QUIZ SET B: Oceanography 101

Check the Course Syllabus for the DUE DATE of this quiz set.

Come to class on the due date with a SCANTRON filled in with your answers. You must submit a SCANTRON to receive credit, not a printout with boxes checked.

This Quiz Set covers Chapter 5, Chapter 6, and Chapter 7 in the Essentials of Oceanography textbook (8th edition by Trujillo & Thurman). I encourage you to print out the quiz and work on it as you read each chapter. There are 45 questions, 15 for each chapter. To encourage you to read each chapter thoroughly, rather than “hunt and peck” for the answers, the questions are in random order; that is, not the order the topics are covered in each chapter.

Chapter 5

1. Ocean water is salty because water can dissolve many materials. This ability to dissolve many things is related to the water molecule's _____________.
   - (a) electrical polarity
   - (b) covalency
   - (c) salinity
   - (d) constant proportionality
   - (e) saturation value

2. Which property of the oceans is the most important for the operation of an OTEC system?
   - (a) The high heat capacity of water.
   - (b) Water's high latent heat of evaporation.
   - (c) Water's high latent heat of condensation.
   - (d) The Principle of Constant Proportions.
   - (e) The thermocline found in tropical oceans.

3. A ____________ represents a change in water temperature with depth, whereas a ____________ represents a change in salinity with depth.
   - (a) oxycline ... halocline
   - (b) thermocline ... oxycline
   - (c) halocline ... pycnocline
   - (d) thermocline ... halocline
   - (e) pycnocline ... lysocline
4. There is no thermocline in __________ regions because ______________.
(a) low latitude ... the water is cold below the surface
(b) low latitude ... surface water is so warm
(e) high or low latitude ... the Principle of Constant Proportions keeps water's salinity more or less the same everywhere
(d) high latitude ... the water is cold all the way from the surface to the depths
(e) high latitude ... large rivers lower the salinity of the ocean surface

5. Water has high heat capacity. Therefore,
(a) water can gain or lose a lot of heat with little change in temperature compared to most other substances.
(b) over time in a particular area, the temperature of the ocean will generally change less than the temperature of the land.
(c) it will take more heat to warm up a pound of water by 20 degrees than to warm up a pound of most other things by the same amount.
(d) (a), (b), and (c) above.
(e) None of the above.

6. Bodies of water like the Red Sea and the Dead Sea have __________ water because of large amounts of ____________.
(a) hypersaline ... evaporation
(b) hypersaline ... runoff
(c) brackish ... evaporation
(d) brackish ... precipitation
(e) brackish ... runoff

7. Which of the following is the best explanation for why ice floats on water?
(a) When ice freezes, it leaves salt behind.
(b) Ice is denser than water.
(c) The thermal contraction of water as it cools down causes ice to form first at the surface, and where it forms, it floats.
(d) The six-sided structures that water molecules make in ice take up more space than they do in liquid water.
(e) Ice traps air as it freezes, and the air bubbles make ice float.
8. If the earth did not have an ocean, but was otherwise the same, how would surface temperatures be different?
   (a) Temperatures would be more extreme (hotter days and colder nights).
   (b) Temperatures would be less extreme (less change between day and night).
   (c) Temperatures would be much warmer during both day and night.
   (d) Temperatures would be much colder during both day and night.
   (e) Temperatures would be cooler at the equator but warmer at the poles.

9. The electrical polarity of water molecules causes them to stick to each other with weak bonds called ____________, and this behavior gives water some unusual properties such as ____________.
   (a) ionic bonds ... refraction
   (b) hydrogen bonds ... surface tension
   (c) covalent bonds ... polarity
   (d) cohesion bonds ... electron sharing
   (e) None of the above answers are correct.

10. Which of the following is INCORRECT regarding desalination?
    (a) One method of desalination is to boil seawater and collect the water vapor.
    (b) Most of the fresh water produced by desalination in the US is made by Florida and California.
    (c) Solar humidification and solar distillation do not require supplemental heat sources, and have been used effectively in arid regions of the world.
    (d) Freezing seawater produces ice that is nearly fresh, making freeze separation a particularly efficient method of desalination.
    (e) Reverse osmosis requires pressure.

11. The two most abundant elements dissolved in seawater are
    (a) flourine and iodine
    (b) gold and silver
    (c) sodium and carbonate
    (d) sodium and chloride
    (e) sulfate and chloride
12. The salinity of ocean surface waters is generally HIGHEST at
   (a) the North Pole.
   (b) about 75 degrees latitude north or south of the Equator.
   (c) about 50 degrees latitude north or south of the Equator.
   (d) about 25 degrees latitude north or south of the Equator.
   (e) the Equator.

13. The density of seawater will increase the most if the water's temperature ____________ and the water's salinity ____________.
   (a) freaks out ... weeps and moans
   (b) increases ... decreases
   (c) increases ... increases
   (d) decreases ... decreases
   (e) decreases ... increases

14. For the same volume of water, which of the following processes will involve the greatest amount of heat (either heat absorbed or heat released)?
   (a) Evaporation of liquid water to water vapor.
   (b) Melting of ice to liquid water.
   (c) Freezing of seawater to form relatively fresh ice.
   (d) A change in the temperature of ice from -50 C to 0 C.
   (e) A change in temperature of liquid water from 0 C to 100 C.

15. If a tub holds 1000 pounds of typical (average) seawater, what will be the weight of the water (H2O molecules) versus the weight of the dissolved solids? (Hint: the answer relates to the average salinity of seawater.)
   (a) 700 pounds of water; 300 pounds of dissolved solids
   (b) 950 pounds of water; 50 pounds of dissolved solids
   (c) 965 pounds of water; 35 pounds of dissolved solids
   (d) 990 pounds of water; 10 pounds of dissolved solids
   (e) 999 pounds of water; 1 pound of dissolved solids
Chapter 6

16. Tropical cyclones (hurricanes) tend to move in which manner?

☐ (a) They move in all directions (their movement is completely unpredictable).
☐ (b) They tend to travel toward the equator in both hemispheres.
☐ (c) In the northern hemisphere they tend to travel from east to west in right-curving paths.
☐ (d) In the northern hemisphere they tend to travel from west to east in left-curving paths.
☐ (e) Southern hemisphere hurricanes commonly cross the equator into the northern hemisphere, and vice versa.

17. When a mass of cold air and a mass of warm air come together at a front

☐ (a) generally little precipitation will occur.
☐ (b) a hurricane often forms.
☐ (c) the warm air tends to move up on top of the cold air, leading to high precipitation.
☐ (d) the Saffir-Simpson scale usually goes up.
☐ (e) the ITCZ reverses direction.

18. The earth gains heat from the Sun, and loses heat to outer space. Which of the following is a CORRECT statement about this process? (Hint: consider Figures 6.2 and 6.3 and the related reading.)

☐ (a) The earth gains the same amount of the Sun's heat, and loses the same amount to space, everywhere on earth.
☐ (b) Overall, the earth gains more heat from the Sun than it loses to outer space -- this is why the earth has slowly warmed up since its formation.
☐ (c) Overall, the earth loses more heat to outer space than it gains from the Sun -- this is why the earth has slowly cooled down since its formation.
☐ (d) In general, there is a net movement of heat from the poles toward the equator, and this explains why the poles are colder than the equator.
☐ (e) Near the equator the earth gains more heat from the Sun than it loses to outer space, while the opposite occurs near the poles.

19. The earth rotates (spins on its axis) in an eastward direction at about

☐ (a) 1000 miles per hour.
☐ (b) 500 miles per hour.
☐ (c) 200 miles per hour.
☐ (d) 50 miles per hour.
☐ (e) Can't say without more information, because the speed of rotation depends on the latitude.
20. **The iron hypothesis most closely relates to which of the following?**

- (a) Fertilizing forests with iron might reduce the burden on the oceans for absorbing excess carbon dioxide.
- (b) Icebergs might be "seeded" with iron particles, providing an important new source of fresh water for people.
- (c) Carbon dioxide levels in the atmosphere might be reduced by adding iron to the ocean.
- (d) Seeding clouds with finely ground iron particles might be a way to reduce the force and destructiveness of hurricanes.
- (e) Seeding clouds with finely ground iron particles might be a way to increase rainfall and agricultural crop yields.

21. **Most of the USA lies between 30 and 60 degrees latitude north of the equator. Therefore in the USA**

- (a) the prevailing winds are the westerlies.
- (b) the prevailing winds are the northeast trades.
- (c) the prevailing winds are the southeast trades.
- (d) the prevailing winds are polar easterlies.
- (e) None of the above, because the US lies along the ITCZ.

22. **The poles of the earth are much colder on average than the tropical (equatorial) areas. Which is the best explanation for this? (Hint: consider Table 6.1 and Figure 6.2 and the related reading.)**

- (a) The equator is closer to the Sun than are the poles.
- (b) The Sun's rays hit the polar areas at a low angle, but hit the equator at a nearly perpendicular angle.
- (c) More sunlight hitting the equator is reflected back into space, heating up the atmosphere on the way.
- (d) The atmosphere is thicker near the equator than it is near the poles.
- (e) The circulation of the atmosphere and the oceans keeps more heat near the equator than near the poles.

23. **Overall, the gas that contributes the most to the greenhouse effect is ______________. However, of the gases that result from human activities, the one that makes the greatest relative contribution to the greenhouse effect is ______________.**

- (a) carbon dioxide ... nitrous oxide
- (b) carbon dioxide ... methane
- (c) methane ... water vapor
- (d) water vapor ... methane
- (e) water vapor ... carbon dioxide
24. Which of the following is correct regarding the three-cell model of global atmospheric circulation, as shown in Figure 6.10? (The numbers in the answers below refer to degrees of latitude North or South of the equator.)

- [ ] (a) Air sinks at about 30 and rises at about 60.
- [ ] (b) Air rises at 0 (the equator) and sinks at about 60.
- [ ] (c) Air rises at about 30 and sinks at the poles.
- [ ] (d) Air sinks at about 0 (the equator) and sinks at about 60.
- [ ] (e) Air rises at about 0 (the equator) and rises at the poles.

25. The energy that powers tropical cyclones (in other words the energy that makes these storms occur) comes from

- [ ] (a) winds sucked into the eye of the storm.
- [ ] (b) heat released by condensation of water vapor.
- [ ] (c) the Coriolis effect.
- [ ] (d) waves that build up from the powerful winds.
- [ ] (e) low atmospheric pressure.

26. The consistent, dependable winds that blow in tropical regions (within 30 degrees latitude of the equator) are

- [ ] (a) northerlies.
- [ ] (b) westerlies.
- [ ] (c) doldrums.
- [ ] (d) trade winds.
- [ ] (e) tropical cyclones.

27. The earth's axis is tilted about 23 degrees relative to the plane of its orbit around the Sun. This is related to

- [ ] (a) the changing seasons (spring, summer, autumn and winter).
- [ ] (b) longer days in the summer.
- [ ] (c) continuous daylight at the North Pole during the northern hemisphere summer.
- [ ] (d) (a), (b) and (c) above.
- [ ] (e) None of the above.
28. Which of the following most closely relates to the formation of a "sea breeze"?
   - (a) Rising air in the ITCZ.
   - (b) Seasonal shifts of the angle of the sun (the angle of incidence).
   - (c) The direction of the prevailing easterly or westerly winds.
   - (d) Differences in the heat capacity of water versus land.
   - (e) None of the above relates to the formation of a sea breeze.

29. An area of cool, dense air will tend to ____________, causing ____________ pressure at the earth's surface. Air at the earth's surface will flow ____________ this area.
   - (a) rise ... low ... away from
   - (b) rise ... high ... toward
   - (c) sink ... high ... away from
   - (d) sink ... low ... toward
   - (e) None of the above.

30. The Coriolis effect
   - (a) causes moving air (wind) to curve to the right in the northern hemisphere.
   - (b) causes air to rise at the equator to form part of the Hadley Cell.
   - (c) causes the Sun to heat the earth's surface unevenly.
   - (d) (a), (b) and (c) above.
   - (e) None of the above.

 Chapter 7

31. A gyre is
   - (a) a circular movement of water in cold-core and warm-core eddies.
   - (b) a circular path of water vapor in Hadley Cells.
   - (c) a circular path of water motion in a wave.
   - (d) a circular path of surface currents flowing around an ocean basin.
   - (e) a circular path of water created when water sinks near the poles and rises again eventually near the equator.
32. The only surface ocean current that flows continually around the earth uninterrupted by land is the
   - (a) Agulas Current.
   - (b) West Wind Drift.
   - (c) Pacific North Equatorial Current.
   - (d) North Atlantic Deep Water Current.
   - (e) Antarctic Intermediate Water Current.

33. What is different about the water offshore of South America during an ENSO warm phase (“El Nino”) as compared to normal?
   - (a) There is stronger upwelling than normal.
   - (b) The surface water temperature is higher than normal.
   - (c) The pycnocline is weaker than normal.
   - (d) (a), (b) and (c) above.
   - (e) None of the above.

34. Ocean surface currents move in large loops called subtropical gyres. Which of the following is an INCORRECT statement about these gyres?
   - (a) There are five major subtropical gyres.
   - (b) Each gyre forms a loop made of four main currents.
   - (c) The equatorial currents in the gyres flow from west to east.
   - (d) The gyres flow in clockwise loops in the northern hemisphere and counter-clockwise loops in the southern hemisphere.
   - (e) The gyres carry warm water away from the equator and cool water toward the equator.

35. Ocean SURFACE currents are driven mainly by ________________, while DEEP currents are driven mainly by ________________.
   - (a) the trade winds ... the westerlies
   - (b) ocean waves ... differences in salinity
   - (c) the Moon's gravity ... the tides
   - (d) the prevailing winds ... differences in water density
   - (e) the equatorial currents ... the equatorial counter-currents
36. Which current within the North Atlantic gyre would likely have the lowest temperature?
   (a) The West Wind Drift.
   (b) The Gulf Stream.
   (c) The Canary Current.
   (d) The Benguela Current.
   (e) The North Equatorial Current.

37. The Gulf Stream is a _____ current and flows mainly ____ and ____.
   (a) warm ... north ... east
   (b) warm ... south ... east
   (c) warm ... south ... west
   (d) cold ... north ... east
   (e) cold ... south ... east

38. Which of the following relates most closely to conveyor-belt circulation?
   (a) The creation of equatorial currents by the trade winds.
   (b) The conveyor-belt like movement of water away from the equator in western boundary currents.
   (c) The movement of warm water east along the equator during El Nino.
   (d) The movement of cold water west along the equator during La Nina.
   (e) The sinking of cold, dense water in the North Atlantic.

39. The movement of ocean currents has been studied and measured using
   (a) floats equipped with radio transmitters.
   (b) chemical tracers.
   (c) drifting toys and Nike shoes washed overboard from container ships.
   (d) (a), (b), and (c) above.
   (e) None of the above.
40. Which of the following is true about currents and upwelling?

☐ (a) Upwelling occurs along the equator.

☐ (b) If wind direction and Ekman Transport combine to make the surface water along a coast flow away from the coast, then there will probably be upwelling along that coast.

☐ (c) Cold upwelling waters tend to be rich in nutrients and marine life.

☐ (d) (a), (b) and (c) above are all true.

☐ (e) None of the above are true.

41. Because of Ekman Transport

☐ (a) cold, salty water sinks at high latitudes.

☐ (b) upwelling or downwelling will develop best along a coastline where the wind blows parallel to the coast.

☐ (c) surface currents flow to the right of the wind in the northern hemisphere and to the left of the wind in the southern hemisphere.

☐ (d) (a) and (b) above.

☐ (e) (b) and (c) above.

42. Thermohaline circulation is related to

☐ (a) the formation of monsoons.

☐ (b) the formation of deep currents.

☐ (c) the development of ENSO.

☐ (d) the formation of warm-core and cold-core rings.

☐ (e) the formation of subtropical gyres.

43. Which of the following is most closely related to the formation of equatorial counter-currents?

☐ (a) The convergence of the California Current and the Peru Current.

☐ (b) The westward intensification of subtropical gyres.

☐ (c) The prevailing westerly winds.

☐ (d) Differences in sea level height across the ocean at the equator.

☐ (e) Ekman Transport of water into the centers of gyres.
44. Ocean surface currents move in large loops called subtropical gyres. Which of the following is CORRECT regarding the boundary currents within these gyres?

- (a) Eastern boundary currents flow toward the equator, while western boundary currents flow away from the equator.
- (b) In the Pacific Ocean, the California Current forms an eastern boundary current and the Kuroshio Current forms a western boundary current.
- (c) In the Atlantic Ocean, the Gulf Stream forms an eastern boundary current and the West Wind Drift forms a western boundary current.
- (d) (a) and (b) above are both correct.
- (e) (b) and (c) above are both correct.

45. During the warm phase of an ENSO (also called "El Nino"),

- (a) trade winds grow weak or even reverse direction.
- (b) areas in the eastern Pacific (from California south to Peru and Chile) get higher rainfall.
- (c) large amounts of water in the Pacific warm pool flow east toward South America.
- (d) the biological productivity of the Pacific Ocean near the coast of South America declines.
- (e) All of the above.

END OF QUIZ SET B!