

Ocean 201 Fall 1999 Exam #2 12:30 Section

Name (Last, First):
Student ID#:

Answer #1-59 on the computer-scan sheet. (1 point each). Use a #2 pencil only and make marks neatly within circles. Please be sure you enter your ID# correctly on the scan sheets.

True/False. A=True B=False

- 1) Westerly winds travel towards the east and westerly currents travel towards the west.
- 2) The hydrothermal vent sites at Loihi have lots of animals around them.
- 3) The gyre circulation in the North Atlantic is opposite to that in the North Pacific because Coriolis Force is opposite in the Western Hemisphere.
- 4) Humid air is more dense than dry air.
- 5) The Ferrel cell is an atmospheric circulation cell that moves air from the Equator to 30 degrees N.
- 6) High pressure zones in the atmosphere occur where air is descending.
- 7) Iron is a chemical that is taken up by many organisms in the ocean because they need it for some biochemical processes.
- 8) The concentration of Silicate (Si) in the deep water of the Pacific Ocean is greater than that in the deep water of the Atlantic Ocean.
- 9) When navigators estimate their position at sea using celestial objects they achieve greater accuracy in their latitude than their longitude.
- 10) Marcet's principle states that "regardless of how the salinity may vary from place to place the ratios between the amounts of the major ions in the waters of the open ocean are nearly constant"
- 11) Carbon dioxide is the only greenhouse gas.
- 12) Geological evidence suggests that 100 million years ago carbon dioxide levels were much higher than that of today's atmosphere.
- 13) During El Nino conditions hurricanes are less likely to come near Hawaii.
- 14) When wind blows over cold ocean water it is more likely to produce rain.
- 15) Red light is absorbed most readily in the ocean.
- 16) The highest tides occur in the spring.
- 17) Outgoing radiation from the Earth is shortwave.
- 18) During El Nino conditions upwelling along the equator ceases.
- 19) During ice ages sea level goes up.
- 20) Chemical tracers can be used to find hydrothermal vent sites.
- 21) Tsunamis are deep water waves.

- 22) Tides have wavelengths of up to 12,000 miles.
- 23) Shoaling decreases the height of a wave.
- 24) The force of gravity is dependent on the volume of the objects involved and the distance between them

Multiple choice

25) The source of energy for life around hydrothermal vents is:

- a) Photosynthesis
- b) Chemosynthesis
- c) Hydrostatic pressure
- d) Radioactive decay
- e) Iron precipitation

26) The heat capacity of a substance is the amount of heat needed to raise its temperature by:

- a) 1°C
- b) 10°C
- c) 15°C
- d) 100°C

27) When water passes through a hydrothermal vent Calcium (Ca) is:

- a) removed from seawater
- b) added to seawater
- c) unaffected
- d) a and b

28) Chimneys form at hydrothermal vent sites because:

- a) various metal sulphides precipitate
- b) the surrounding seawater is oxidizing
- c) the surrounding seawater is cold
- d) all of the above
- e) none of the above

29) In class we saw slides showing the Alvin submarine diving on hydrothermal vent sites, how are the motors and the life support systems on the Alvin powered at the bottom of the ocean?

- a) a cable from the surface ship
- b) a diesel powered generator
- c) a nuclear reactor
- d) rechargeable batteries
- e) none of the above

30) The 1% light level in the open ocean (say just north of Hawaii) is somewhere around:

- a) 1 m
- b) 60 m
- c) 120 m
- d) 200 m

31) The atmospheric pressure at the top of Mauna Kea is approximately

- a) 1000 mb
- b) 820 mb
- c) 560 mb
- d) 200 mb

32) The mass of one square inch of the atmosphere at the Earth's surface is approximately:

- a) 5 pounds
- b) 1 pound

- c) 15 pounds
- d) 25 pounds
- e) 10 pounds

33) Effective transport in the Ekman layer in the northern hemisphere relative to the wind is:

- a) 20° to the left
- b) 90° to the left
- c) 15° to the right
- d) 45° to the right
- e) directly ahead

34) Western boundary currents are:

- a) Warmer than eastern boundary currents
- b) Slower than eastern boundary currents
- c) All of the above
- d) Neither of the above

35) The timing of the voyage of the Hokulea from Mangareva to Rapa Nui was selected:

- a) to take advantage of the prevailing trade winds
- b) to take advantage of breaks in the prevailing trade winds
- c) to take advantage of the prevailing surface currents
- d) because it is warmer at this time of year

36) Currents flow around the boundary of the gyres because of:

- a) Geostrophic balance
- b) Coriolis force
- c) Trade winds
- d) Ekman spiral
- e) Kelvin waves

37) Southern oscillation is:

- a) A variation in the upwelling along the equator
- b) A subsurface wave that travels along the thermocline
- c) A variation in the pressure gradient between Tahiti and Darwin
- d) A popular dance from the 1930s
- e) The reversal in the magnetic poles.

38) El Niño comes to an end because:

- a) Subsurface waves bring cold water near to the surface ocean
- b) Wind strength increases in the Central Pacific
- c) Rainfall increases in the Central Pacific
- d) all of the above

39) In the video we showed in class what were the climatic effects of El Niño on Southern California?

- a) Forest fires
- b) Drought
- c) Ocean storms
- d) Dust storms

40) The average speed of sound in water is:

- a) 5 meters/second
- b) 500 m/s
- c) 1500 m/s
- d) 3000 m/s
- e) the same as in air

41) 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

42) The SOFAR layer in the ocean is a region:

- a) with maximum sound speed
- b) with minimum sound speed
- c) where submarines can hide from SONAR
- d) where sound waves refract away from

43) The maximum energy of light coming into the surface ocean is in the following part of the spectrum?

- a) violet-indigo
- b) blue-green
- c) yellow-orange
- d) red-infrared
- e) microwave

44) A wave is classified as a shallow water wave or deep water wave depending on its:

- a) wavelength
- b) depth of the water through which it is traveling
- c) period
- d) frequency
- e) a and b

45) Data from ice-cores shows that when carbon dioxide levels in the atmosphere went down, average planetary temperatures:

- a) Stayed the same
- b) Went up
- c) Went down

46) In 1998 the average atmospheric carbon dioxide level was approximately:

- a) 280 ppmv
- b) 350 ppmv
- c) 367 ppmv
- d) 560 ppmv

47) Compared to the size of the atmospheric reservoir of carbon dioxide the fossil fuel reservoir is approximately:

- a) 10 times
- b) 13.5 times
- c) 25.7 times
- d) 100 times
- e) 140 times.

48) The rate of increase of carbon dioxide in the atmosphere is:

- a) decreasing
- b) increasing
- c) constant

49) The Vostock ice core was drilled by French and Soviet scientists in:

- a) France
- b) Greenland
- c) Siberia
- d) Antarctica
- e) Alaska

50) What is the approximate mixing time of the oceans?

- a) 100 yrs
- b) 1,000 yrs
- c) 36,000 years
- d) 1 million years
- e) 1 billion years

51) 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.

52) Conservative ions are:

- a) those whose proportions remain constant to each other in all oceans:
- b) those whose proportions vary relative to each other in all oceans.
- c) those ions whose concentration is less than 1 mmol
- d) those ions whose concentration is greater than 1 mmol
- e) those ions that listen to Rush Limbaugh.

53) The most important source for most of the chemicals in seawater is:

- a) Hydrothermal vents
- b) Rivers
- c) Rain
- d) Phytoplankton
- e) Costco

54) The presence of dissolved chemicals in sea water is important for:

- a) Allowing life to exist in the sea
- b) The regulation of the climate of the earth
- c) Altering the freezing point of seawater
- d) All of the above

55) The river where the "Great Tidal Bore" occurs every fall (as seen in the movie in class) occurs in what country?

- a) The United States
- b) China
- c) Japan
- d) Russia
- e) Uzbekistan

56) A tidal bore is a:

- a) standing wave
- b) long wave
- c) tsunami
- d) type of stokes drift
- e) diurnal tide

57) Neap tides occur when:

- a) The moon is new
- b) The moon is full
- c) The sun and moon are aligned
- d) Jupiter is aligned with Mars
- e) none of the above

58) Approximately what % of incoming light reaches 10 m depth?

- a) 1%
- b) 6%
- c) 16%
- d) 46%
- e) 0.01%

59) A seiche can occur in a:

- a) a harbor
- b) a bathtub
- c) a lake
- d) a pan of water
- e) all of the above

Fill in the blank (One point each)

The three factors that determine wave height are? _____

Name three mechanisms by which heat can be transferred

Essays. Please be clear and concise. Answer only in the space given.

(5 points) If a tsunami has a wavelength of 100 kilo meters, what is its velocity while traveling across the Pacific Ocean, which has an average depth of 4600 meters? Write the equation you are using and circle it.

Hint, use $\sqrt{4600} = 70$

(6 points) Name four chemicals that are needed by all oceanic plants and two that are needed by some organisms that build skeletons. Circle the two that are needed to build skeletons.

(4 points) Name the four principal currents that make up the gyre of the N. Pacific