Name: _____ Class: _____ Date: _____ ID: A

OCN-201 Chemistry and Physics section

True/False
Indicate whether the statement is true or false.

____ 1. Because of the dissolved salt in seawater its freezing point is lower than that of pure water

____ 2. Short residence time elements are found in the greatest concentration near their point of removal from the ocean

____ 3. The concentration of Silicate in the deep water of the Pacific Ocean is greater than that in the deep water of the Atlantic Ocean

____ 4. The maximum density of seawater occurs at approximately 4˚C

____ 5. Outgoing radiation from the Earth is shortwave

____ 6. Low pressure zones in the atmosphere occur where air is ascending

____ 7. During El Nino the upwelling along the coast of South America ceases

____ 8. Wind waves are deep water waves

____ 9. The speed of a shallow water wave is related to its period

____ 10. Tsunami are shallow water waves

____ 11. The effect of the Sun on the generation of tides is about 40% of that of the Moon

____ 12. There are two neap tides every 28 days

____ 13. Carbon dioxide is one of several greenhouse gases

____ 14. When the CO_2 level of the atmosphere is low the average temperature of the planet is low

____ 15. A significant contributor to future global sea level rise is thermal expansion of surface ocean water

____ 16. Photosynthesis only occurs in the dark

____ 17. Deep water waves transport the same water particles over the entire distance they travel

____ 18. Tritium is a chemical that can be used to trace the physical movement of water in the oceans

____ 19. Deep water forms in the Pacific Ocean and flows to the Atlantic

____ 20. The gyre circulation in the North Atlantic is opposite to that in the North Pacific because Coriolis Force is opposite in the W Hemisphere

____ 21. Westerly winds and westerly currents travel in the opposite directions

____ 22. More solar radition per m^2 reaches the poles than tropics

____ 23. Tides are created only as a result of gravitational attraction

____ 24. Temperature and salinity affect water density. Cold, salty water tends to sink.

____ 25. The Hadley cell is an atmospheric circulation cell that moves air between the Equator and 30˚N

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 26. Major ions in sea water have residence times:
a. greater than 1 million years
b. greater than 1,000 years
c. less than 1million years
d. more than 100 million years

____ 27. Nutrients are removed from the surface waters of the ocean down to the point where the light level is
a. 75%
b. 50%
c. 10%
d. 1%

____ 28. The thermocline is the part of the ocean where
a. the density changes rapidly
b. salinity changes rapidly
c. the temperature changes rapidly
d. you are most likely to find Elvis

____ 29. The heat capacity of a substance is the amount of heat needed to raise the temperature of 1 gram of that substance by
a. 1˚C
b. 10˚C
c. 15˚C
d. 100˚C

____ 30. In water the speed of sound
a. increases with decreasing temperature
b. increases with increasing pressure
c. all of the above
d. none of the above

____ 31. The speed of light in water, compared to air is:
a. greater
b. less
c. same

____ 32. The mass of one square inch of the atmosphere at the Earth's surface is approximately
a. 5 pounds
b. 1 pound
c. 10 pounds
d. 15 pounds
e. 25 pounds

____ 33. During El Nino conditions the surface waters of the eastern Pacific are:
a. colder than normal
b. warmer than normal
c. more productive than normal
d. drier than normal

____ 34. A wave behaves as a shallow water wave when the depth of the ocean is equal to or less than:
a. one wavelength
b. 1/2 wavelength
c. 1/20 wavelength
d. 1/23 wavelength

____ 35. If a wind wave has a period of 12 seconds its velocity in meters per second in deep water would be approximately:
a. 8
b. 12
c. 18
d. 36

____ 36. The period of a wave is:
a. the distance between its crests
b. the time it takes succeeding crests to pass a fixed point
c. the number of waves that pass a fixed point each second
d. the distance from the crest to the trough of a wave

____ 37. Each day high tide is approximately:
a. 1 hour later
b. 1 hour earlier
c. 2 hours later
d. exactly the same time

____ 38. The Vostock ice core was drilled by French and Soviet scientists in
a. France
b. Greenland
c. Siberia
d. Antarctica
e. Alaska

____ 39. One sverdrup equals _____ cubic meters/second
a. 1
b. 1 thousand
c. 1 million
d. 1 billion

____ 40. High surface salinity (e.g., in the Mediterranian Sea) is due to:
a. Precipation exceeding evaporation
b. Fish sweating
c. Evaporation exceeding precipation
d. Both A and C

____ 41. A high pressure system in the Northern Hemisphere will
a. have rising air which draws surface air in, the surface winds spiral to the left
b. have rising air which draws surface air in, the surface winds spiral to the right
c. have sinking air which pushes surface air out, the surface winds spiral to the left
d. have sinking air which pushes surface air out, the surface winds spiral to the right

____ 42. Dry air is
a. 78% O_2, 21% N_2
b. 78% N_2, 21% O_2
c. 78% N_2, 21% CO_2
d. mainly water vapor

____ 43. Ekman transport in the Northern Hemisphere
a. in the same direction as the wind over the top 100m
b. 45° to the left of the wind, over a layer extending down to the depth where the current in the opposite direction to the wind
c. 90° to the right of the wind, over a layer extending down to the depth where the current in the opposite direction to the wind
d. 90° to the right of the wind over the top 100m

____ 44. The wave speed of a shallow water wave in the ocean depends on
a. Coriolis
b. it's wavelength
c. it's period
d. the ocean depth
e. the amount of water it is transporting

____ 45. In sea water major ions constitute what percentage of the total?:
a. 100%
b. 99.8%
c. 90%
d. 50%
e. 10%

____ 46. How much salt is dissolved in a kilogram of typical seawater
a. 1gram
b. 15 gram
c. 35 gram
d. 1000 gram
e. 0.1 gram

____ 47. How long would it take to replace all the water in the oceans with river water?
[The volume of the ocean is 1.4×10^{21} liters and the rate of river input into the ocean is 4×10^{16} liters/year.]
a. 36,000 years
b. 8 million years
c. 1000 years
d. 1 million years
e. 100 million years

____ 48. Most of the chemicals in seawater come from (Cl^- is the most noticable exception)
a. hydrothermal vents
b. rivers
c. rain
d. phytoplankton

____ 49. Western boundary currents are:
a. slower than eastern boundary currents
b. colder than eastern boundary currents
c. all of the above
d. none of the above

____ 50. Currents flow around the boundary of the gyres because of
a. geostrophic balance
b. Coriolis force
c. trade winds
d. Ekman spiral

____ 51. Based on your knowledge of Coriolis and Ekman transport, how do you think coastal upwelling works on the west coast of the US?
a. Southerly wind (poleward) pushes water offshore allowing deep water to surface near the coast
b. Northerly wind (equatorward) pushes water offshore allowing deep water to surface near the coast
c. Southerly wind (poleward) pulls water toeards the coast

____ 52. In the video clip with the aircraft carrier we watch in class was there
[91% of you voted for this question to be on the exam]
a. a helicopter in the air
b. two helicopters in the air
c. a helicopter on the flight deck
d. no helicopter

____ 53. In the Pacific Ocean, Tsunami travel at approximately:
a. 13 mph
b. 45 mph
c. 150 mph
d. 450 mph

____ 54. Spring tides occur when:
a. the moon is one quarter
b. the Sun and Moon are aligned with the Earth
c. Jupiter is aligned with Mars
d. none of the above

____ 55. The most recent measurements of sea level rise from satellites show sea level rising at:
a. 1 mm/year
b. 3 mm/year
c. 6 mm/year
d. 10 mm/year
e. 20 mm/year

____ 56. If the polar ice caps and glaciers amount to 7 million cubic miles of water, approximately how much water is in the ocean?
a. 1 million cubic miles
b. 1 million cubic meters
c. 7 million cubic miles
d. 50 million cubic miles
e. 300 million miles

____ 57. Nutrients will be
a. Depleted with depth
b. Depleted at the suface
c. Unchanged with depth
d. Uniform everywhere in the ocean

____ 58. If caught in a rip current you should
a. Give up and drown
b. Wait and see if a cute lifeguard will rescue you
c. Swim across it (parallel to shore)
d. Swim against it (straight into shore)

____ 59. The current CO_2 content of the atmosphere (in ppmv) is about:
a. 129
b. 183
c. 390
d. 562

____ 60. Relative to the atmosphere how much carbon dioxide is dissolved in the oceans:
a. the same amount
b. one tenth
c. 70 times as much
d. 1000 times as much

Completion
Complete each statement.

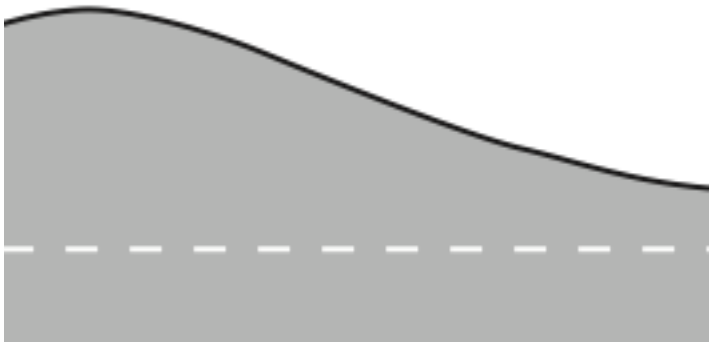
61. Major boundary currents include Agulhas, Canary, California, Benguela, Brazil, East Austrailian, Gulf stream, Kuroshio, Peru, West Austrailia, Peru. In the North Atlantic subtropical gyre, the western boundary current is _____ and the eastern boundary current is _____.

Essay

62. Name 5 of the 6 major ions in seawater.

63. Why is the ocean blue?

64. Along the dashed line in the figure below, mark the area of high pressure and low pressure. With a geostrophic balance in northern hemisphere which direction is the flow going (toward the left; toward the right; into the page; or out of the page).



65. Use the TS diagram below, and draw lines on the TS diagram indicating you working.
a) What is the density to the nearest kg/m^3 of water with a temperature (T) of 25°C and a salinity (S) of 36 g/kg?
b) Is water water with T = 25°C and S = 36 g/kg more or less dense than water with T = 0°C and S = 33.5 g/kg?