _____, which can lead to increased erosion downcoast

Groins | Longshore Current

28. (2.00 pts)
In many places, winters lead to an increase in the _____ action along the coast, leading to a(n) _____ in erosion of finer sediments, leading to a higher exposure of bedrock or gravel along the beach.

Wave | increase

29. (2.00 pts)
The tide generating force is proportional to the _____ of the distance between the two bodies. This explains why the Moon has a _____ influence on the tides than the Sun.

inverse cube | larger

30. (2.00 pts) The _____ of the ocean is around 8 on average, but _____ with depth, leading to the CCD at around 4000 m depth

pH | decreases

31. (2.00 pts)
The _____ is the densest water mass in the world ocean. The _____ is more saline, but is much warmer, so it sits on top of 35, being traced from its source hundreds of kilometers into the Atlantic Ocean.

Antarctic Bottom Water | Mediterranean Intermediate

32. (2.00 pts)
There are twelve _____ in the ocean, where the tidal range in 0, a result of the _____ of crests and troughs as the tidal crest rotates around the basin.

Amphidromic Points | Destructive Interference

33. (1.00 pts) _____ can be either wave, river or tidal dominated, depending on the relative strength of the waves, tides and river at that location.

Deltas

34. (3.00 pts)

The _____ buoy system has been deployed for the warning of pending tsunamis in the Pacific. These buoys are attached to _____ sensors that can sense changes in ocean level in addition to a _____ to record ground shaking caused by an earthquake.

DART | Pressure | Seismometer

35. (1.00 pts)
In some high latitude regions, there are peninsulas or islands formed by _____ that were deposited at the end of a glacier. The surrounding area was lower lying and was subsequently submerged. Cape Cod is an example of one such feature.

Moraines

36. (1.00 pts)
The high _____ of water is largely responsible for the moderating effect of oceans on the climate around them. This same property is also why there is nearly always a breeze along the coast.

Specific Heat

37. (1.00 pts)
The melting of sea ice creates a _____, whereby the increase in sea ice melt promotes further sea ice melt because the open ocean water absorbs more heat than the sea ice did due to the lower _____ of the open ocean water.

Positive Feedback Loop | albedo

38. (1.00 pts)
A(n)_____ margin faces a mid-ocean ridge and generally lacks volcanism. They also generally have broader continental shelves and lack a trench.

passive

39. (1.00 pts) _____ form at the offsets in mid-ocean ridges where the plates on either side of the feature are moving in opposite directions.

transform faults

40. (1.00 pts)
Careful measurements of ocean height by satellite _____ can help detect seamounts, ridges, and other submerged features, because these features have a tendency to “pull” water on top of them leading to a local high at that location.

Altimetry

41. (3.00 pts)
_____ are waves that form largely at the bottom of the _____ and other places where there are significant changes in water density. These waves propagate _____ than wind driven waves because of the lower density contrast at their boundary.

internal | pycnocline | slower

42. (1.00 pts)
For the following questions, answer with **ONLY** the letter.

Breakwaters are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

B

43. (1.00 pts)
Berms are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

D

44. (1.00 pts)
Wave-cut Terraces are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

A

45. (1.00 pts)
Spits are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

D

46. (1.00 pts)
Lapilli deposits are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

C

47. (1.00 pts)
Accretionary Wedges are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

C

48. (1.00 pts)
Sea Stacks are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

A

49. (1.00 pts)
Tombolos are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

D

50. (1.00 pts)
Jetties are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

B

51. (1.00 pts)
Ophiolites are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

C

52. (1.00 pts)
Oolits are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

E

53. (1.00 pts)
Manganese nodules are:

A) erosional coastal features B) human constructed features C) volcanic/tectonic features D) depositional coastal features E) features of (bio)chemical deposition in the ocean.

E

54. (2.00 pts)
For each of the following, decide if the scenario described would lead to an increase, decrease or no change in sea level and if the effect would be global or local. (Blank #1: "Increase" or "Decrease", Blank #2: "Global" or "Local")

The melting of all the glaciers in Antarctica

increase | global

55. (2.00 pts)
For each of the following, decide if the scenario described would lead to an increase, decrease or no change in sea level and if the effect would be global or local

The isostatic adjustment to glaciers melting

decrease | local

56. (2.00 pts)
For each of the following, decide if the scenario described would lead to an increase, decrease or no change in sea level and if the effect would be global or local

The decrease in sediment input caused by the damming of a river

Increase | local

57. (2.00 pts)
For each of the following, decide if the scenario described would lead to an increase, decrease or no change in sea level and if the effect would be global or local

A return to ice age conditions in the Northern Hemisphere

decrease | global

58. (2.00 pts)
For each of the following, decide if the scenario described would lead to an increase, decrease or no change in sea level and if the effect would be global or local

The thermal response of water to an increase of 5 degrees of the average temperature

increase | global

59. (2.00 pts)
For each of the following, decide if the scenario described would lead to an increase, decrease or no change in sea level and if the effect would be global or local

Increased compaction due to a large city being constructed along the coast

increase | local

60. (2.00 pts) **To the nearest 0.1 m/s, calculate the speed of the following wave : (Do not include units.)**

A tsunami with a wavelength of 150 km in water that is 2 kilometers deep

140.1

61. (1.00 pts)
To the nearest 0.1 m/s, calculate the speed of the following wave : (Do not include units.)

An internal wave occurred at the boundary between a water mass with a density of 1.026 and a water mass with a density of 1.028, which has a wavelength of 1000 m and a water depth of 1500m

16.9

62. (1.00 pts) **To the nearest 0.1 m/s, calculate the speed of the following wave : (Do not include units.)**

A wind driven wave with a wavelength of 150 m in water that is 100 m deep

15.3

63. (2.00 pts) **To the nearest 0.1 m/s, calculate the speed of the following wave :**

A wind driven wave with a wavelength of 200 m in water that is 50 m deep

22.1

64. (1.00 pts) It is believed the Earth had oceans immediately upon its formation

○ True ◉ False

65. (1.00 pts) The refraction of sound waves in the ocean is responsible for some depths being sound shadow zones where objects like submarines can hide from radar

◉ True ○ False

66. (1.00 pts) Over 10% of the Earth's surface is ocean that is underlain by continental crust

◉ True ○ False

67. (1.00 pts) Sea level today is the highest it has ever been

○ True ◉ False

68. (1.00 pts) The continental slope has a slope of over 10 degrees

○ True ◉ False

69. (1.00 pts) Headlands along the coast concentrate wave energy, causing them to be preferentially eroded

◉ True ○ False

70. (1.00 pts) Deep water waves tend to undergo dispersion, leading the waves to be sorted by wavelength, while shallow water waves do not

- (●) True
- ( ) False

71. (1.00 pts)
Warm ocean water less effectively dissolves gases like CO2, creating a positive feedback loop with increased water temperatures leading to the release of CO2 encouraging further warming

- (●) True
- ( ) False

72. (1.00 pts) The geographic equator is the precise location of the meteorological equator, about which the global wind system that helps drive surface currents is centered

- ( ) True
- (●) False

73. (1.00 pts) The Thermohaline circulation is largely driven by changes in density, with over 10 regions of localized sinking

- ( ) True
- (●) False

74. (1.00 pts) The highest point on land is roughly the same height as the deepest part of the ocean is deep

- ( ) True
- (●) False

75. (1.00 pts) The period of a wave changes as it approaches the shore

- ( ) True
- (●) False

76. (1.00 pts) The Coriolis effect is strongest at the equator because the equator is moving faster than all other portions of the earth

- ( ) True
- (●) False

77. (1.00 pts)
The Canary current isn't as deep as the Gulf Stream, largely because of the difference in Coriolis effect at the high latitude source of the Canary current compared to the low latitude source of the Gulf Stream

- (●) True
- ( ) False

78. (1.00 pts)
Equilibrium tidal theory is a simple tidal theory, assuming there are no continents, no friction, the Earth responds immediately to the tide generating force, and the ocean is a constant depth everywhere

- (●) True
- ( ) False

79. (1.00 pts) Western boundary currents tend to follow their continental coastlines more closely than their eastern boundary counterparts

- (●) True
- ( ) False

80. (1.00 pts) The proportions of ions found in inland salty lakes (like Utah's Great Salt Lake) are roughly the same as the rations found in the ocean

- ( ) True
- (●) False

81. (3.00 pts) What term describes sediments in the ocean that are a result of biologic activity and what are the two dominant compositions of such sediments?

Expected Answer: Biogenous, silica and calcium carbonate

82. (1.00 pts) If you live in Cincinnati, Ohio, does El Nino influence your weather at all? If so, what conditions can you expect?

Expected Answer: Yes, the weather would generally be expected to be drier than average

83. (2.00 pts) Why is the salinity of the Mediterranean so high compared to the portion of the Atlantic at the same latitude?

Expected Answer: There are few major rivers than outlet into the Mediterranean Sea and with its narrow input from the Atlantic, it is nearly an increased basin. That, combined with its location near the horse latitudes, leads to a high evaporation rate, resulting in its high salinity

84. (2.00 pts)
Consider if the Earth didn't rotate. How many (and which) of the following would not operate in the way they do now: surface currents, hurricanes, plate tectonics, tides ?

Expected Answer: 3, hurricanes, tides and surface currents (one point for 3, one point for listing ALL the things that would be different

85. (2.00 pts) What is the approximate wavelength of the true tidal waves?

Expected Answer: Half the Earth's circumference or ~20,000 km

86. (1.00 pts) Why is conductivity generally used as a proxy for salinity in ocean profile collection devices?

Expected Answer: The electric conductivity of seawater increases with increasing dissolved solids, since pure water generally doesn't conduct electricity that well

87. (2.00 pts) What leads to the minimum in oxygen concentrations at a depth of about 800-1000 m?

Expected Answer: That depth is below the majority of the biological activity that could produce oxygen, so the combination of cellular respiration and decomposition lower the oxygen concentration (full credit for just "respiration and decomposition", partial credit (1 point) for either process alone)

88. (2.00 pts) Which part of the continental margin would a scientist go in the ocean to study a bouma sequence and what is the significance of that sequence?

Expected Answer: The continental rise (1 point), it is the deposit from turbidity currents (1 point)

89. (1.00 pts) The slope of a beach is often dependent on what, causing it to change seasonally in many regions?

Expected Answer: The slope of a beach is dominated by the grain size (or sediment type) that makes up the beach

90. (2.00 pts) What causes the difference in color between white and black smokers? Which is more common?

Expected Answer: The minerals that are being precipitated. The black smokers are more common (1 point for each part)

91. (2.00 pts) What problems can be caused by a piston corer when collecting samples of soft sediments?

Expected Answer: The piston corer can compress or blow away the upper layers of a sample. This can distort the data provided, if not handled carefully

92. (2.00 pts) Why can sea ice formation increase the salinity of the water around it?

Expected Answer: Ice generally does not take salt into its structure. When sea ice forms, the water largely leaves the salt behind. This makes the surrounding seawater saltier, increasing the salinity

93. (1.00 pts)
Give the chemical formula of the compound or element that fits the description provided:

This compound makes up the majority of the skeletal structure of corals. Because of its solubility in acidic solutions, the decreasing pH of the ocean will cause a problem for the growth of coral reefs

CaCO3

94. (1.00 pts) Give the chemical formula of the compound or element that fits the description provided:

This element is believed to be responsible for the generation of red tides in the Gulf of Mexico, blowing across the ocean basin in desert sand

Fe

95. (1.00 pts)
Give the chemical formula of the compound or element that fits the description provided:

Sources of this compound to the world ocean are generally thought to include volcanic outgassing and transport from comets which have collided with the Earth over the course of geologic time

H2O

96. (1.00 pts)
Give the chemical formula of the compound or element that fits the description provided:

This compound makes up a large part of the dissolved gases in the ocean, though despite accounting for over 78% of the atmosphere, it accounts for only 48% of the dissolved gas in the ocean

N2

97. (1.00 pts)
Give the chemical formula of the compound or element that fits the description provided:

This compound is one of the main ones that comes out of black smokers, accumulating in large piles that become the vents in addition to being responsible for the black color of the smoke

FeS2

98. (1.00 pts) Give the chemical formula of the compound or element that fits the description provided:

This is the most common formula unit (compound) by mass in the Earth's crust, in addition to being a very important one in the functioning of the world ocean

SiO2

99. (1.00 pts)
Give the chemical formula of the compound or element that fits the description provided:

This element has the longest residence time in the ocean in its ionic form, and is believed to be sourced largely from the mantle through volcanic outgassing, as it is much more abundant in the dissolved solids in the ocean than it is in the crustal rock

Cl

100. (8.00 pts)
There is suspicion that there is a new mid-ocean ridge in the middle of a previously unmapped portion of the ocean. You are the scientist who has been put in charge of the mission to properly map it, in addition to determining whether all of its spreading centers are spreading at the same rate. It is believed the ridge is at least 3.4 million years old. You are given a completely equipped research vessel (consider it has any instrument that you would need to complete this survey). How would you go about finding the ridge? How would you determine if all the spreading centers are spreading at the same rate (you should have 2 methods to do this, since you never know when one will fail)?

Expected Answer: Find the Ridge: Satellite altimetry. Echo sounding or other depth measurements could be used from a ship to find a feature in the relatively high portion of seafloor, about which rest of the topography is symmetric. Magnetic anomaly measurements could also be made using a magnetometer to find the axis about which the magnetic anomalies are symmetric. Or a combination of all of them. Spreading rates: Measure the distance from different ridge segments to magnetic reversals which can be matched with the magnetic time scale to get a spreading rate. Alternatively, core samples of the basalt could be collected at regular intervals along a transect moving away from the ridge at each spreading center could be radiometrically dated to obtain the same information. A simple, but less sensitive method would also be to take detailed bathymetric profiles around each segment of the spreading center. If the spreading rate is the same, the bathymetric profiles should all show the same shape.