

# CHAPTER 13--WATER RESOURCES

*Student:* \_\_\_\_\_

1. Most of the water in the Colorado River comes from which of the following sources?
  - A. Great Salt Lake
  - B. snow melt in the Rocky Mountains
  - C. glaciers in Canada
  - D. aquifers in Wyoming
  - E. lakes in Montana
2. The Colorado River provides water and electricity to what percentage of the U.S. population?
  - A. 2%
  - B. 5%
  - C. 8%
  - D. 10%
  - E. 15%
3. Access to water issue for all of humanity. The authors list four of those issues. Which of the following is not one of those issues?
  - A. scientific issue
  - B. global health issue
  - C. economic issue
  - D. national and global security issue
  - E. environmental issue
4. What percentage of the earth's surface is covered by water?
  - A. 86%
  - B. 71%
  - C. 67%
  - D. 58%
  - E. 52%
5. What percentage of the world's water supply is liquid freshwater that is available to living organisms?
  - A. 24%
  - B. 20%
  - C. 10%
  - D. 0.024%
  - E. 0.000024%

6. Which of the following is *false*?
- A. Recharging of groundwater is a slow process.
  - B. The water table moves down in dry weather.
  - C. Some caverns have rivers flowing through them
  - D. Groundwater is stationary, it does not move.
  - E. The water table is the top of the zone of saturation.
7. At a certain depth, the area where the spaces in soil and rock are completely filled with water is called
- A. the zone of saturation
  - B. the water table
  - C. an aquifer
  - D. surface water
  - E. the bedrock
8. The geological layer, consisting of underground caverns and porous layers of sand, gravel, or bedrock, where groundwater flows, is called
- A. the zone of saturation
  - B. the water table
  - C. an aquifer
  - D. surface water
  - E. the bedrock
9. The land from which surface water drains into a particular lake, river, or other body of water is called
- A. the zone of saturation
  - B. watershed
  - C. an aquifer
  - D. surface water
  - E. the bedrock
10. What percentage of the world's reliable surface runoff is currently being withdrawn?
- A. 10%
  - B. 18%
  - C. 22%
  - D. 34%
  - E. 45%
11. What percentage of water withdrawn from lakes, streams, and rivers is used by cities and residences?
- A. 10%
  - B. 20%
  - C. 50%
  - D. 70%
  - E. 80%

12. In the United States what percentage of direct water use is lost due to water leaks?
- A. 27%
  - B. 22%
  - C. 17%
  - D. 16%
  - E. 14%
13. Affluent lifestyles use a lot of water. For example, how much water does it take to make one automobile?
- A. 450,000 gallons
  - B. 392,600 liters
  - C. 104,000 gallons
  - D. 45,000 liters
  - E. 45,000 gallons
14. Indirectly used water, that is, water consumed to produce food and other products, is called
- A. surface runoff
  - B. virtual water
  - C. non-renewal aquifers
  - D. water table
  - E. groundwater
15. There are four major problems associated with the use of the Colorado River's water. Which one of the following is *not* one of those problems?
- A. Mexico and the U.S. have agreed to take more water than is in the river
  - B. The river does not have much of a flow considering its size.
  - C. The river gets most of its water from mountain snow melt.
  - D. Water seldom makes it to the mouth of the river.
  - E. The Colorado River basin includes some of the driest areas in the U.S.
16. What percentage of China's major cities are already facing water shortages?
- A. 25%
  - B. 33%
  - C. 50%
  - D. 67%
  - E. 100%
17. By 2013 at least 36 U.S. states are likely to face water shortages for all of the following reasons, *except*
- A. drought
  - B. cooling temperatures
  - C. population growth
  - D. urban sprawl
  - E. waste of water

18. What percentage of groundwater and surface water withdrawn in the U.S. was used to cool electric power plants?
- A. 41%
  - B. 37%
  - C. 13%
  - D. 9%
  - E. 3%
19. The United States unnecessarily wastes approximately how much of the water it withdraws from groundwater and surface supplies?
- A. 30%
  - B. 40%
  - C. 50%
  - D. 60%
  - E. 70%
20. By the year 2025 how many of the world's people are likely to lack access to clean water?
- A. 1 billion
  - B. 2 billion
  - C. 3 billion
  - D. 4 billion
  - E. 7.9 billion
21. Aquifers provide drinking water for how much of the world's population?
- A. 25%
  - B. 33%
  - C. 50%
  - D. 67%
  - E. 75%
22. Saudi Arabia gets 70% of its drinking water from
- A. deep aquifers
  - B. water imports
  - C. dammed rivers
  - D. desalinization
  - E. lakes
23. The advantages of withdrawing groundwater include all of the following *except*
- A. pollution is quickly removed
  - B. can be used for drinking and irrigation
  - C. exists almost anywhere
  - D. renewable if not overpumped
  - E. cheaper to extract than most surface waters

24. The United States is withdrawing groundwater from aquifers at a rate that is \_\_\_\_ times faster than it can be recharged.
- A. 2
  - B. 3
  - C. 4
  - D. 5
  - E. 10
25. The water table for parts of the massive Ogallala aquifer has dropped as much as \_\_\_\_ meters as a result of the water being withdrawn for irrigation.
- A. 5
  - B. 10
  - C. 15
  - D. 20
  - E. 30
26. The term *subsidence* refers to
- A. failure of the groundwater supply
  - B. sinking of ground when water has been withdrawn
  - C. living on very little money
  - D. intrusion of salt water into a freshwater aquifer
  - E. money paid by the government to farmers
27. Withdrawing too much water from an aquifer can cause all of the following *except*
- A. droughts
  - B. land subsidence
  - C. sinkholes
  - D. freshwater contaminated with saltwater
  - E. making aquifers impossible to recharge
28. Tapping deep aquifers for water sources creates all of following concerns *except*
- A. they are nonrenewable on a human time scale
  - B. little is known about geological or ecological impacts
  - C. many are found under more than one country with not international agreements
  - D. deep aquifers are heavily polluted
  - E. costs of tapping deep aquifers are unknown
29. The main goals of a dam and reservoir include all of the following *except*
- A. produce electricity
  - B. clean the water
  - C. supply water for irrigation
  - D. provide recreational activities
  - E. reduce downstream flooding

30. Four of the following are disadvantages of dam and reservoir systems; one is not. Choose the one that is not.
- A. disrupts migration of some fish
  - B. displaces people behind the dam
  - C. leads to devastating flooding if there is a failure
  - D. reduces water loss through evaporation
  - E. reduces nutrients released downstream
31. Because of greatly increased irrigation, Africa's Lake Chad has shrunk by \_\_\_\_% since the 1960s.
- A. 43
  - B. 55
  - C. 77
  - D. 86
  - E. 97
32. Which of the following is not true of the Colorado River basin?
- A. much needed sediment is washed to coastal wetlands
  - B. 80% of water withdrawn from the Colorado River goes to irrigation
  - C. government subsidies have led to inefficient use of irrigation water
  - D. water is leaking to the ground below the river
  - E. there is a high evaporation rate
33. To address the water supply problems in the Colorado River basin, experts call for the 7 states using the river water to do all of the following *except*
- A. slow urban population growth and development
  - B. lower the price of water taken from the river
  - C. switch water thirst crops to less arid areas
  - D. prohibit use of water on golf courses and lawns
  - E. eliminate subsidies for agriculture in this region
34. Farmers could not grow lettuce in the arid interior of California without which of the following?
- A. desalinization
  - B. winds coming off the Pacific Ocean
  - C. El Nino southern oscillation
  - D. government subsidies
  - E. cheap prices for lettuce seeds
35. Which of the following *is not* true of the disaster that befell the Aral Sea?
- A. Surface level of the sea has dropped by 22 meters.
  - B. Caused by a water diversion project.
  - C. Shrinkage of the Aral Sea has altered local climate.
  - D. Populations of local animal species have remained stable.
  - E. Salt and sand from the dry sea bottom spread as far as 300 kilometers.

36. One method of desalination uses high pressure to force saltwater through a membrane filter. This method is called
- A. diffusion
  - B. distillation
  - C. reverse osmosis
  - D. active transport
  - E. passive transport
37. Which of the following is *not* a problem of desalination?
- A. reduces soil salinization on irrigated lands.
  - B. high energy cost
  - C. chemicals used to sterilize the water kill marine organisms
  - D. resulting salty wastewater must be disposed of
  - E. pumping seawater through pipes requires lots of energy
38. All of the following are proposals for improving desalinization except one. Chose the one that is not a proposal.
- A. ships that carry desalination equipment operating offshore
  - B. desalination plants operated by solar energy
  - C. desalination plants using ocean wave energy
  - D. build desalination plants next to coastal energy plants to use their cooling water
  - E. let natural evaporation remove the water in large shallow basins
39. According to water resource experts, the main cause of water waste is
- A. leakage
  - B. long showers
  - C. old toilets
  - D. dishwashers
  - E. cheap prices
40. Which of the following is the most efficient means of water delivery to crops?
- A. center-pivot sprinkler systems
  - B. low-energy precision-application (LEPA) sprinkler systems
  - C. trickle or drip irrigation
  - D. gravity-flow canal systems
  - E. diagonal-pivot systems
41. Which of the following is *not* one of the solutions for water waste?
- A. night irrigation
  - B. discourage organic farming
  - C. irrigate with treated urban waste water
  - D. line canals bringing water to irrigation ditches
  - E. avoid growing water-thirsty crops in dry areas

42. Developing countries use all of the following low-tech methods for irrigation, *except*
- A. rainwater harvesting
  - B. planting deep-rooted perennial crop varieties
  - C. mulching fields
  - D. using monoculture instead of polyculture farming
  - E. harvest fog with fog catcher nets
43. Which of the following is *not* a way to reduce water waste in industry and homes?
- A. use water-thrifty native plants in lawns
  - B. using gray water to irrigate lawns and nonedible plants
  - C. raising the cost of water in water-short areas
  - D. condensing water vapor from indoor air
  - E. recycling water for use in industry
44. One of the major human activities that has contributed to flooding is
- A. constructing dams
  - B. directing stream flow
  - C. destroying vegetation
  - D. irrigation
  - E. urbanization
45. One of the most important and effective ways to reduce flooding is to
- A. preserve and restore wetlands
  - B. straighten and deepen streams
  - C. build floodwalls
  - D. encourage people to build on floodplains
  - E. build dams
46. Despite the heavy withdrawals of water from the Colorado River, most of its water reaches the Gulf of California.
- True   False
47. Emerging shortages of water for drinking and irrigation in many parts of the world is one of the three most serious environmental problems the world faces during this century.
- True   False
48. Since 1999, much of the United States, especially the arid southwest, has experienced severe drought.
- True   False



49. Because there is so little freshwater, most of humanity manages what water they have in an efficient and helpful way.
- True False
50. Water is a national security issue.
- True False
51. Water percolating downward until it comes to an impenetrable layer of rock is called groundwater.
- True False
52. Below the relatively dry soil close to the earth's surface, the spaces in the soil, gravel, and rock are filled with water and called the water table.
- True False
53. Groundwater does not move at all.
- True False
54. Withdrawing water from a nonrenewable aquifer is similar to mining a nonrenewable mineral resource.
- True False
55. The United States has more than enough renewable freshwater.
- True False
56. Each day the average American directly uses about 69 gallons of water a day.
- True False
57. Based on climate models the southwestern United States and northern Mexico will likely have extended periods of extreme drought throughout the rest of this century.
- True False
58. Two-thirds of the annual surface runoff in rivers and streams is not available for human use.
- True False
59. In the United States, approximately one-half of the water used comes from groundwater sources and the other one-half from surface sources.
- True False

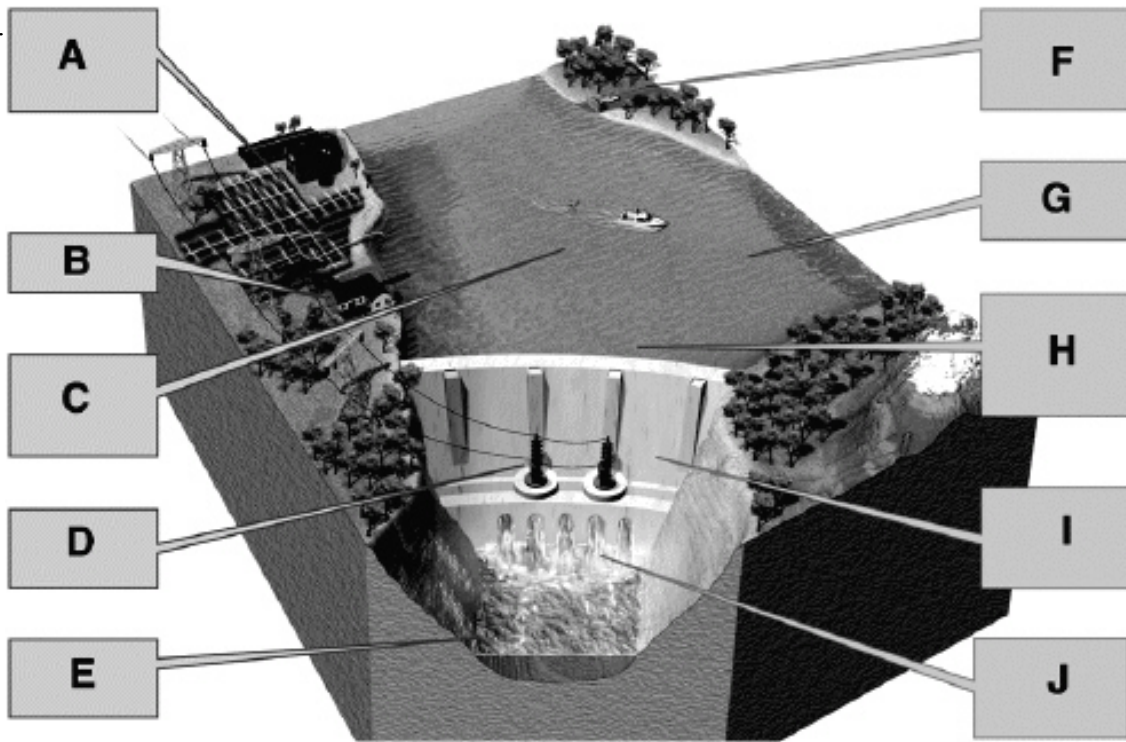
60. Global competition for water to grow food will result in food shortages and hunger among the wealthier nations of the world.
- True False
61. Saudi Arabia intends to stop producing wheat by 2016 because of depletion of its major deep aquifers.
- True False
62. Government subsidies designed to increase crop production have discouraged depletion of the Ogallala aquifer.
- True False
63. Unless depletion of aquifers is slowed, an increasing number of the world's people will have to live on water from the oceans.
- True False
64. Water in reservoirs behind dams now hold 50 times more water than the total amount flowing in all of the world's natural rivers.
- True False
65. Ninety percent of the water used by Las Vegas, Nevada, comes from the Colorado River.
- True False
66. Many people living in arid southern California cities may have to move elsewhere because of water shortages in this century.
- True False
67. The southern part of the Aral Sea has lost 90% of its volume of water, destroying wetlands and eliminating large numbers of bird and mammal species.
- True False
68. Reverse osmosis is the only practical method of desalination.
- True False
69. Desalination is practical only for rich, water-poor countries.
- True False
70. Israel has the world's largest number of desalination plants.
- True False

71. Currently, desalination plants meet about 12% of the world's water needs.
- True   False
72. Despite advances in technology, desalination is still not cheap enough to make it useful for most irrigation or drinking water.
- True   False
73. The United States is the world's largest user of water.
- True   False
74. Flood irrigation is the most efficient method of delivering water needed for crops.
- True   False
75. The low cost of water to users due to government subsidies is a major cause of water waste.
- True   False
76. Approximately 30% of irrigation water applied throughout the world does not reach the targeted crops.
- True   False
77. Microirrigation is the most efficient way to deliver small amounts of water to crops.
- True   False
78. Flushing toilets with water accounts for one-fourth of water use in the home.
- True   False
79. Floods provide several important benefits.
- True   False
80. Even though rises in sea level during this century may result in millions of Bangladeshi environmental refugees, the government of Bangladesh is not preparing for this possibility.
- True   False
81. Most of the water in the Colorado River comes from snowmelt in the \_\_\_\_\_.
- \_\_\_\_\_
82. About one of every \_\_\_\_\_ people in the United States is dependent on the Colorado River for water and electricity.
- \_\_\_\_\_

83. Access to water is a(n) \_\_\_\_\_ because lack of safe water for drinking and sanitation is the world's single largest cause of illness.
- \_\_\_\_\_
84. Water in the spaces between soil, rock, and gravel, called \_\_\_\_\_, is one of the most important sources of freshwater and a key component of the earth's natural capital.
- \_\_\_\_\_
85. Groundwater in an aquifer typically moves only a(n) \_\_\_\_\_ or so per year.
- \_\_\_\_\_
86. Precipitation that does not infiltrate the ground, or evaporate, is called \_\_\_\_\_.
- \_\_\_\_\_
87. Drought is a prolonged period in which precipitation is at least \_\_\_\_\_ % lower and evaporation is higher than normal in an area that is not normally dry.
- \_\_\_\_\_
88. By 2050, some 60 countries, many of them in Asia, with \_\_\_\_\_ of the world's population, are likely to be suffering from water stress..
- \_\_\_\_\_
89. In 2005, one of every \_\_\_\_\_ people lacked access to enough clean water to drink, cook, and wash.
- \_\_\_\_\_
90. Currently more than 400 million people are being fed grains produced by \_\_\_\_\_ water use.
- \_\_\_\_\_
91. The gigantic Ogallala aquifer supplies about \_\_\_\_\_ of all the groundwater used in the United States.
- \_\_\_\_\_
92. Groundwater overdrafts near coastal areas can contaminate aquifers with \_\_\_\_\_.
- \_\_\_\_\_

93. Of the world's 177 longest rivers, only \_\_\_\_\_ of them run freely all the way to the sea.
- \_\_\_\_\_
94. Agreements between the United States and \_\_\_\_\_ allocate water from the Colorado River that totals more than the river carries.
- \_\_\_\_\_
95. If irrigation was just \_\_\_\_\_ % more efficient, there would be enough water for domestic and industrial uses in southern California.
- \_\_\_\_\_
96. Agriculture consumes \_\_\_\_\_ of the water withdrawn in California, much of it used inefficiently for growing crops in desert-like condition of the southern half of the state.
- \_\_\_\_\_
97. Desalination produces large amounts of wastewater that contains lots of \_\_\_\_\_, which can not be dumped into nearby oceans.
- \_\_\_\_\_
98. Experts suggest that, worldwide, \_\_\_\_\_ of the water people use is wasted through evaporation, leaks, and other losses.
- \_\_\_\_\_
99. About \_\_\_\_\_ % of the irrigation water applied throughout the world does not reach the targeted crops.
- \_\_\_\_\_
100. The largest single use of domestic water in the United States is \_\_\_\_\_.
- \_\_\_\_\_
101. A flood happens when water in a stream overflows its normal channel covers the adjacent area called a(n) \_\_\_\_\_.
- \_\_\_\_\_

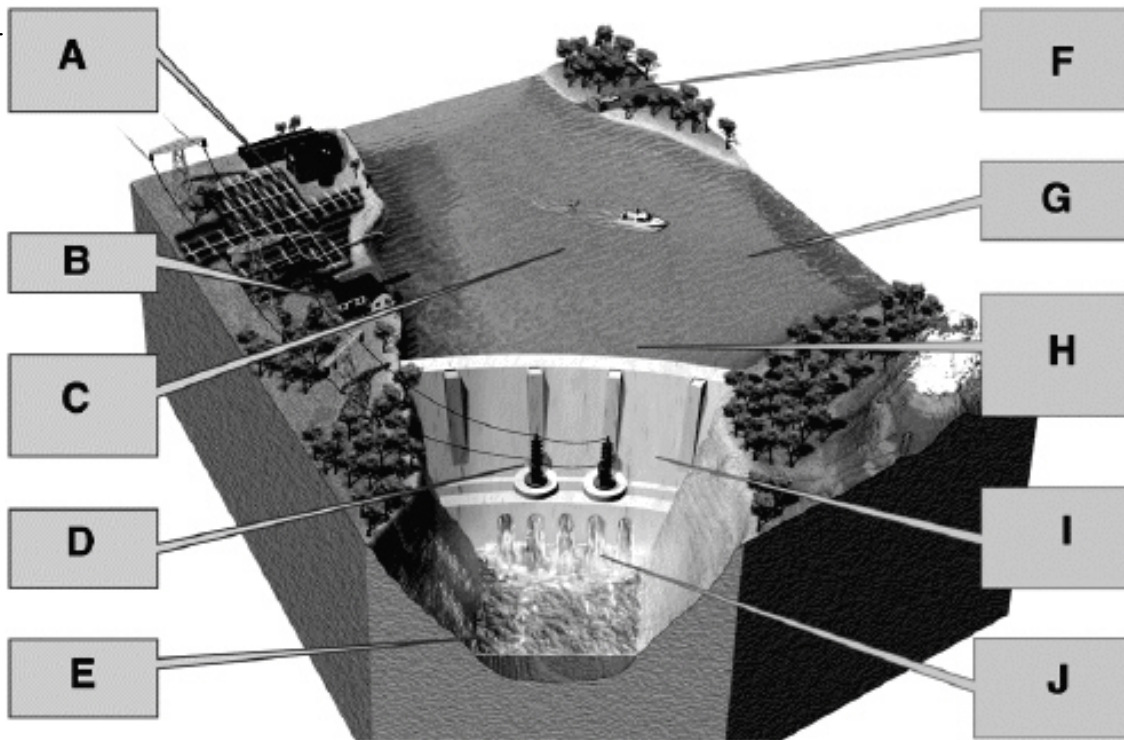
102.



The above diagram points to the advantages (A-E) and the disadvantages (F-J) of large dams and reservoirs. Correctly identify and each of the five advantages (A-E) and disadvantages (F-J) of such large dams and reservoirs as indicated on the diagram.

Flooded land destroys forests or cropland and displaces people.

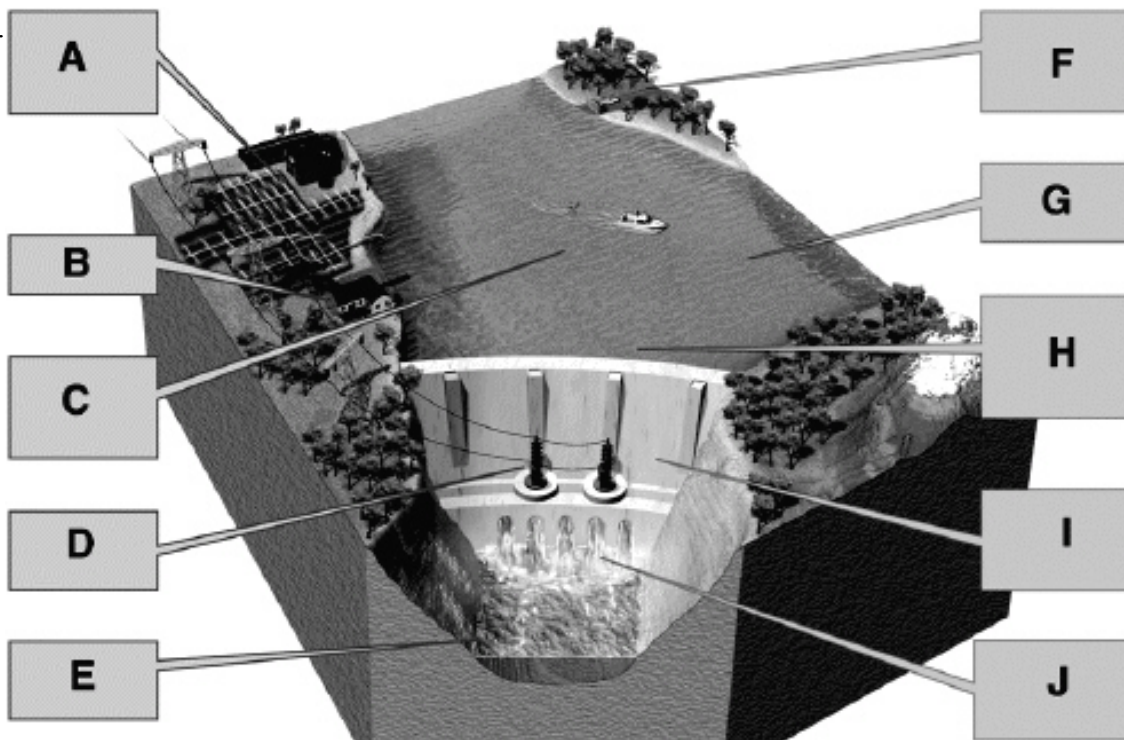
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Provides water for irrigation of cropland.

104.

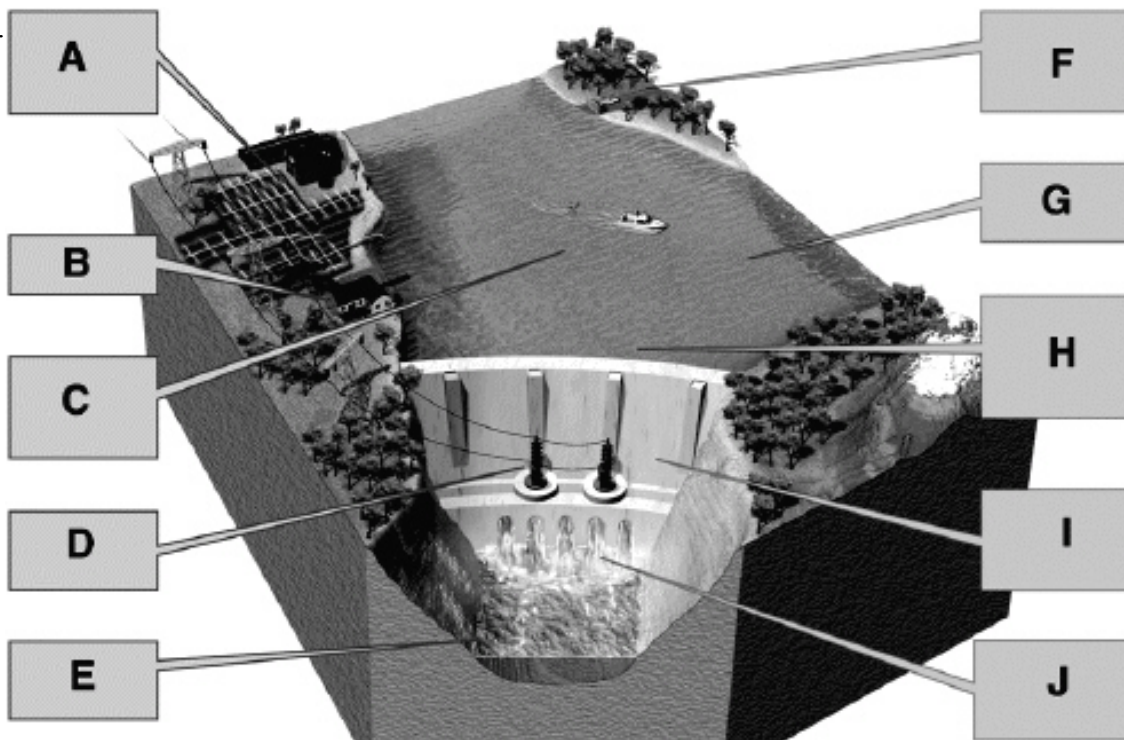


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Provides water for drinking.



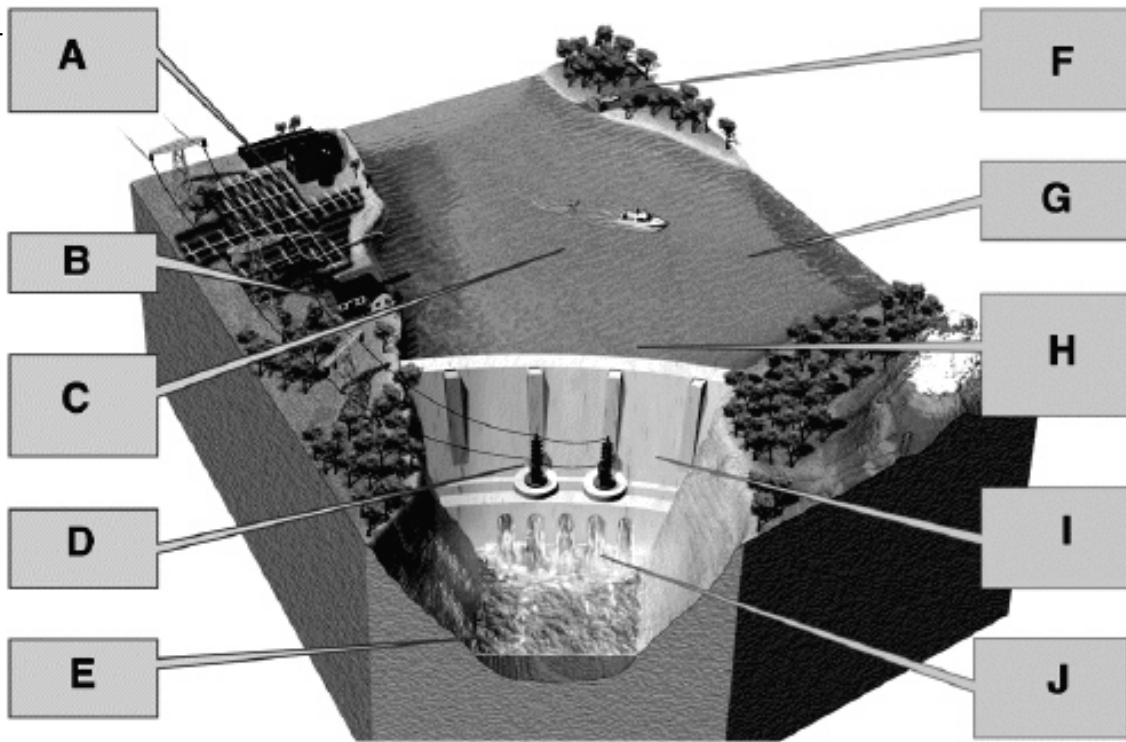
105.



The above diagram points to the advantages (A-E) and the disadvantages (F-J) of large dams and reservoirs. Correctly identify and each of the five advantages (A-E) and disadvantages (F-J) of such large dams and reservoirs as indicated on the diagram.

Risk of failure and devastating downstream flooding.

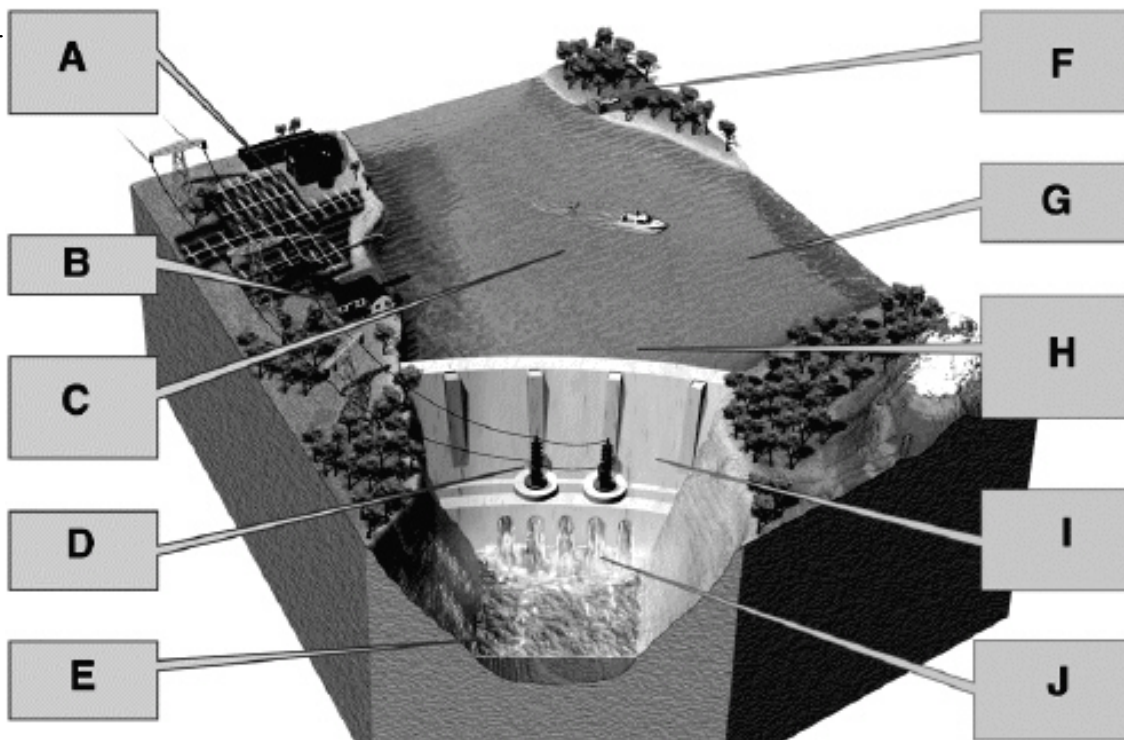
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Can produce cheap electricity (hydropower).

107.



The above diagram points to the advantages (A-E) and the disadvantages (F-J) of large dams and reservoirs. Correctly identify and each of the five advantages (A-E) and disadvantages (F-J) of such large dams and reservoirs as indicated on the diagram.

Downstream cropland and estuaries are deprived of nutrient-rich silt.

108. The three most serious environmental problems the world faces this century are water shortages, biodiversity loss, and climate change. Some analysts believe water shortages could lead to war between countries that need to share water. Do you think this is possible? Why or why not?
109. Freshwater is a very tiny fraction of all the earth's water supply. Even so, the United States, the largest user of freshwater, has very few controls on how water is transported or used. We also subsidize water costs in order to keep them low, which encourages use rather than conservation. Should the U.S. begin to move toward controls on water? What controls would you prefer to be instituted?
110. Many aquifers, including the Ogallala aquifer, were formed thousands of years ago. Many of these aquifers are either very slowly recharged, or cannot be recharged. Should removal of this water be treated in the same fashion as mining other resources? What steps should be taken to control the removal of a nonrenewable resource such as this?

111. Dams have significant advantages, and significant disadvantages. Compare and contrast these advantages and disadvantages and explain whether you think dams are an appropriate tool for dealing with fresh water.
112. The Aral Sea Disaster Case Study is a classic example of unintended consequences. Summarize the events leading to the current situation and suggest what you think may be in the future for the sea.
113. Is desalination a viable option for the need for fresh water? Why or why not?

114. Most governments subsidize the cost of water. Should government subsidies be phased out so that the full cost of water is borne by the user? Why or why not?

115. Floods cause tremendous property damage and kill large numbers of people each year. Why does this happen every year, and is there anything that can be done about it?

## CHAPTER 13--WATER RESOURCES **Key**

1. B
2. D
3. A
4. B
5. D
6. D
7. A
8. C
9. B
10. D
11. A
12. E
13. C
14. B
15. C
16. D
17. B
18. A
19. C
20. C
21. C
22. D
23. A
24. C
25. E
26. B
27. A
28. D
29. B
30. D

- 31. E
- 32. A
- 33. B
- 34. D
- 35. D
- 36. C
- 37. A
- 38. E
- 39. E
- 40. C
- 41. B
- 42. D
- 43. D
- 44. C
- 45. A
- 46. FALSE
- 47. TRUE
- 48. TRUE
- 49. FALSE
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- 51. TRUE
- 52. FALSE
- 53. FALSE
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- 73. TRUE
- 74. FALSE
- 75. TRUE
- 76. FALSE
- 77. TRUE
- 78. TRUE
- 79. TRUE
- 80. FALSE
- 81. Rocky Mountains
- 82. then *or* 10
- 83. global health issue
- 84. groundwater
- 85. meter
- 86. surface runoff
- 87. 70
- 88. three-quarters *or* 3/4s
- 89. 6 *or* six
- 90. unsustainable
- 91. one-third
- 92. saltwater
- 93. 21
- 94. Mexico
- 95. 10
- 96. three-fourths *or* 3/4s
- 97. salt
- 98. two-thirds *or* 2/3s

99. 60

100. toilet flushing

101. floodplain

102. F

103. A

104. B

105. I

106. D

107. H

108. Conflict has already occurred over freshwater, although actual warfare has not. Since water is necessary for life, it adds significant emphasis to any existing problems between nations. Any answer should consider such concerns as climate change, environmental refugees, etc., making the situation worse.

109. The U.S. has a lot of water. However, we treat it as if it was unlimited. As our population increases, the reserve between what is needed and what is available will get smaller. We can wait until the situation becomes critical, or we can take steps to conserve. If we were merely to reduce leakage and evaporation, and shift to more efficient irrigation, we would reduce the likelihood that the situation will become critical.

110. The answer should examine whether water is a resource equivalent to other nonrenewables. If it is, then the argument is strengthened that it should be treated in the same fashion. If the person suggests that it should not be treated as any other nonrenewable, then an explanation of why it is not like other nonrenewables should be given. If it is to be treated in such a fashion, controls similar to mining might be imposed: licensing, environmental impact statements, leasing rights similar to mineral rights, etc. could be considered.

111. The answer should weigh the advantages and disadvantages given in figure 13-13 on page 328. A decision on whether one side outweighs the other may lead to a decision on whether it is appropriate. Placement of the dam would play a significant role in the decision making. For example, a dam considered for the Hudson River in New York would flood culturally significant and economically important areas. On the other hand, a dam considered for the plains of Kansas might not have that impact.

112. The major points of the case study (page 333) should be summarized. Note the last paragraph of the case study, which suggests that, despite efforts, the main part of the sea is expected to continue to shrink and may disappear completely.

113. Desalination may become a necessary evil. The problems that plague it may be reduced. If steps are not taken to reduce waste and improve efficiency, it may be necessary to increase the amount of desalination. At the present time, the last paragraph of the section states it well, "significant desalination is practical only for water-short, wealthy countries and cities that can afford its high cost."

114. Subsidies benefit a portion of the populace at the expense of someone else. It would probably be better if the cost of water reflected the actual cost of its use. To encourage the use of a limited resource is not a good long-term strategy. The removal of subsidies, though, should be phased in so that the users may adjust to the increased cost.

115. Significant numbers of people live in floodplains. We do so because it is easy to build there, and because it is usually easy to grow crops there. These benefits, though, come with a cost—the danger of being flooded. Some people can not afford to live anywhere else, in places such as Bangladesh, for example. Others live there because they see an economic advantage to living and/or working there. Whatever the reason, floodplains are inherently dangerous places. For poor countries and for poor people, there is little likelihood that anything other than the most stringent controls would work. For the more affluent, though, controls could be implemented to restrict people from the most dangerous floodplains.