Name:_____ Hydrosphere Time Allotted: 30 minutes

Key: (*) = none, one, or more than one answer possible (e.g. Answer: A, D, and E)

1. Which of the following statements is/are false concerning global warming's effects on the hydrosphere? (*)

a) The movement of water through the hydrologic cycle is decelerated.
b) The addition of more water through the melting of glacial and sea ice over-intensifies deep-sea circulation.
c) Ocean volume thermal expansion is the primary cause of sea level rise in the long run.
d) The frequency and intensity of hurricanes are greatly increased.
e) Warm ocean water retains less dissolved oxygen.
f) Ocean warming causes slower metabolic rates for ocean species.

2. Which of the following would you likely find among neritic ocean deposits? (*)

a) Red clays
b) Coccoliths
c) Radiolarian tests
d) Siliceous ooze
e) Glacial erratics
f) Stromatolites
g) Tektites
h) Manganese nodules
i) Oolites
j) Clathrate hydrates
k) Turbidites

3. Which of the following is/are false concerning the ocean's clines? (*)

a) Calcareous ooze cannot exist below the bottom end of a water column's lysocline.
b) Salinity at depth below a water column's halocline is the same regardless of latitude.
c) Clines begin at the surface in low-latitude regions.
d) Strong winds can result in both the intensification and weakening of a thermocline.
e) The generation of internal waves is associated a water column's pycnocline.
f) Freshwater runoff entering shallow coastal waters form strong haloclines.
g) The combination of freshwater runoff and dry offshore winds creates isohaline conditions.
h) A thermocline can be used to generate electricity.

4. What is the shortest possible duration for any location on Earth to experience the full extent of its tidal range?

a) 3 hours
b) 6 hours
c) 12 hours
d) A full lunar synodic day
e) Around one week
f) Around half a month
g) Around one month

5. Which of the following is/are false concerning ocean acidification? (*)

a) Ocean acidification involves a shift in ocean waters toward conditions where pH < 7.
b) Ocean acidification is causing a chemical change in pigment molecules in coral reef ecosystems around the world.
c) Ocean acidification is not exclusively a modern development; it has occurred in the geologic past.
d) The ocean responses to ocean acidification by converting bicarbonate molecules into carbonic acid molecules.
e) Ocean acidification causes a higher risk of the dissolution of carbonate secretions.

6. Under ideal conditions in the Southern Hemisphere with winds blowing N50W over a water column, what is the net direction of the column's surface currents? Currents above 100 m depth? Currents below 100 m depth?

a) N50W; N50W; N50W
b) N50W; N05W; N40E
c) Not enough information; N05W; N40E
d) N50W; S85W; S40W
e) N50W; S40W; not enough information
f) S85W; S40W; not enough information
g) Not enough information; not enough information; not enough information

7. Complete the following sentence by choosing two of the following options. (*)

a) Chemical composition of sediment in stream channel
b) Distance from ocean
c) Precipitation and evaporation rate
d) Volume and particle size of sediment in stream channel
e) Slope and discharge of stream

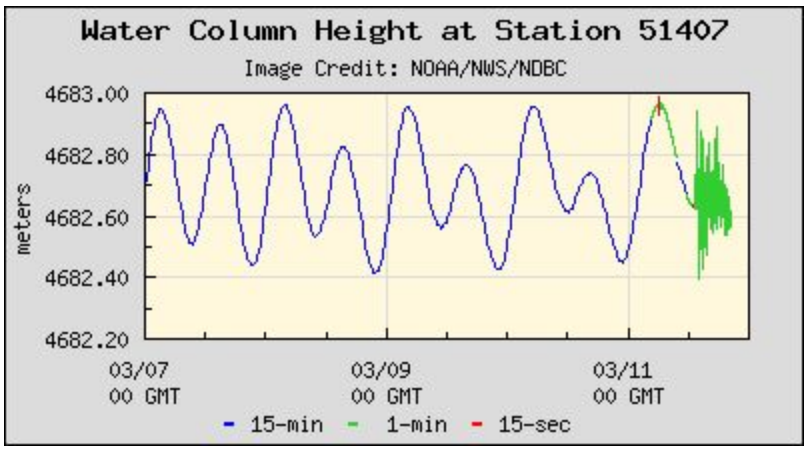
8. Ancient ocean sediment samples consisting of the shells of dead marine organisms are collected, and their geochemical compositions are analyzed. The researchers discover notably high concentrations of 18O. Based on these observations, which of the following can the researchers most likely conclude? (*)

a) The relatively high 18O concentrations indicate warmer temperatures, so the samples are representative of an interglacial period.
b) The relatively high 18O concentrations indicate colder temperatures, so the samples are representative of a glacial period.
c) The relatively high 18O concentrations indicate higher sea levels, so the samples are representative of an interglacial period.
d) The relatively high 18O concentrations indicate higher sea levels, so the samples are representative of a glacial period.
e) The relatively high 18O concentrations indicate an irregularly high population of marine organisms, so the samples are representative of an interglacial period.
f) The relatively high 18O concentrations indicate an irregularly high population of marine organisms, so the samples are representative of a glacial period.

9. As geologists dig for marine sediment samples at Outcrop A, they uncover layers of limestone, shale, and sand in descending order. Based on these observations, which of the following can the geologists most likely conclude?

a) The sediment layers are evidence of a marine transgression and a relative increase in sea level.
b) The sediment layers are evidence of a marine transgression and a relative decrease in sea level.
c) The sediment layers are evidence of a marine regression and a relative increase in sea level.
d) The sediment layers are evidence of a marine regression and a relative decrease in sea level.

Consider the figure below.



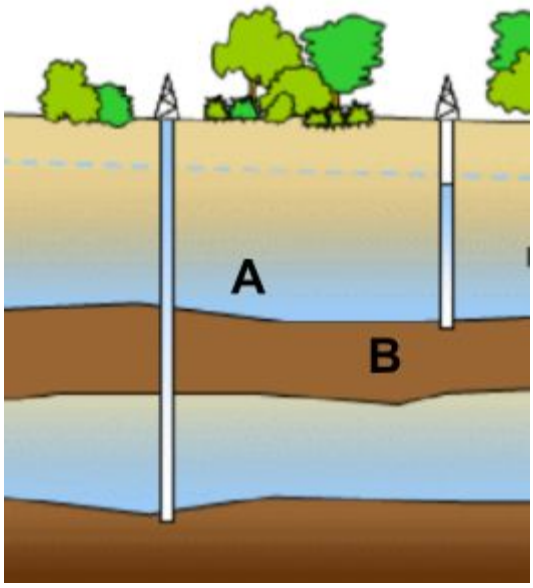
10. Note that the tidal range becomes increasingly asymmetric from one tide to the next. Based on the graph and your knowledge of tides, which of the following statements is/are correct in explaining the changes in tidal range? (*)

a) Diurnal inequality is caused by the inclination in the moon's orbital plane relative to the ecliptic.
b) Diurnal inequality is caused by changes in the relative speed of the moon's orbit.
c) Tidal ranges are larger during neap tides than spring tides.
d) Tidal ranges are larger during spring tides than neap tides.
e) Tidal ranges are larger when the moon is at apogee.
f) Tidal ranges are larger when the moon is at perigee.

11. The Ekman Spiral and related Ekman Transport are important phenomena that influence surface ocean currents. Based on your knowledge of ocean currents and the two processes, which of the following statements is correct? (*)

a) Current velocity increases with depth, while the Coriolis Effect weakens.
b) Current velocity decreases with depth, while the Coriolis Effect strengthens.
c) Ekman Transport is responsible for the convergence of water at 30N and 30S.
d) Ekman Transport is responsible for the divergence of water at 30N and 30S.
e) Ekman Transport is responsible for equatorial downwelling.
f) Ekman Transport is responsible for equatorial upwelling.

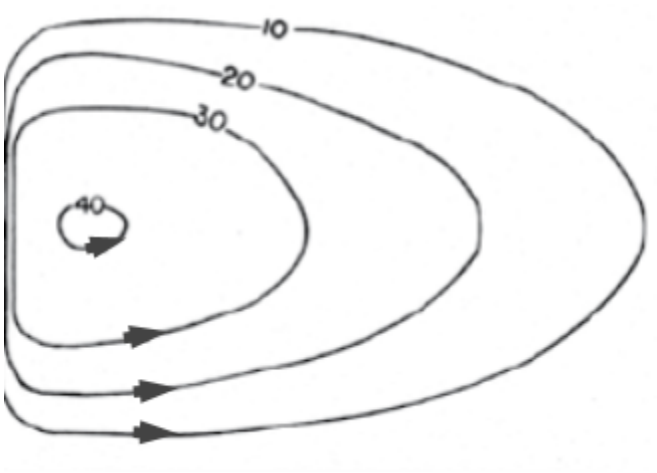
Consider the figure below.



12. Which of the following statements regarding the composition of the rock layers, A and B, could be true? (*)

a) Layer A is limestone because it is permeable, and layer B is sandstone because it is impermeable.
b) Layer A is sandstone because it is permeable, and layer B is clay because it is impermeable.
c) Layer A is gravel because it is permeable, and layer B is pyroclastic rock because it is impermeable.
d) Layer A is limestone because it is permeable, and layer B is shale because it is impermeable.
e) Layer A is glacial till because it is permeable, and layer B is clay because it is impermeable.

Consider the figure below depicting sea surface elevation.

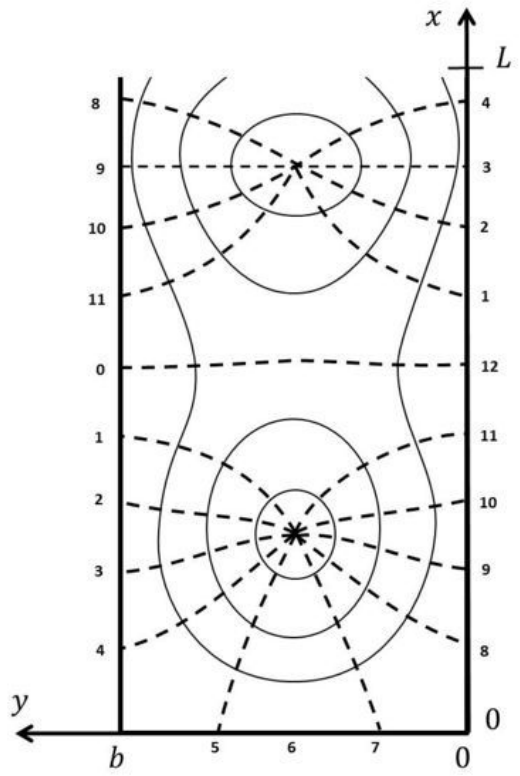


a) This subtropical gyre is in the Northern Hemisphere.
b) This subtropical gyre is in the Southern Hemisphere.
c) Water is moving slower on the west side of the gyre.
d) Water is moving slower on the east side of the gyre.
e) The hill of water to the west of the center is caused by the Coriolis effect.
f) The hill of water to the west of the center is caused by the presence of a subpolar gyre.
g) The hill of water to the west of the center is caused by trade winds and westerlies.

14. Which of the following statements regarding ocean waves is/are true? (*)

a) Long waves move faster than waves that are short in length
b) Tall waves move slower than waves that are short in height
c) In constant depths, shallow-water waves, transitional waves, and deep waves are differentiated based on wavelength.
d) In theory, a wave with a steepness of 0.1 will break.
e) Given the frequency of a wave, one can calculate its period.

Answer Q15-17 using the figure below.



15. The above figure depicts an idealized solution for the expected propagation of tidal waves in a semi-enclosed rectangular basin of uniform depth, with dashed lines representing places with the same tidal phase at a given hour (cotidal lines). A system exhibiting the motion above could theoretically be found in which of the following regions?

a) The Northern hemisphere
b) The Southern hemisphere
c) Either hemisphere
d) Either hemisphere, but only in small enclosed areas

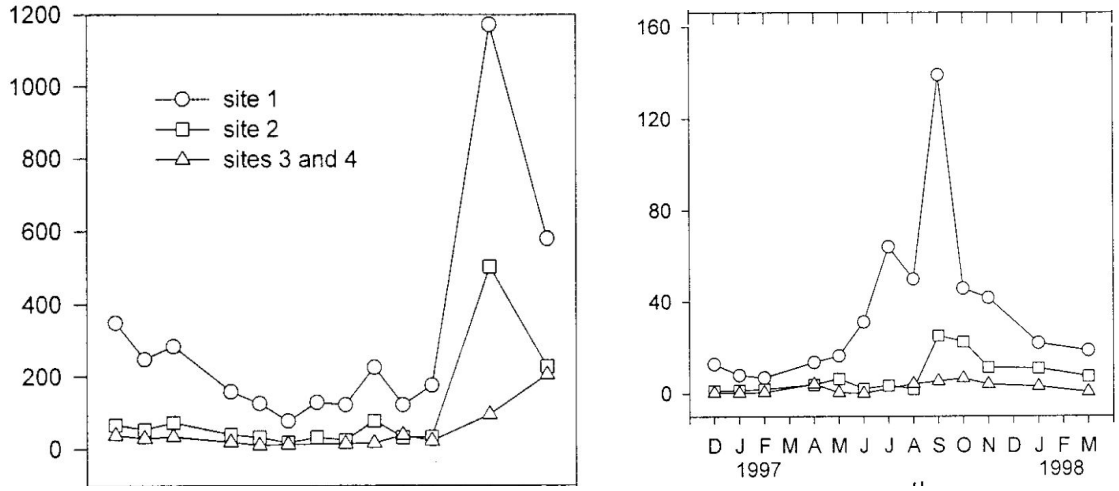
16. As one moves farther from the two central points (also known as amphidromic points), one would find that which of the following is true?

a) Tide depth increases
b) Tide depth decreases
c) Tide depth stays the same
e) Tide depth is not consistently variable with distance from the central point

17. Which of the following durations is most closely related to the rotation frequency of these systems?

a) Sidereal day
b) Synodic day
c) Lunar day
d) Half a lunar month

Answer Q18-20 using the figure below.



18. The figures above (they share the same x-axis) show the fluctuation of nitrite and nitrate concentrations at various sites in a local estuary. Which of the following statements is true?

a) The left graph is nitrite, the right graph is nitrate
b) The left graph is nitrate, the right graph is nitrite
c) Indeterminate, both a and b could be true

19. The graphs likely show evidence for which of the following? (*)

a) Bacterial activity
b) Human activity
c) Slowdown of runoff by native fauna
d) Carbon sequestration via biological pump

20. Which of the following statements is/are likely to be true? (*)

a) Site 1 is far inland while Site 4 is near the estuary outlet
b) Site 1 is near the estuary outlet while Site 4 is far inland
c) Site 2 is likely nutrient poor
d) Site 3 is likely oxygen poor