

Minnesota Science Olympiad
Division C
State Competition
Sunday, March 11th, 2007

Oceanography

General information:

1. All resoures must fit in an area of 12" x 12" x 3".
2. A non-programmable calculator is allowed for the competition.
3. All answers are to be recorded on the test.

Scoring: Questions will be assigned point values. Ties will be broken by pre-determined tiebreaker questions (30, 29, 37, 35 in that order...)

Multiple Choice (2 points each)

Use the following answer option for questions 1 through 6

- a. Divergent
- b. Convergent
- c. Transform
- d. All of the above
- e. None of the above (not associated with any plate boundary)

1. The Aleutian Islands are associated with which type of plate boundary?
2. Iceland is associated with which type of plate boundary?
3. The Andes Mountains are associated with which type of plate boundary?
4. The Tonga Trench is associated with which type of plate boundary?
5. The Hawaiian Islands are associated with which type of plate boundary?
6. The majority of the world's earthquakes are found along _____ plate boundaries.

7. Evidence used by Alfred Wegener to support his hypothesis of continental drift included all of the following except:
 - a. Matching coastlines of continents now separated by oceans.
 - b. Evidence of glaciers in areas that are now tropical.
 - c. The composition of meteors from outer space.
 - d. The diversity of species of fossils, especially those of dinosaurs and mammals.
 - e. The pattern of similar mountain belts on different continents.
8. Compared to continental crust, oceanic crust tends to be:
 - a. Older, thinner, and more dense
 - b. Older, thicker, and more dense
 - c. Older, thinner and less dense
 - d. Younger, thicker, and less dense.
 - e. Younger, thinner, and more dense.
9. Which of the following species is not a major component of sea water?
 - a. Chloride
 - b. Sodium
 - c. Calcium
 - d. Phosphate
10. In which region is the salt content of seawater the highest?
 - a. Arctic Ocean
 - b. Red Sea
 - c. North Sea
 - d. Sea of Japan
11. In which region is the salt content of seawater the lowest?
 - a. Arctic Ocean
 - b. Red Sea
 - c. North Sea
 - d. Sea of Japan

12. What is the density of FRESH water in g/cm^3 at 4°C ?
 - a. 1.03
 - b. 1.00
 - c. 2.00
 - d. 10.00
13. What is the density of SEAWATER in g/cm^3 at 4°C ?
 - a. 1.03
 - b. 1.00
 - c. 2.00
 - d. 10.00
14. What is the water temperature in deep ocean regions?
 - a. 0°C
 - b. 4°C
 - c. 8°C
 - d. 12°C
15. At what stage of hurricane development is a name given to it?
 - a. Tropical Depression
 - b. Tropical Storm
 - c. Category 1 Hurricane
 - d. Tropical Disturbance
16. What is the minimum average wind speed for a Category 1 Hurricane?
 - a. 35 mph
 - b. 55 mph
 - c. 75 mph
 - d. 95 mph
17. Why don't hurricanes normally form in the South Atlantic Ocean?
 - a. Ocean water is too cold to support a hurricane
 - b. Upper atmosphere wind shear disrupts forming storms
 - c. The Coriolis force isn't present
 - d. Humidity levels are too low
18. Why don't hurricanes form at the equator?
 - a. Ocean water is too cold to support a hurricane
 - b. Upper atmosphere wind shear disrupts forming storms
 - c. The Coriolis force isn't present
 - d. Humidity levels are too low
19. In what area of a hurricane, relative to the direction of travel, is the potential for damage the greatest?
 - a. Front Left
 - b. Front Right
 - c. Rear Left
 - d. Rear Right
20. When is a hurricane name retired?
 - a. If the hurricane makes landfall
 - b. If the hurricane reaches category 4
 - c. If the hurricane reaches the United States
 - d. If the hurricane causes large amounts of damage

21. What often precedes the arrival of the peak of the Tsunami wave?
 - a. Several large rapid waves
 - b. The Tsunami wave trough
 - c. Calm water
 - d. The tide
22. What feature of a Tsunami allows us to distinguish it from other waves with the Tsunami warning network?
 - a. The high wave peak as it travels across the ocean
 - b. The large amount of energy stored in the wave
 - c. The long wavelength of the wave
 - d. The high frequency of the wave
23. What events are potential causes of Tsunami formation?
 - a. Hurricanes and earthquakes
 - b. Landslides and earthquakes
 - c. Hurricanes and waterspouts
 - d. None of the above
24. The Tsunami that resulted from an earthquake off the island of Sumatra on December 26th 2004 resulted in severe devastation and loss of life. Why didn't the warning network detect this Tsunami?
 - a. The network didn't have enough time to see the wave before it hit land
 - b. The network wasn't turned on
 - c. The network wasn't in the proper location
 - d. The network was overwhelmed by the size of the wave
25. The energy of a wave is dependant on
 - a. Both frequency and amplitude
 - b. Only Frequency
 - c. Only Amplitude
 - d. Neither frequency nor amplitude
26. Which is not a major contributor to coastal erosion?
 - a. Wind
 - b. Waves
 - c. Tides
 - d. Currents

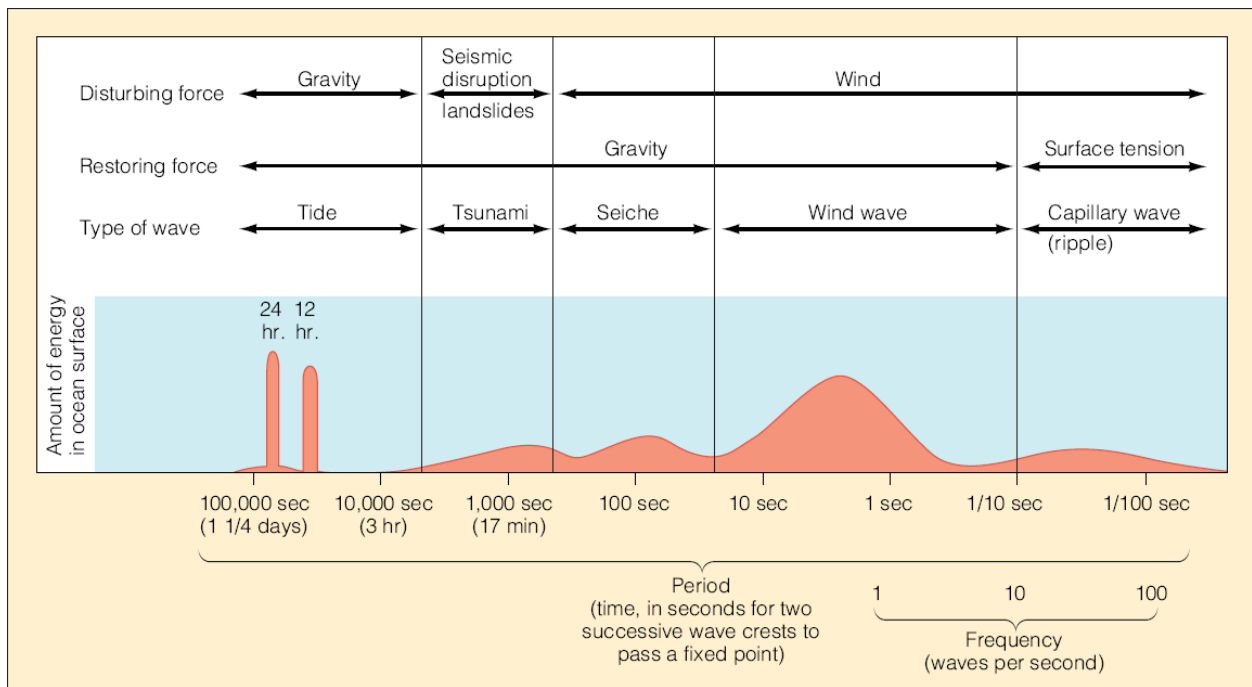
Short Answer (4 points each)

27. What is meant by a coast normal track hurricane? Why do these storms normally cause more damage?

28. What is a storm surge? What feature of a hurricane causes it?

29. In wave predictions Tsunami always behave as a shallow water wave. Why is this?

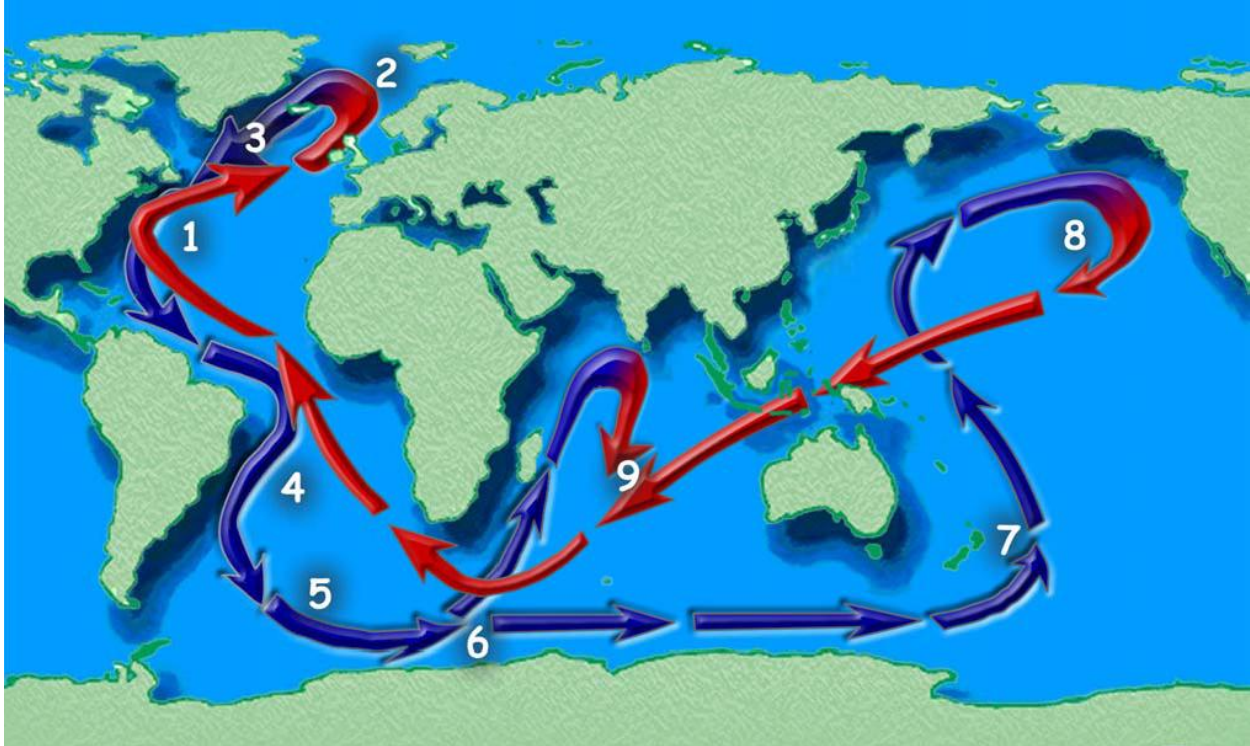
30. How does a beach in front of a cliff help protect the cliff from erosion?



Use the above graph to answer the following questions.

31. Which two types of waves are the most energetic?

32. Explain why a Tsunami causes significantly more damage than wind waves when it contains a much lower amount of energy.



Use the above diagram of the Oceanic Conveyor Belt for the following questions.

33. Explain what is happening at position 2.

34. Explain what is happening at position 6.

35. How does this system affect the climate in Europe and North Western America?

36. Approximately how long does it take for one complete cycle of the conveyor belt to occur?

37. Draw the earth and moon below indicating the positions of a semidiurnal tide.

38. What is the difference between a diurnal and semidiurnal tide? Which is observed more commonly?

Matching (2 points each)

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|-----------------------------|---|
| _____ 39. Shelf Break | a. Flooded edge of the continent, not the body of water above it. |
| _____ 40. Continental Rise | b. Term for a lithospheric plate that consists of only sea floor and outer ridge mantle |
| _____ 41. Oceanic Plate | c. Massive accumulation of sediment that covers the contact between a continent and the sea floor |
| _____ 42. Microcontinents | d. Term for sea floor volcanoes that extend for less than 1000m above the sedimentary cover |
| _____ 43. Oceanic Ridge | e. Name for a coral reef that is attached along its inner side |
| _____ 44. Fringe Reef | f. Deepest part of the sea floor |
| _____ 45. Lamellar Flow | g. This can neither erode nor transport solid particles |
| _____ 46. Continental Shelf | h. General name for the submerged volcanic mountain chain that forms at a divergent edge in the ocean |
| _____ 47. Knolls | i. Term for a small rifted fragment of a continent such as Cuba or Puerto Rico |
| _____ 48. Trench | j. This separates the continental shelf from the continental slope |