

## Version2 Fall 2004

### True/False

Indicate whether the sentence or statement is true or false.

- 1. Short residence time elements are found in the greatest concentration near their point of removal from the ocean
- 2. Marquet'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"
- 3. Hydrothermal chimneys are formed from lava at mid-ocean ridge hydrothermal vent sites.
- 4. There are no hydrothermal vents in the Arctic Ocean
- 5. Calcium is an essential nutrient in seawater used by all organisms
- 6. All of the nitrate in the ocean comes from rivers
- 7. Deep water forms in the Pacific Ocean and flows to the Atlantic
- 8. Thermohaline circulation is the process whereby surface seawater becomes denser at high latitudes and sinks to form new deep water
- 9. In the mid-latitudes 30-40° there is more evaporation from the surface of the ocean than precipitation back into it
- 10. Outgoing radiation from the Earth is shortwave
- 11. Humid air is more dense than dry air
- 12. The Ferrel cell is an atmospheric circulation cell that moves air from the Equator to 30°N
- 13. Low pressure zones in the atmosphere occur where air is ascending
- 14. Surface currents are driven by thermohaline processes
- 15. Gyres in the Northern hemisphere are anticlockwise
- 16. During El Nino conditions hurricanes are more likely to come near Hawaii
- 17. When wind blows over cold ocean water it is more likely to produce rain
- 18. Wind waves are deep water waves
- 19. The wavelength of a wave is the distance from the crest to the trough
- 20. Wave packets travel more slowly than individual waves
- 21. When the crest of a wave overlaps with the trough of another wave this is called constructive interference
- 22. The crest of a tsunami always arrives first
- 23. Tsunami are deep water waves
- 24. The effect of the Sun on the generation of tides is about 45% of that of the Moon

- \_\_\_ 25. Tides are created only as a result of gravitational attraction
- \_\_\_ 26. The highest tides occur in the spring
- \_\_\_ 27. Average tidal range in Hawaii is 9 feet
- \_\_\_ 28. Carbon dioxide is one of several greenhouse gases
- \_\_\_ 29. Evidence from ice cores suggests that CO<sub>2</sub> levels in the atmosphere just before the industrial revolution were much higher than today
- \_\_\_ 30. Geological evidence suggests that 100 million years ago carbon dioxide levels were much higher than that of today's atmosphere
- \_\_\_ 31. The most significant contributor to future global sea level rise is thermal expansion of surface ocean water

### Multiple Choice

*Identify the letter of the choice that best completes the statement or answers the question.*

- \_\_\_ 32. How much salt is dissolved in a kilogram of typical seawater
  - a. 1 gram
  - b. 15 gram
  - c. 35 gram
  - d. 1000 gram
  - e. 0.1 gram
- \_\_\_ 33. What is the approximate mixing time of the oceans?
  - a. 100 yrs
  - b. 1,000
  - c. 36,000 years
  - d. 1 million years
- \_\_\_ 34. How long would it take to replace all the water in the oceans with river water?
  - a. 36,000 yrs
  - b. 8 million years
  - c. 1000 years
  - d. 1 million years
  - e. 100 million years
- \_\_\_ 35. How much of the Earth's surface water is in the oceans?
  - a. 10%
  - b. 97%
  - c. 99%
  - d. 73%
- \_\_\_ 36. When sea water passes through a hydrothermal system
  - a. Anhydrite (Ca SO<sub>4</sub>) is precipitated
  - b. Magnesium (Mg) is removed by reaction with the rock.
  - c. Sulphate is reduced to sulphide.
  - d. All of the above.
- \_\_\_ 37. Chimneys form at hydrothermal vent sites because

- a. iron sulphide precipitates
  - b. the surrounding seawater is oxidising
  - c. the surrounding seawater is cold
  - d. all of the above
- \_\_\_ 38. What determines the depth to which nitrate and phosphate are completely removed from the surface waters of the ocean?
- a. light penetration
  - b. upwelling
  - c. pressure
  - d. temperature
- \_\_\_ 39. The freezing point of seawater of salinity 35 is approximately:
- a. 0°C
  - b. -2.9°C
  - c. -1.9°C
  - d. 4°C
- \_\_\_ 40. If you cool seawater its density
- a. increases
  - b. decreases
  - c. stays the same
- \_\_\_ 41. Of the total water in the ocean the deep zone accounts for about
- a. 1%
  - b. 18%
  - c. 80%
  - d. 99.4%
- \_\_\_ 42. The colour of light that is absorbed least in the ocean is
- a. violet
  - b. blue
  - c. green
  - d. red
- \_\_\_ 43. The speed of light in water compared to air is:
- a. greater
  - b. less
  - c. same
- \_\_\_ 44. Approximately what % of incoming light reaches 10 m depth
- a. 1%
  - b. 6%
  - c. 16%
  - d. 46%
- \_\_\_ 45. 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
- \_\_\_ 46. 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
- \_\_\_ 47. At the equator the Earth is rotating eastward at approximately:
- a. 100 mph
  - b. 10,000 mph
  - c. 1,000 mph
  - d. 1,500 mph
- \_\_\_ 48. Eastern boundary currents are:
- a. slower than western boundary currents
  - b. colder than western boundary currents
  - c. all of the above
  - d. none of the above
- \_\_\_ 49. 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 new dance
- \_\_\_ 50. 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
- \_\_\_ 51. 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
- \_\_\_ 52. If a wind wave has a period of 8 seconds its velocity in meters per second in deep water would be approximately:
- a. 8
  - b. 12
  - c. 24
  - d. 210
- \_\_\_ 53. When wave trains propagate away from a storm they lose what percentage of their height each day?
- a. 10%
  - b. 50%
  - c. 30%
  - d. 22%
- \_\_\_ 54. When a deep water wave approaches the shore which of the following is true:
- a. its velocity remains constant
  - b. its period remains constant
  - c. its wavelength remains constant

- d. all of the above
- \_\_\_ 55. In the Pacific Ocean, Tsunami travel at approximately:
  - a. 13 mph
  - b. 45 mph
  - c. 150 mph
  - d. 450 mph
- \_\_\_ 56. The period of a typical Tsunami is:
  - a. 30 seconds
  - b. 2 minutes
  - c. 15 minutes
  - d. 35 minutes
- \_\_\_ 57. Spring tides occur when:
  - a. the moon is full
  - b. the sun and moon are aligned
  - c. Jupiter is aligned with Mars
  - d. none of the above
- \_\_\_ 58. Typical tidal range in Hawaii is
  - a. 2ft
  - b. 6ft
  - c. 10ft
  - d. 20ft
- \_\_\_ 59. Each day high tide is approximately:
  - a. 1 hour later
  - b. 1 hour earlier
  - c. 2 hours later
  - d. exactly the same time
- \_\_\_ 60. The current CO<sub>2</sub> content of the atmosphere (in ppmv) is about:
  - a. 120
  - b. 180
  - c. 375
  - d. 560
- \_\_\_ 61. The rate of increase of carbon dioxide in the atmosphere is:
  - a. decreasing
  - b. increasing
  - c. constant
- \_\_\_ 62. Compared to the size of the atmospheric reservoir of carbon dioxide the fossil fuel reservoir is approximately:
  - a. 13.5-times
  - b. 25.7-times
  - c. 100-times
  - d. 140-times
  - e. 10-times
- \_\_\_ 63. During an ice age sea level
  - a. goes up
  - b. goes down

- c. stays the same

### **Completion**

*Complete each sentence or statement.*

64. The mixing time of the oceans is approximately \_\_\_\_\_ years
65. Major ions are well mixed in the ocean because they have a \_\_\_\_\_ residence time.
66. The energy released when atmospheric water vapour turns into rain is called \_\_\_\_\_ heat
67. Currents are named for the direction they \_\_\_\_\_, winds are named for the direction they \_\_\_\_\_
68. The two forces that raise the tides on the surface of the Earth are \_\_\_\_\_ and \_\_\_\_\_

### **Essay**

69. Name 5 of the 6 major ions in seawater.
70. Name the principal currents in the North Pacific gyre
71. Name the three mechanisms of heat transfer.