True/False

Indicate whether the sentence or statement is true or false.

2. Aerosol particles in air pollution can have a cooling effect on climate.
3. Calcium is an essential nutrient in seawater used by all organisms.
4. In the ocean, sound travels farthest in the regions where its velocity is greatest.
5. Gyres in the Northern hemisphere move counter-clockwise.
6. The velocity of a deep water wave can be calculated from its period.
7. The density of seawater is determined by temperature and salinity.
8. Rising air gets warmer.
9. Upwelling usually brings nutrient-poor water to the surface.
10. Deep-ocean nitrate comes from remineralization.
11. Short residence time elements are uniformly distributed in the oceans.
12. The Hadley cell is an atmospheric circulation cell that moves air from the Equator to 30˚N.
13. Spring tides occur when the Sun and the Moon are in line with each other.
14. There is more phosphate in the deep water of the Pacific Ocean than in the deep water of the Atlantic Ocean.

Multiple Choice

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

15. The ocean is blue because
   a. Blue light is absorbed more readily than other colors
   b. Reefs and other benthic structures are blue
   c. Red light is absorbed more readily than other colors
   d. None of the above

16. 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

17. Nutrients are removed from the surface waters of the ocean down to the point where the light level is
   a. 50%
   b. 10%
c. 5%
d. 1%

18. The energy to move the winds comes from
   a. the sun  
   b. the ocean  
   c. the rotation of the Earth  
   d. the tides

19. The freezing point of seawater of salinity 35 is approximately:
   a. 0°C  
   b. -2.9°C  
   c. -1.9°C  
   d. 4°C

20. During an El Nino event, Southeast Asia and Indonesia get
   a. rainier  
   b. drier  
   c. higher sea level  
   d. more intense hail storms

21. Typical tidal range in Hawaii is around
   a. 2ft  
   b. 6ft  
   c. 10ft  
   d. 20ft

22. 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

23. 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

24. The period of a typical Tsunami is:
   a. 30 seconds  
   b. 2 minutes  
   c. 15 minutes  
   d. 35 minutes

25. 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

26. The thermohaline conveyor belt makes one circuit in about
   a. 100 years  
   b. 1000 years  
   c. 1 million years  
   d. 10.5 months

27. The pycnocline is the depth in the ocean where
   a. the temperature changes rapidly
b. the salinity changes rapidly
c. the density changes rapidly
d. sharks hang out waiting for surfers

28. How much salt is dissolved in a kilogram of typical seawater
   a. 1 gram
   b. 15 grams
   c. 35 grams
   d. 0.1 gram

29. In the Northern Hemisphere, the coriolis effect causes winds to
   a. rise
c. bend left
   b. fall
d. bend right

30. The 1% light level in the open ocean (say just north of Hawaii) is somewhere around
   a. 1 m
   b. 40 m
   c. 120 m
d. 200 m

31. The IPCC has confirmed that
   a. the Earth is warming everywhere
c. only a few places are warming
   b. most of the Earth is warming
d. the temperature record is so variable that we cannot conclusively say if the Earth is warming

32. As you move down deep into the ocean, the sodium concentration
   a. increases
c. stays the same
   b. decreases
d. none of the above

33. Western boundary currents are:
   a. slower than eastern boundary currents
   b. colder than eastern boundary currents
   c. both of the above
   d. none of the above

34. When waves refract, they:
   a. bend
c. convert to heat
   b. bounce in all directions
d. uniformly bounce in one direction

Completion

Complete each sentence or statement.

35. The Earth loses its heat by ___________
36. The doldrums are located in the _________ zone.
37. Major ions are well mixed in the ocean because they have a _______ residence time.

Short Answer

38. The source of iron in the central Pacific is _______
39. Explain why tsunamis in the deep ocean are considered to be shallow-water waves.

Essay

40. Can you see in the ocean below 1000 m? Why or why not?