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Name:_____ Class:_____ Date:_____

Chapter: 2

1. Adding dissolved compounds such as salt to water _____ the boiling point and _____ the freezing point.
   a. increases; increases
   b. increases; decreases
   c. decrease; increases
   d. decreases; decreases

ANSWER: b

2. The high specific heat of water
   a. means large amounts of heat are needed to change the temperature of water.
   b. requires significant heat energy to make the transition from solid to liquid.
   c. requires significant heat energy to make the transition from liquid to gas.
   d. makes it difficult to increase the temperature of liquid water above 100°C.

ANSWER: a

3. Which is NOT an adaptation that exploits the density of water?
   a. a gas-filled swim bladder
   b. droplets of oil on algae
   c. long, filamentous appendages
   d. high percentages of fat

ANSWER: c

4. The low density of ice
   a. makes it ineffective at insulating water from the cold.
   b. allows aquatic plants to survive the winter.
   c. is due to the high viscosity of water.
   d. prevents it from moving in water.

ANSWER: b

5. Water's polar nature
   a. explains its high density.
   b. makes it a good solvent.
   c. causes it to freeze at 0°C.
   d. limits the amount of dissolved nutrients it can hold.

ANSWER: b

6. At what temperature does water reach its maximum density?
   a. 32°C
   b. 0°C
   c. 4°C
   d. –12°C
   e. 100°C

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Chapter: 2

ANSWER: c

7. The limit to the amount of minerals water can hold is called
   a. the dissolution limit.
   b. the solvent point.
   c. deposition.
   d. saturation.

ANSWER: d

8. Which is the most basic?
   a. human blood
   b. acid rain
   c. carbonated beverages
   d. pure water

ANSWER: a

9. Which causes acid rain?
   a. CO_2
   b. SO_2
   c. HCO_3
   d. NaOH

ANSWER: b

10. Aquatic organisms have developed streamlined shapes to adapt to the
   a. density of water.
   b. viscosity of water.
   c. polar nature of water.
   d. basic nature of water.

ANSWER: b

11. Which part of an organism is less dense than water?
   a. bone
   b. protein
   c. muscle
   d. fat

ANSWER: d

12. A liquid with low pH would have
   a. high OH^- concentration.
   b. low NO_2 concentration.
   c. low $CaCO_3$ concentration.

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d. high H+ concentration.

ANSWER: d

13. Which of the nutrients listed below is NOT required by all organisms?

a. nitrogen
b. phosphorus
c. potassium
d. sulfur
e. silicon

ANSWER: e

14. Limestone deposits are due to

a. the low pH of ocean water.
b. the solubility of calcium carbonate.
c. the polar nature of water.
d. acid deposition.

ANSWER: b

15. You are studying a small stream and find that its pH is 4.5. What does this tell you about the stream, and what might be the cause?

ANSWER: The stream is abnormally acidic, given that the typical range of pH for small ponds and streams is between 6 and 9. The cause of the acidity could be anthropogenic, such as acidic drainage from mining wastes or acid rain.

16. What is unusual about the physical properties of water?

ANSWER: While most substances increase in density from gas to liquid to solid, ice is one of the few substances with a solid state that is less dense than its liquid state

17. Why is liquid water important for the formation of life on Earth?

ANSWER: The liquid state of water allows it to act as a solvent for many nutrients, making them accessible to early life forms. The heat capacity of water also moderates the temperature of bodies of water and Earth itself.

18. How does a low pH harm aquatic environments?

ANSWER: At high levels hydrogen ions can interfere with enzymes and dissolve heavy metals, many of which are toxic.

19. Solutes

a. are membranes through which nutrients pass into cells.
b. reduce the acidity of water.
c. are particles that can pass through cell membranes.
d. are substances dissolved in water.

ANSWER: d

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Chapter: 2

20. A freshwater fish with a high concentration of dissolved nutrients will
    a. have high osmotic pressure.
    b. have low osmotic pressure.
    c. be hyposmotic.
    d. actively secrete solutes.

ANSWER: a

21. Hyperosmotic conditions
    a. cause low osmotic pressure.
    b. occur in freshwater organisms.
    c. cause active secretion in gills.
    d. occur in arid landlocked lakes.

ANSWER: b

22. Why is it important for organisms to osmoregulate?
    a. Organisms cannot survive in hyposmotic conditions.
    b. Active transport requires large amounts of energy.
    c. An imbalance in solutes disrupts cell functions.
    d. High osmotic pressure can burst cell walls.

ANSWER: c

23. The use of salt on roads in winter has led to
    a. adaptation of roadside plants to increased salt levels.
    b. decreased survival of freshwater organisms in nearby ponds.
    c. hyperosmotic conditions.
    d. increased acid deposition.

ANSWER: b

24. Mangroves grow on salt-laden coastal mudflats that are inundated daily by high tides. Which of the following is NOT used by the plant to address the problem of water acquisition and elimination of excess salts?
    a. growing only when salt content of the coastal mudflats are at the season lowest levels
    b. maintaining high concentrations of organic solutes in their roots
    c. excluding salts from their roots by active transport
    d. actively excreting salt from glands on the surfaces of their leaves

ANSWER: a

25. Ammonia is a by-product of
    a. digesting proteins.
    b. absorbing excess salts.
    c. excreting urea.

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d. active uptake in gills.

ANSWER: a

26. How does the permeable nature of cells affect evolution in aquatic animals?

ANSWER: Because their cells are permeable, aquatic animals must adapt ways to regulate the transfer of nutrients and water between their cells and their environment. Marine and freshwater organisms have evolved differently because of the opposite conditions in the two environments: Marine organisms must adapt to high salt concentrations, and freshwater organisms must adapt to low salt concentrations.

27. Why do sharks retain urea rather than excrete it? How does this influence their fitness?

ANSWER: Because the urea acts as a solute in their blood, it reduces the osmotic pressure produced by hyperosmotic conditions in the ocean. Their fitness is improved because they require less energy to survive and therefore need less food to remain healthy.

28. Explain why freshwater fish do not need to drink water.

ANSWER: Since freshwater fish are hyperosmotic in relation to their environment, their cells tend to absorb water from their environment. This means they must work to eliminate excess water and do not need to drink any additional water.

29. Which of the following is NOT a part of carbon equilibrium in water?

a. bicarbonate
b. ammonia
c. hydrogen ions
d. carbonic acid

ANSWER: b

30. Why are both carbon dioxide and oxygen limited in aquatic environments?

a. They are not very soluble in water.
b. They change to different chemical forms in water.
c. They cannot diffuse across cell membranes.
d. They are rare in the atmosphere and therefore limited in water.

ANSWER: a

31. How does the concentration of bicarbonate in water compare to the concentration of carbon dioxide in the air?

a. one-tenth
b. about the same
c. twice as much
d. about 30 times more
e. over 100 times more

ANSWER: e

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Chapter: 2

32. How does water in a bog differ from water in other locations?
    a. More bicarbonate and more carbon dioxide are available.
    b. More bicarbonate and less carbon dioxide are available.
    c. Less bicarbonate and more carbon dioxide are available.
    d. Less bicarbonate and less carbon dioxide are available.

ANSWER: c

33. Which does NOT limit the ability of aquatic plants to photosynthesize?
    a. slow diffusion of carbon dioxide in water
    b. boundary layers
    c. the size of bicarbonate molecules
    d. high levels of carbonic acid

ANSWER: d

34. The dissolved oxygen levels in water did NOT require adaptation for
    a. whales.
    b. sharks.
    c. squid.
    d. zooplankton.

ANSWER: a

35. Which is used to increase oxygen extraction?
    a. hydrogen ions
    b. boundary layers
    c. countercurrent circulation
    d. concurrent circulation

ANSWER: c

36. Anaerobic conditions
    a. decrease photosynthesis.
    b. are due to increased pH.
    c. decrease the diffusion of oxygen.
    d. are more common in deep water than in the shallows.

ANSWER: d

37. Which is a byproduct of anaerobic respiration?
    a. CO_2
    b. H_2CO_3
    c. H_2S
    d. HCl

ANSWER: c

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Chapter: 2

38. Which is NOT an adaptation to low-oxygen aquatic environments?
    a. increased hemoglobin
    b. breathing air
    c. increased metabolic activity
    d. symbiotic relationship with algae

ANSWER: c

39. In which location would you expect to find the highest levels of dissolved oxygen?
    a. deep ocean water
    b. a freshwater bog
    c. a landlocked lake
    d. a fast, shallow river

ANSWER: d

40. Explain why there are relatively few plant species in mangrove forests.

ANSWER: Mangrove forests have both low levels of oxygen and high salinity. Survival in these conditions requires additional energy and specific adaptations. Relatively few plants have evolved to withstand both low levels of oxygen and high salinity.

41. What are some ways to prevent an aquarium from becoming anoxic?

ANSWER: One possibility is adding aquatic plants that produce oxygen. Another option is to increase the surface area of water that is exposed to the air (with stirring, for example), since that will increase the rate of diffusion.

42. Why is it surprising that some organisms are able to live at temperatures above 75°C?
    a. High temperatures decrease the efficiency of glycoproteins.
    b. High temperatures denature proteins.
    c. High temperatures evaporate water in cells.
    d. High temperatures increase the permeability of cell membranes.

ANSWER: b

43. What enables thermophilic bacteria to withstand very high temperatures?
    a. high glycerol concentrations that protect cell membranes
    b. low concentrations of isozymes that change form at high temperatures
    c. cell materials that reduce heat transfer
    d. high proportions of particular amino acids that form strong bonds

ANSWER: d

44. The rate of biological processes increases two to four times for each _____ increase in temperature
    a. 12°C
    b. 10°C

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c. 8°C
d. 5°C

ANSWER: b

45. What prevents ice formation in blood and tissues of marine animals?
a. an increased concentration of glycerol
b. an increased concentration of oxygen
c. a decreased concentration of salt
d. a decreased concentration of trimethylamine oxide

ANSWER: a

46. Organisms that survive in varied temperatures adapt to changes by using
a. supercooling.
b. hyperosmotic molecules.
c. countercurrent circulation.
d. isozymes.

ANSWER: d

47. Suppose organisms in a lake are limited by oxygen. How might the lake's ability to support organisms change if the temperature increased by 10°C, assuming that all the organisms were still within their thermal optima?
a. It could support about twice as many organisms.
b. It could support about half as many organisms.
c. It could support about the same number of organisms.
d. More information is required to determine whether it would change.

ANSWER: b

48. Glycoproteins coat ice crystals that begin to form in blood and prevent freezing in a process called
a. antifreeze accumulation.
b. supercooling.
c. isozymal coating.
d. osmoregulation.

ANSWER: b

49. What concept does the graph illustrate? Explain why it is important.

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Chapter: 2

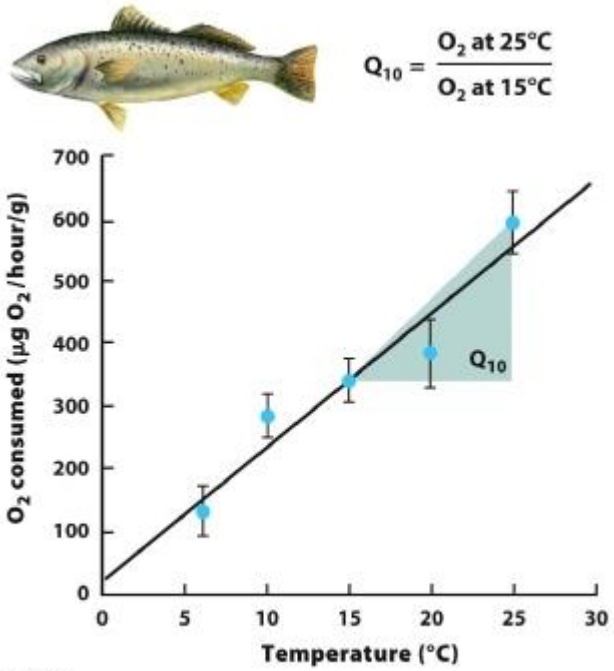


Figure 2.18
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ANSWER: The graph illustrates the Q10 ratio of physiological processes. This is a measure of how organisms increase their metabolism at higher temperatures and as a result develop faster, up to the point when high temperatures begin to have negative effects.

50. What unique low-temperature challenge are marine organisms likely to encounter?

ANSWER: Because of its high salt content, seawater freezes at –1.9°C. The tissue and blood of most vertebrates contain roughly half as much salt as sea water, meaning they can freeze while the water around them is still liquid.

51. Explain why thermal pollution is relatively rare in oceans.

ANSWER: While local temperatures can be increased by human activities, the large size of the oceans means that any change will have much less impact, since currents and diffusion will reduce the change in temperature unless the effect is global, like the increase in temperature from climate change.

52. Explain how osmotic regulation might make marine organisms better at surviving low temperatures than freshwater organisms.

ANSWER: Because of the higher solute concentration in oceans, marine organisms such as sharks have adapted to higher solute concentrations in their tissues to reduce the energy required for osmotic regulation. An increase in salt or similar solutes will reduce the freezing point of the organism, potentially allowing it to survive temperatures that could freeze a freshwater organism.

53. What percentage of a normal distribution is within one standard deviation of the mean?

a. 34%
b. 50%
c. 68%
d. 76%

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e. 95%

ANSWER: c

54. Nine ponds are sampled, and the mean salt concentration is 121 ppm, with a sample variance of 25 ppm. What is the standard deviation of the sample?

a. 0.6
b. 2.2
c. 3
d. 5
e. 11

ANSWER: d

55. Samples of ocean water are taken from 25 locations, and the mean salt concentration is 36 ppt, with a sample variance of 1 ppt. What is the standard error of the sample?

a. 0.2
b. 0.5
c. 1
d. 1.2
e. 5

ANSWER: a

56. What do a large standard deviation and small standard error tell you about the data from several samples?

ANSWER: A large standard deviation means that the data are spread out around the mean, while a small standard error indicates that the calculated mean is the actual mean.

57. The primary cause of coral bleaching is

a. decreased water temperature.
b. increased water temperature.
c. decreased salt concentrations.
d. increased water pH.
e. decreased water pH.

ANSWER: b

58. Coral bleaching

a. occurs when coral exoskeletons begin to break down.
b. is due to a lack of dissolved nutrients from the surrounding water.
c. is a temporary process that is usually reversed within days.
d. occurs when algae are expelled from coral.

ANSWER: d

59. Explain how increased atmospheric carbon dioxide can affect the ability of coral to build their exoskeletons.

ANSWER: The increased carbon dioxide in the atmosphere increases the diffusion of carbon dioxide into the

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water, which becomes carbonic acid. This carbonic acid dissociates and recombines with existing carbonate to form bicarbonate, reducing the available carbonate used by coral as calcium carbonate.

60. Explain how acid precipitation indirectly impacts trees.
ANSWER: Acid precipitation causes leaching of soil nutrients, thus making these nutrients unavailable for use by trees.

61. You are studying a river estuary system. Explain why a prolonged summer drought in the river's watershed might have a potential impact on species living in the estuary.
ANSWER: More salt water would advance up the river from the ocean.

62. The thermal optimum for an organism results from
a. the environment in which the organism is found.
b. the genetic makeup of the organism.
c. the niche of the organism.
d. the thermal properties of water.
ANSWER: b

63. Organisms that can withstand high environmental temperatures without having their proteins denatured are termed
a. endothermic.
b. exothermic.
c. thermophilic.
d. homeothermic.
ANSWER: c

64. Fish obtain oxygen from the water through their gills using
a. countercurrent circulation.
b. concurrent circulation.
c. unidirectional circulation.
d. recurrent circulation.
ANSWER: a

65. Spotted salamanders lay eggs in gelatinous masses on twigs partially submerged in small ponds or vernal pools. Associated with the eggs, scientists have found a species of alga living in a mutualistic relationship with the developing eggs. What benefit does the salamander receive from this relationship?
a. The salamander eggs are better camouflaged.
b. The salamander embryos receive an increased oxygen supply.
c. The salamander embryos receive an increased carbon dioxide supply.
d. The salamander embryos receive an increased nitrogen supply.
ANSWER: b

66. The region of unstirred air or water surrounding the leaf surfaces of a terrestrial or aquatic plant is called the

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Chapter: 2

a. photosynthetic active region.
b. diffusion layer.
c. boundary layer.
d. transpiration zone.

ANSWER: c

67. A smallmouth bass swimming in colder water of a springtime lake would likely expend _____ energy than when swimming in warmer water of the same lake during the summer (all things being equal).

a. less
b. more
c. the same
d. There is no way to determine.

ANSWER: b

68. The intricately designed shells of the algae known as diatoms are made up of which minor nutrient?

a. magnesium
b. calcium
c. iron
d. silica

ANSWER: d

69. Explain from a physiological perspective why it would be advantageous for a temperate freshwater fish species to produce isoenzymes.

ANSWER: During the course of the year, temperate freshwater fish are exposed to varying water temperatures (winter to summer). Enzymes mediate physiological reactions in the cells of the fish. Enzymes operate most efficiently with specificity to temperature, and thus the chemical reactions within the cells of fish require multiple forms of an enzyme that function at the varying environmental temperature ranges to which the fish would be exposed.

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