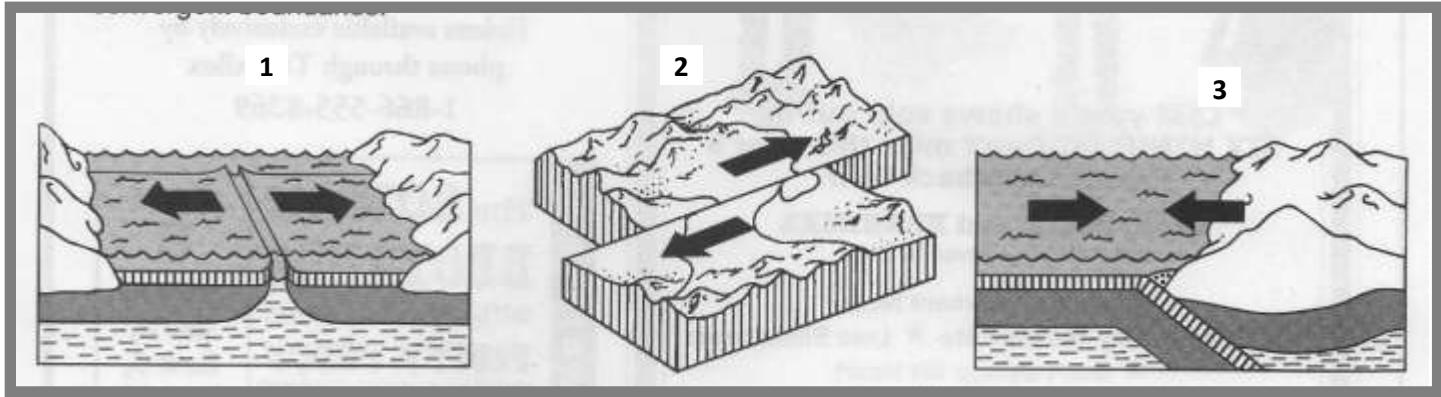




Exam
Dynamic Planet
Oceanography
Regional 2016

DO NOT WRITE IN THIS EXAM BOOK
MARK ALL ANSWERS ON YOUR ANSWER SHEET

Questions 1 – 3 Identify each plate boundary



1. _____

2. _____

3. _____

4. What picture above represents the boundary where sea floor is created? (choose) 1 2 3
5. What picture above represents the boundary where sea floor is destroyed? (choose) 1 2 3
6. The San Andreas fault is represented by what picture? (choose) 1 2 3
7. What picture above represents the process that creates island arcs? (choose) 1 2 3
8. What discovery did scientist make that supports the theory of plate tectonics and seafloor spreading? _____
a. The atlantic ocean surface salinities is greater than the pacific ocean.
b. Magnetic reversal patterns within the sea floor near the mid-ocean ridges.
c. The Hawaiian Islands are a volcanic island chain created by a weak spot in the earth's lithosphere.
d. Hydrothermal vent communities thrive on sulfur fixing bacteria in the mid ocean ridge system.

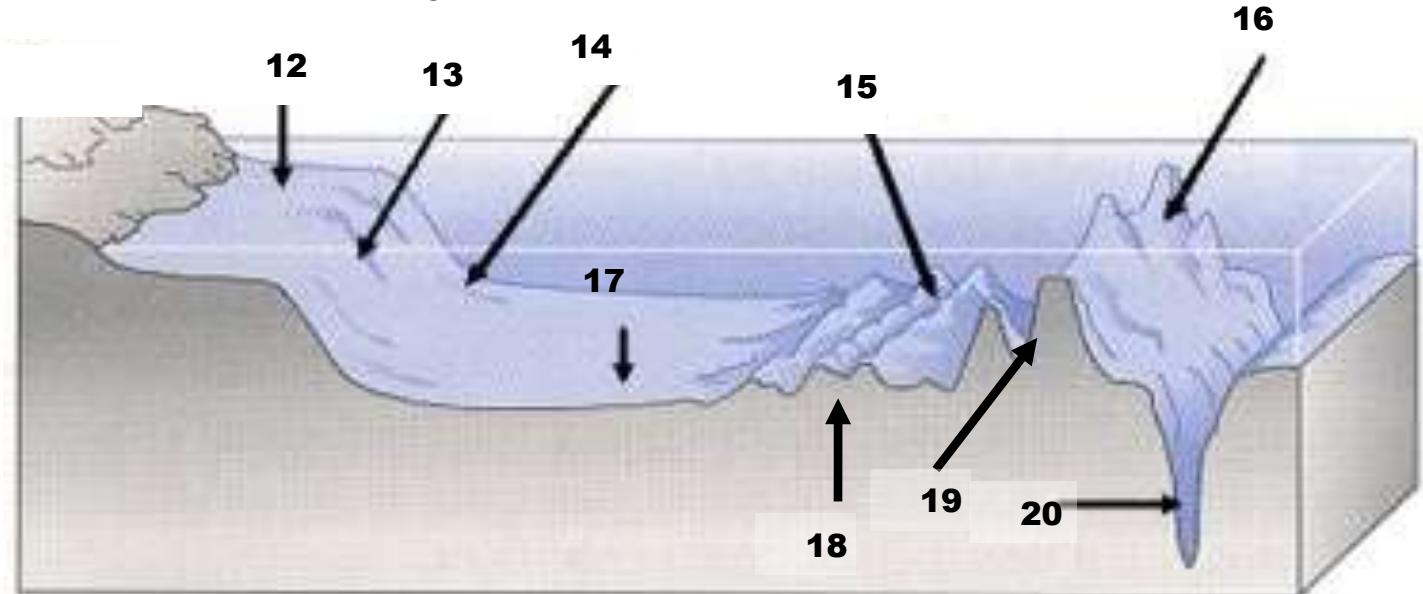
2pt 9. Continental crust is primarily composed of _____ rock which is less dense than oceanic crust that consists of _____ rock.

10. Which statement is true? _____

- a. The oldest age of continental crust and oceanic crust is about 350 million years old
- b. The oldest continental crust is 180 million years old, while the oldest oceanic crust is 480 million years old
- c. The oldest continental crust is 480 million years old while the oldest oceanic crust is 180 million years old
- d. The ages of continental crust and oceanic crust are unknown.

3pt 11. Plate tectonics is the theory that the outer rigid layer of the earth (the *lithosphere*) is divided into "plates" that move around across the earth's surface relative to each other. Describe what the force that is driving the plates to move?

Questions 12 -20 Label the following sea floor features



12. _____ a. rift valley

13. _____ b. abyssal plain

14. _____ c. continental shelf

15. _____ d. trench

16. _____ e. continental slope

17. _____ f. mid ocean ridge

18. _____ g. seamount

19. _____ h. continental rise

20. _____ i. guyot

Questions 21 – 25 Choose the answer that best completes the following statement s

21. Biogenic sediment is the primary marine sediment covering the_____

a. continental shelf.

b. shoreline.

c. Himalayan mountains.

d. abyssal plain.

22. 50% of the world's marine biological productivity is found _____

a. on the continental shelf.

b. in the Amazon rainforest.

c. in the mid ocean ridges.

d. on the abyssal plain.

23. Hot molten lava, rich in iron minerals rises _____, creating new ocean floor as the tectonic plates spread apart.

a. on the continental shelf

b. in the Mariana's trench

c. on the seamount

d. in the rift valley

24. Sea floor landforms that have evidence of wave erosion and coral fossils indicating they once rose above sea level are _____

- a. seamounts.
- b. guyots.
- c. mid ocean ridges.
- d. clastic sediments.

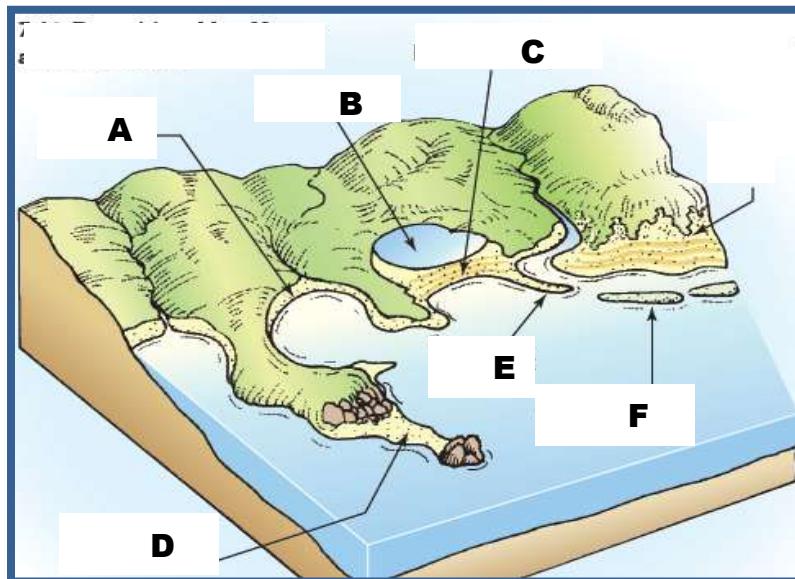
25. The deepest part of the world's ocean is _____

- a. on the continental shelf.
- b. in the Grand Canyon.
- c. in the Mariana's trench.
- d. in the rift valley.

Questions 26 – 28 Multiple Choice

26. Which is best characterized by erosional landforms?

- a. Large sediment deposits such as the coast of North Carolina
- b. Rugged terrain such as the coast of England
- c. Subsidence of the coastal plain such as the coast of Louisiana
- d. Calving of ice bergs such as the coast of Iceland

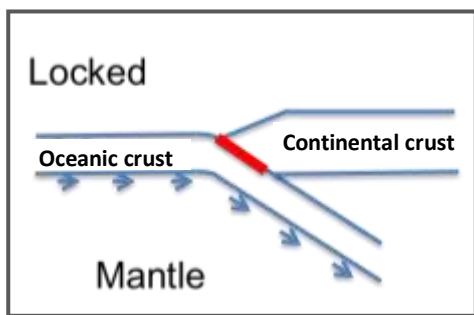


27. What is the action that caused landform E?

- a. rip current
- b. upwelling
- c. spring tides
- d. longshore drift

28. A tombolo is labeled? (choose) A B C D E F

Questions 29 -31 Refer the below diagram



29. The diagram depicts two moving plates. What type of tectonic plate margin is this? _____.
30. What process is most likely to happen while the plates are "stuck"? _____.
31. Where will the above answer occur? Continental crust or Oceanic crust _____.

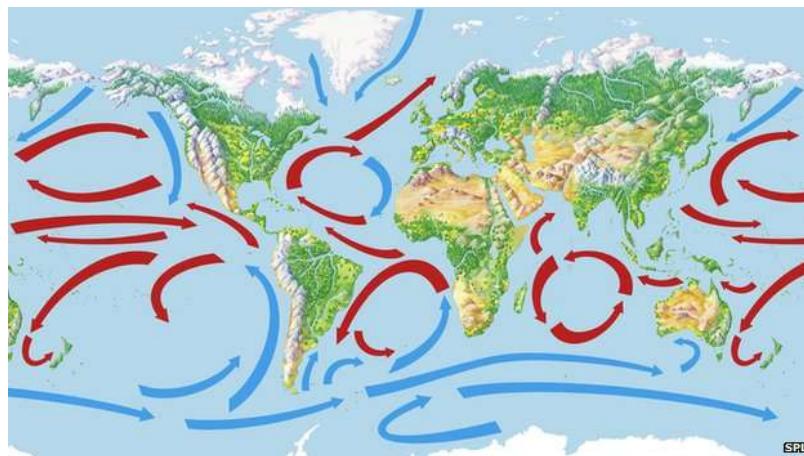
32. What was the dip-slip faulting event that lead to the subsidence of 10 meters of the Burma plate and caused a tsunami that killed over 200,000 people?

- a. The 1906 San Francisco earthquake
- b. The 1970 Peru earthquake
- c. The 2004 Sumatra earthquake
- d. The 2011 Japanese Tsunami

33. What is an "atoll"?

- a. A mountain rising from the seafloor that does not reach to the water's surface, and thus is not an island.
- b. A reef that is separated from their adjacent land mass by a lagoon of open, often deep water.
- c. A reef that formed around an island that subsides below sea level while the coral continues to grow upward.
- d. A coastal landform created by wave action and weathering.

Questions 34 - 36 Refer to the diagram below.



34. What is the name of the cold water surface current off the coast of South America? _____

3pt 35. Look at the pattern of cold and warm water currents. What seems to determine whether a current carries warm or cold water? _____

36. The long term global wind pattern and the force created by the earth's rotation sets up what?

- a. El Nino Southern Oscillation
- b. deep ocean water masses
- c. twelve major tectonic plates
- d. five major ocean gyres

37. In the Northern Hemisphere, which describes net water movement caused by the Ekman spiral?

- a. 40 kilometers per hour
- b. 45 degrees to the wind direction
- c. 90 degrees to the wind direction
- d. 10 miles per hour

Questions 38 – 42 Match the best choice answer

38. Thermohaline Circulation _____

- a. Water mass moves along the Atlantic basin from South to North
- b. Ocean conveyor belt

39. North Atlantic _____

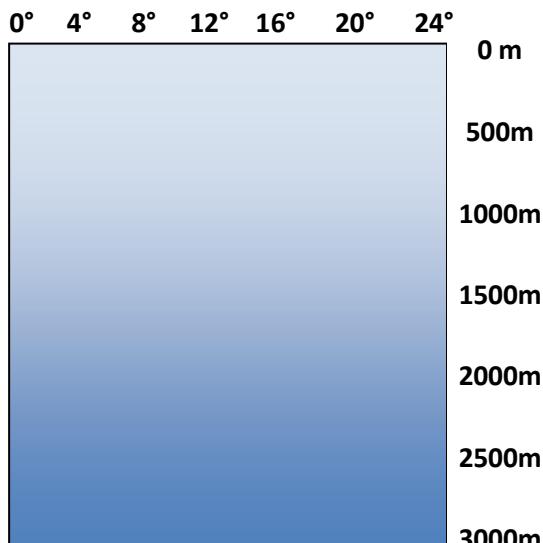
- c. Transport time of the circulation is 2000 years to upwell here.
- d. Will disrupt the deep ocean circulation and may causes cooler temperatures in Northern Europe.
- e. Northern flowing currents cool and trans-evaporation increases the salinity. Denser water then flows downward.

40. Melting of Greenland Ice Caps _____

41. Pacific Ocean _____

42. Antarctic Bottom water _____

2pt 43. What two (2) properties does density of seawater depend on? _____ and _____



44. Graph the temperature of the ocean at midlatitudes on the diagram to the left. (Draw only on your answer sheet)

45. The thermocline is defined as?

- a. rapid change in density
- b. rapid change in temperature
- c. gradual change in temperature
- d. gradual change in salinity

46. 50% of the ocean is the mixed surface zone and 50% is the deep water zone. True or False

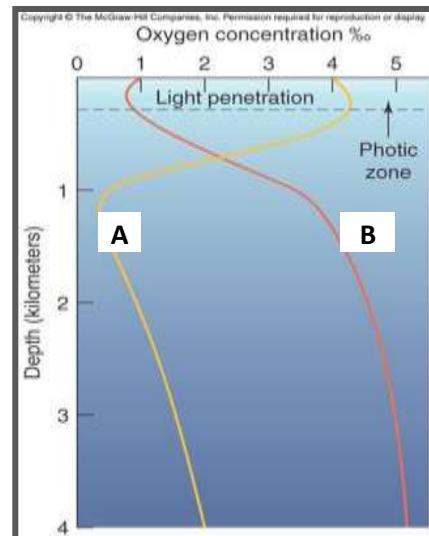
47. The pycnocline is the primary reason there is no vertical mixing of the oceans. True or False

Questions 48 – 49 Refer to the diagram on the right.

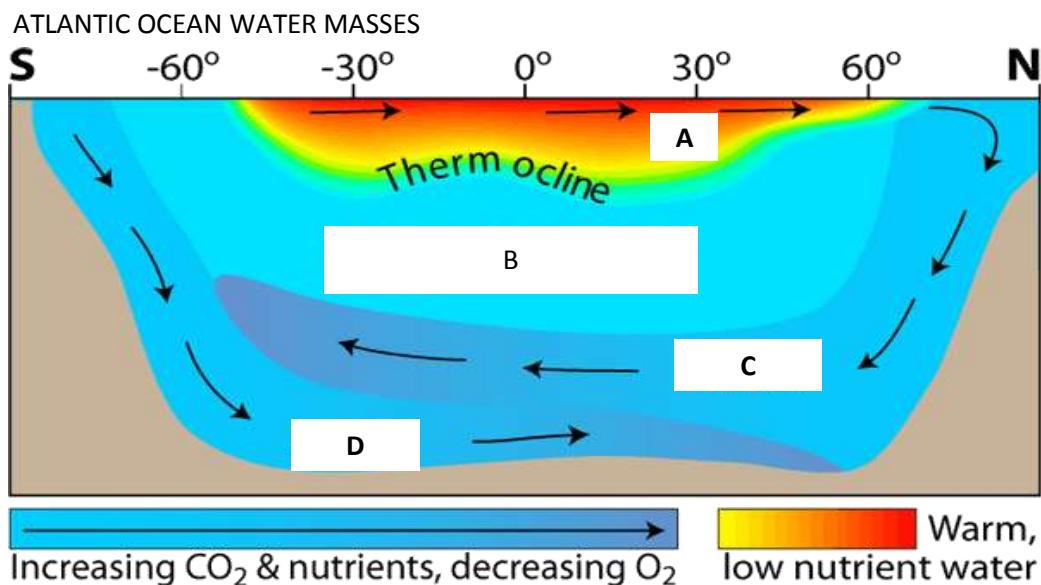
48. Which graph line represents dissolved oxygen. (choose) A B

49. What organism is responsible for the production of oxygen in the photic zone?

- a. shrimp
- b. phytoplankton
- c. zooplankton
- d. saltmarsh cordgrass



Questions 50 – 52 Refer to the diagram below.



50. The North Atlantic Deep Water is labeled? (choose) A B C D

51. What is the main primary driving force of the deep ocean circulation?

- a. wind
- b. productivity
- c. tides
- d. density

52. N. Atlantic gyre is labeled? (choose) A B C D

53. Salinity is a measurement of the weight of dissolved solids in the water. What is the average ocean salinity?

- a. 30 parts per thousand
- b. 35 parts per thousand
- c. 39 part per thousand
- d. 43 parts per thousand

2pt 54 The two major dissolved salts in the ocean are _____ and _____.

55. What does the data of ocean surface salinity levels indicate?

- a. Salinity is uniform throughout the oceans.
- b. The Atlantic Ocean has higher salinity levels than the Pacific Ocean.
- c. The Southern Ocean has higher surface salinities than Atlantic Ocean.
- d. Areas of higher salinities are upwelling areas.

56. What has the strongest influence upon tides?

- a. sun
- b. density
- c. wind
- d. moon

57. What is the measurement between high and low tide water levels called? _____

58. When is the highest spring tide?

- a. The sun, moon and earth form a 45° angle.
- b. The sun, earth, moon align in this order
- c. The sun, moon, earth align in this order
- d. During the months of March & April

59. What is the amphidromic point? _____

60. Draw diagram with the earth, moon and sun to show **neap tide formation**:

3pt

61. Diurnal tides include ____ every day.

- a. Two high tides and two low tides.
- b. More high tides than low tides.
- c. A varying number of tides.
- d. One high tide and one low tide.

62. Which best describes an estuary?

- a. A place where wildlife is protected from hunting and fishing
- b. A muddy beach
- c. A place where fresh water from the land mixes with salt water from the ocean
- d. A rocky coastline

63. What is the initial process that leads to hypoxia, low oxygen, in estuaries?

- a. high nutrient input from rivers causing algae blooms
- b. fish and shellfish taking up too much oxygen
- c. the increase in atmospheric carbon dioxide
- d. high turbidity due to input of sediment from rivers

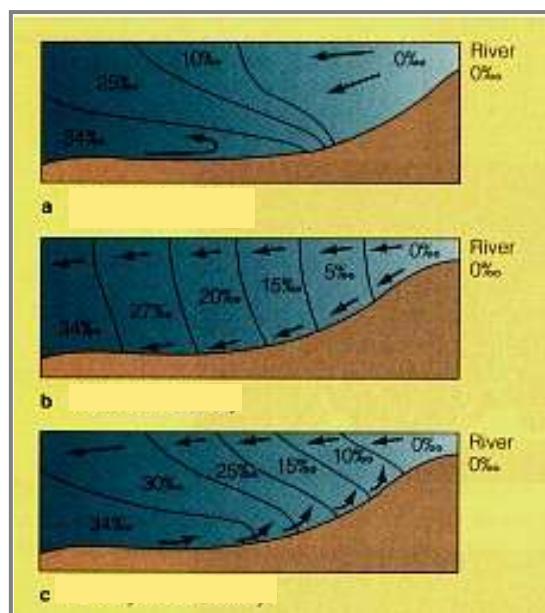
Questions 64- 66. Match each condition with the diagram on the right.

64. Well mixed estuary _____

65. Salt wedge estuary _____

66. Partially mixed estuary _____

67. What is the type of estuary leading to a stratified water column and the potential for bottom water hypoxia?



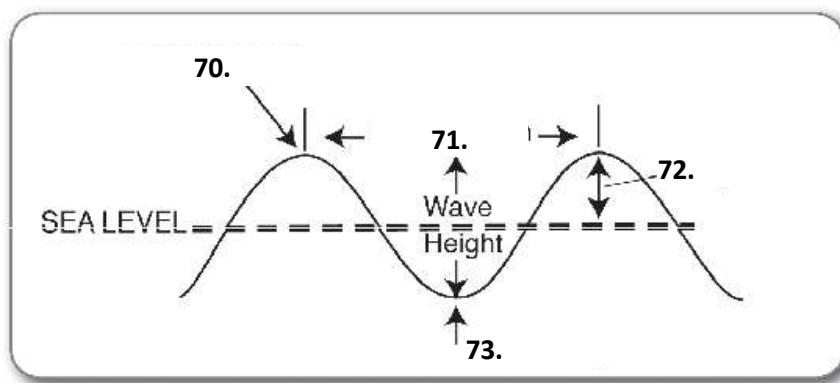
68. Water in most estuaries is brackish because of the mixing of fresh water from rivers and saltwater from incoming tides. What would a drought in the bay watershed most likely cause in the bay?

- a. increase in sediment
- b. decrease in salinity
- c. no change in conditions
- d. increase in salinity

69. The distance and direction that a wave travels in the open ocean is referred to as?

- a. capillary
- b. tsunami
- c. fetch
- d. surf

Questions 70–73. Identify the following on the wave.



70. _____

71. _____

72. _____

73. _____

74. In the open ocean, a water particle in a wave does what?

- a. It moves horizontally with the wave.
- b. It does not move with the wave.
- c. It moves in an orbital pattern.
- d. It is pushed down into the water column.

75. As waves approach the shore, they come into contact with the sea floor. As they slow down, they squash together in the process called shoaling. What does this cause?

- a. The buildup of sediments in the inlets.
- b. A decrease in the fetch and the increase in the wavelength.
- c. The formation of a rip current near the shore.
- d. An increase in wave height and tipping forward of the wave crest.

76. What causes most tsunami waves?

- a. earthquakes
- b. el nino
- c. hydrothermal vents
- d. hurricanes

77. What is the process that moves beach material along the beach and the backwash, pulls the material back down the beach at right angles to the coastline, causing a net shift of material along the coast? _____

78. At which of the following pH levels of seawater would coral most likely die? (Assume all other factors are within range for healthy coral)

- a. 7.8
- b. 8.1
- c. 8.3
- d. 8.6

79. When carbon dioxide is added to the ocean from the atmosphere, the acidity of the seawater increases. If the acidity increases, then there is relatively less carbonate ion (CO_3^{2-}) in seawater causing what?

- a. decreases the value of Ω
- b. increase the value of Ω
- c. has no effect on Ω
- d. Ω equals β

2pt 80. What is the most likely cause of the change in pH of the oceans? _____

Questions 81 – 83 Refer to the satellite imagery of Peru and the coast

81. What is this satellite image showing?

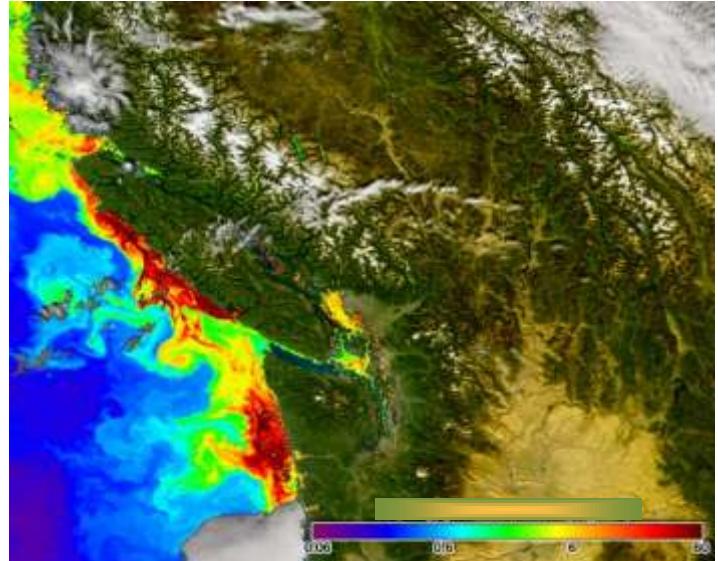
- a. salmon populations
- b. zooplankton levels
- c. chlorophyll concentrations
- d. temperature changes

82. What color represents the highest concentration?

- a. red
- b. blue
- c. yellow
- d. green

83. What do scientists use these types of satellite imagery to study?

- a. topography along coastlines
- b. ocean currents
- c. temperature changes along coastlines
- d. ocean biological productivity



84. What process brings nutrient-rich deep water to the surface, fueling primary productivity?

- a. tectonic uplift
- b. coastal downwelling
- c. eckman spiral
- d. coastal upwelling

Questions 85 – 88 Match what is used to study each subject.

85. deep-ocean science and exploration _____

a. SONAR

86. ocean floor mapping _____

b. sediment cores

87. ocean profiling of temperature, salinity & velocity _____

c. human occupied submersibles

88. study climate change and past ocean conditions _____

d. argo floats

89. Approximately what percentage of the earth's surface is covered by oceans?

- a. 10%
- b. 35%
- c. 70%
- d. 82%