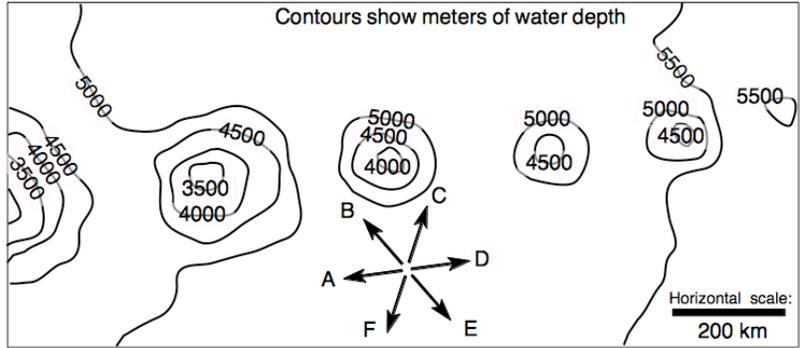


8. Which lettered arrow best indicates the direction in which the oceanic crust is moving? [2]

This map represents a hypothetical area of Earth surface; do not try to match it to a known piece of seafloor.

This question assumes a conventional understanding of plate tectonics and mantle processes.



9. Given the map above, would you guess the rate of spreading in this ocean basin is _____ [2]

A. Faster than the global average
B. Slower than the global average

10. Match each of the oceanographic features with their seismic characteristics (fill in all blanks, so some or all letters will be used multiple times). [3]

- | | | |
|-----------------------|-------------------------|--|
| ___ Marianas Trench | ___ Mid-Atlantic Ridge | A. Abundant shallow earthquakes but no deep earthquakes. |
| ___ Rio Grande Rise | ___ Walvis Ridge | B. Both shallow and deep earthquakes. |
| ___ East Pacific Rise | ___ Aleutian Island Arc | C. Few earthquakes of either sort. |

11. The greatest depth in the ocean is about _____ [3]

A. 200 meters	D. 11,000 meters	G. 36,000 meters
B. 500 meters	E. 18,000 meters	H. 50,000 meters
C. 7000 meters	F. 24,000 meters	J. 20,000 leagues

12. The age of the oldest oceanic crust on the seafloor is roughly _____ [2]

A. 1000 years	D. 2,000,000,000 years (the Proterozoic)
B. 1,000,000 years	E. 4,550,000,000 years (the age of the earth)
C. 160,000,000 years (the Jurassic)	

13. Where is the oldest oceanic crust found? [2]

A. southern Indian	C. Southern Ocean	E. western North Pacific
B. eastern Pacific	D. Black Sea	H. eastern South Atlantic

14. For the map on the screen, match the numbered areas with the seafloor provinces. [5]

1	2	3	4	5	A. Abyssal Plain	D. Trench	G. Cont'l slope
					B. Seamount	E. Aseismic Ridge	H. Cont'l rise
					C. Mid-Ocean Ridge	F. Island Arc	J. Back-arc basin

For each kind of earthquake, indicate the most likely point that it might happen.

_____ _____ A. α B. β C. γ D. δ E. ϵ [2]

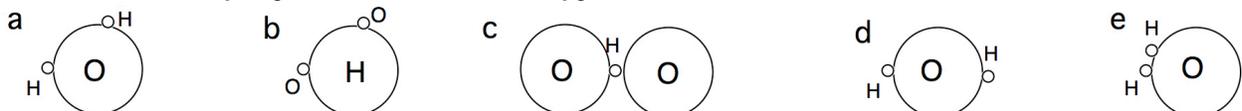
Shallow Very deep
in earth in earth

What direction is the seafloor at Point δ moving? [2]

_____ A. Northwest B. Northeast C. East D. Southeast E. North F. Southwest

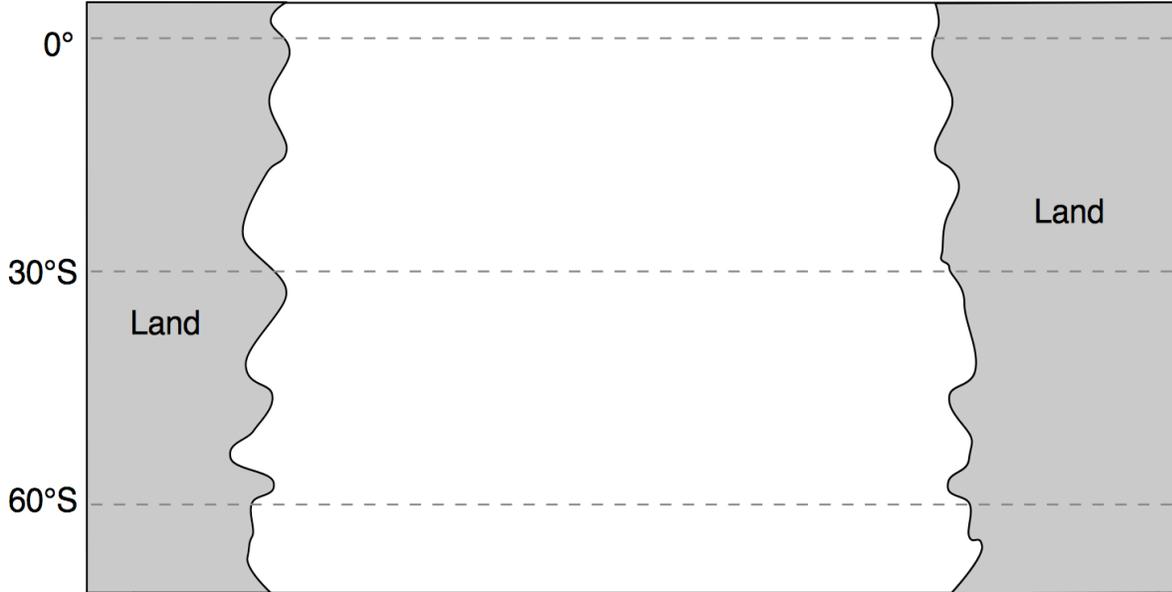
15. Which of the following is the best depiction of a water molecule? _____ [3]

("H" labels hydrogen atoms and "O" labels oxygen atoms)



16. The density of seawater increases with _____ [2]
- A. Increasing temperature and decreasing salinity.
 - B. Decreasing temperature and decreasing salinity.
 - C. Increasing temperature and increasing salinity.
 - D. Decreasing temperature and increasing salinity.

17. On the map of a hypothetical ocean basin below, do the following: [10]
- 1) With H's and L's, indicate regions of high barometric pressure and low barometric pressure at the earth's surface.
 - 2) With dashed or thin arrows, show the prevailing wind directions.
 - 3) With solid or thick arrows, show the directions of the surface currents.

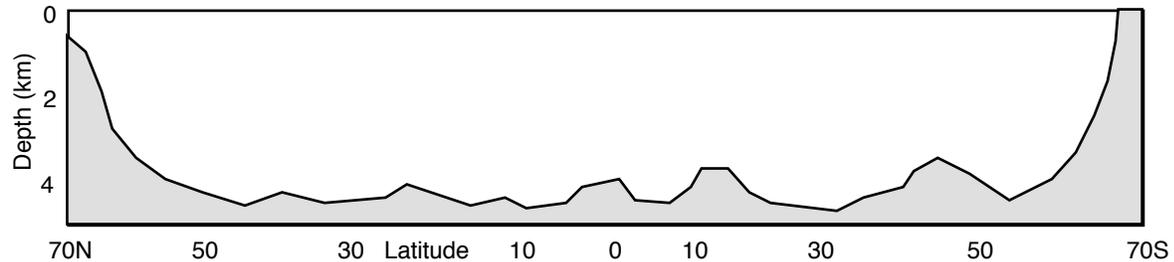


18. On the map above, use a “@” to mark the location of highest sea level relative to the oblate spheroid that is Earth’s shape (i.e., where sea level is anomalously high). [2]

19. Which one of these is not like the others? [3]
- A. Peru Current B. Brazil Current C. Canaries Current D. California Current E. Benguela Current

_____ Why is that one different from the others? _____

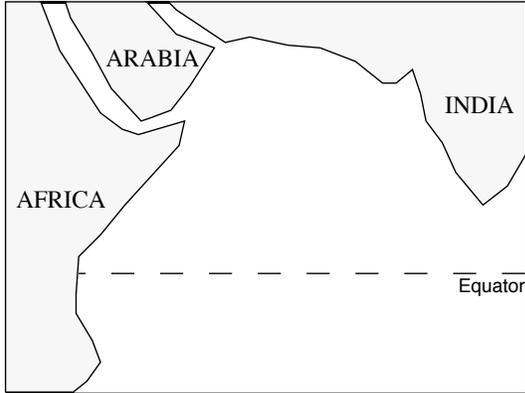
20. On the North-South cross-section of the Atlantic Ocean Basin below, sketch and label the flow paths or positions of the major intermediate to bottom water masses in the Atlantic. [6]



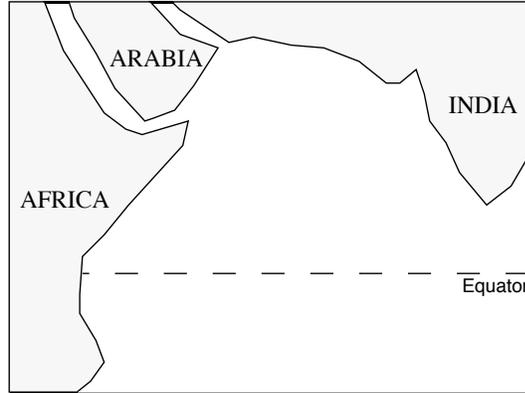
22. What surface current goes all the way around the Earth, circling the globe in one latitudinal belt? [2]

21. Which of the following is physical oceanographers' generalization of deep ocean circulation? [3]
- A. Meridional ocean circulation in which water sinks in the North Atlantic and upwells in the Southern Ocean.
 - B. Meridional ocean circulation in which water sinks in the North Pacific and upwells in the Southern Ocean.
 - C. Longitudinal ocean circulation in which water sinks in the Southern Ocean and upwells in the North Atlantic.
 - D. Latitudinal ocean circulation in which water sinks in the eastern Atlantic and upwells in the western Pacific.

23. On the map below at left, use *dashed arrows* to show winds in the Arabian Sea in the Northern Hemisphere winter and spring, and use *solid arrows* to show surface currents in the winter and spring.



On the map below at right, use *dashed arrows* to show winds in the Arabian Sea in the Northern Hemisphere late summer, and use *solid arrows* to show surface currents in the late summer. [4]



24. What current becomes stronger during an ENSO event? _____ [3]

25. Of the following, check all changes in ocean phenomena that occur during an El Niño/ENSO. [3]

- ___ Warming of western Pacific
- ___ Rise of sea level in western Pacific
- ___ Weakening of N&S Pacific Equatorial Currents
- ___ Reduced outflow of Mediter'n Intermediate Water
- ___ Increase in formation of North Atlantic Deep Water
- ___ Intensification of upwelling in western Pacific
- ___ Decrease of upwelling in eastern Pacific
- ___ Strengthening of Northern & Southern Pacific Equatorial Currents
- ___ Drop of sea level in western Pacific
- ___ Warming of surface water of eastern Pacific

26. Of the following, check all changes in non-oceanic phenomena that occur during an El Niño/ENSO. [3]

- ___ Drought in Panama
- ___ Drought in Australia and Indonesia
- ___ Heavy rain and flooding in Peru and Ecuador
- ___ More extensive melting of glacial ice in Greenland.
- ___ Rain at low elevation and snow at high elevation in California.
- ___ Failure of fisheries in the eastern Pacific
- ___ Sea birds in Japan and South Korea abandon their egg-filled nests.

27. Which of the following maps most accurately shows the oceans' regions of great (>36 ppt) salinity? [2]

