

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

1. The ease with which fluids pass through a rock is determined by the rock's
  - A. Porosity.
  - B. Permeability.
  - C. Malleability.
  - D. Age.
2. Which of the following would probably have the highest porosity?
  - A. Sandstone
  - B. Rock salt
  - C. Unfractured granite
  - D. Unfractured gneiss
3. Most of the water in the hydrosphere is found in
  - A. The oceans.
  - B. The polar ice caps.
  - C. The atmosphere.
  - D. Aquifers.
4. Properly, groundwater is
  - A. All subsurface water.
  - B. Water in the vadose zone.
  - C. Water in the saturated zone.
  - D. Soil moisture.
5. The zone of saturation is also commonly referred to as
  - A. Aeration zone.
  - B. Phreatic zone.
  - C. Aphreatic zone.
  - D. Vadose zone.
6. The vadose zone is also known as the
  - A. Unsaturated zone.
  - B. Saturated zone.
  - C. Confined zone.
  - D. Recharge zone.
7. The set of processes by which ground water is replenished is termed
  - A. Discharge.
  - B. Recharge.
  - C. Saturation.
  - D. Transpiration.
8. The water table
  - A. Is the top of the zone of saturation.
  - B. Is the top of the zone of aeration.
  - C. Is a hard rock layer within the zone of aeration.
  - D. Is a perfectly flat sheet of water below the ground surface.

9. When the groundwater leaves the aquifer via escaping the surface in a spring or flowing into a stream it results in
  - A. Recharge.
  - B. Discharge.
  - C. Soil moisture.
  - D. Aquitard.
10. The top of the zone of aeration is
  - A. The water table.
  - B. The surface of the ground.
  - C. The vadose zone.
  - D. The bottom of the zone of saturation.
11. Groundwater discharge does not occur naturally
  - A. Through springs and seeps.
  - B. Through stream and river bottoms and sides.
  - C. Into marshes and swamps.
  - D. Through water wells.
12. To be useful as a source of water, a rock must be
  - A. Porous but not too permeable.
  - B. Permeable but not too porous.
  - C. Both porous and permeable.
  - D. Low in both porosity and permeability.
13. Artesian conditions require
  - A. A confined aquifer.
  - B. An unconfined aquifer.
  - C. Very pure water.
  - D. A nearby body of surface water.
14. If the water were unconfined, the height to which the water's pressure would raise the surface is called as the \_\_\_\_\_ surface.
  - A. Potentiometric
  - B. Artesian
  - C. Hydraulic
  - D. Permeable
15. "Underground rivers" may exist
  - A. In all types of aquifers.
  - B. In soluble aquifers, such as limestone, gypsum or halite, where large-diameter continuous paths can exist.
  - C. In lava tubes.
  - D Both in soluble aquifers, such as limestone, gypsum or halite, where large-diameter continuous paths . can exist and in lava tubes are correct.
16. Groundwater flow is best explained by
  - A. Newton's law.
  - B. Ohm's law.
  - C. Archimedes' principle.
  - D. Darcy's law.
17. Karst aquifers
  - A. Develop within fractured granite.
  - B. Develop within glacial outwash gravels.
  - C. Develop within fractured metamorphic rock, in particular a kyanite schist.
  - D. Develop within fractured limestone.

18. Where abundant groundwater percolates through limestones, \_\_\_\_\_ may be formed.
- A. Artesian wells
  - B. Aquicludes
  - C. Sinkholes and caverns
  - D. Perched water tables
19. Hard water is
- A. Water containing high levels of dissolved calcium and magnesium.
  - B. Hard to drink because it tastes bad.
  - C. Hard to extract from aquifers because of all the dissolved minerals.
  - D. All of the choices are correct.
20. Limitations on the use of surface water as a water source include
- A. Basic lack of surface water in some regions.
  - B. Seasonality of stream flow.
  - C. Past use of some lakes and streams for dumping wastewater.
  - D. All of the choices are correct.
21. The largest reservoir of unfrozen freshwater is
- A. The water in all lakes and streams.
  - B. Groundwater.
  - C. Water in the atmosphere.
  - D. Water in the biosphere.
22. Around an actively pumped well in an unconfined aquifer, a \_\_\_\_\_ may develop in the water table.
- A. Sinkhole
  - B. Recharge
  - C. Cone of depression
  - D. Zone of saturation
23. A drop in the potentiometric surface of an aquifer
- A. Occurs only in an unconfined aquifer.
  - B. Occurs only in very dry regions.
  - C. Reflects water use exceeding recharge.
  - D. All of the choices are correct.
24. Possible consequences of excessive groundwater withdrawal include
- A. Surface subsidence.
  - B. Swelling of aquifer rocks.
  - C. Increased permeability of aquifer rocks.
  - D. All of the choices are correct.
25. Recharge of groundwater
- A. Is fast, so that ground water supplies are generally plentiful and consist of water that has been underground for only a few years.
  - B. Is slow, so that nearly all ground water has been underground millions of years.
  - C. Varies according to the geology and climate of the region and so groundwater may have been underground a few years (Karst regions) to 10,000 years or more (southwestern USA).
  - D. Is unpredictable.
26. Most of the water consumed in the United States is consumed by
- A. Agricultural Activities.
  - B. Thermoelectric power generation.
  - C. Municipal water supply systems.
  - D. Hydroelectric power generation.

27. A problem associated with aquifers in coastal regions is
- A. Compaction.
  - B. Surface subsidence.
  - C. Groundwater mining.
  - D. Saltwater intrusion.
28. The quality of water can be measured using which of the following ways:
- A. Parts per million (ppm) and parts per billion (ppb)
  - B. pH
  - C. Total dissolved solids (TDS)
  - D. All the choices are correct
29. The region of the U.S. that uses the most water for irrigation
- A. The northeastern states (east of the Mississippi River and north of the Ohio River).
  - B. The southeastern states (east of the Mississippi River and south of the Ohio River).
  - C. The southwestern states including southern California (west of the Mississippi River and south of 40°N latitude).
  - D. The northwestern states (west of the Mississippi River and north of 40°N latitude).
30. Lake Chad, on the border of the Sahara Desert,
- A. Is the last surviving deep-water lake in Africa and represents an important and stable water source for Chad, Niger, Nigeria and Cameroon.
  - B. Is a good analogy to Lake Erie, in that it has undergone extensive rehabilitation after being severely polluted and is now a healthy water source.
  - C. Was originally a glacier that melted and so the water supply is dwindling.
  - D. Is a shrinking, shallow-water lake, depleted both by withdrawals for irrigation and by lack of recharge during a multi-decade period of declining rainfall.
31. The membrane-filtration method of desalination
- A. Works well only on water with low concentrations of dissolved impurities.
  - B. Is efficient but extremely slow compared to other methods.
  - C. Is prohibitively expensive; it would increase the cost of water beyond the reach of most homeowners.
  - D. All of the choices are correct.
32. Solar-powered distillation of water
- A. Works even on very saline water, including seawater.
  - B. Is not energy-efficient.
  - C. Is very fast.
  - D. Requires the same amount of land area as any other method of water distillation.
33. Along its length, the Colorado River
- A. Becomes less saline toward its confluence with the Sea of Cortez.
  - B. Is greatly reduced in volume by heavy use and evaporation loss from reservoirs.
  - C. Flows entirely over insoluble igneous rocks.
  - D. Receives considerable water through ground water discharge.
34. Radium in groundwater
- A. Occurs only near leaking radioactive-waste dumps.
  - B. Can be removed by water softeners.
  - C. Makes the water unsafe for bathing.
  - D. All of the choices are correct.
35. Water use for irrigation in the region of the Aral Sea has resulted in
- A. Decreased water salinity.
  - B. Increased crop yields because of nutrient salts deposited on fields.
  - C. Health problems from blowing toxic dust.
  - D. All of the choices are correct.

36. Poorly cemented sandstones often have high porosity and permeability.  
True False
37. Water stored in aquifers is stationary and does not take part in the hydrologic cycle.  
True False
38. By definition, the water table never extends above the ground surface.  
True False
39. An aquitard is a rock that is low in permeability, so water does not readily pass through it.  
True False
40. Artesian water is desirable because it is unusually pure and clean.  
True False
41. Hard water is so named because it has an alkaline pH.  
True False
42. A water softener removes calcium and elements such as magnesium that show similar chemical behavior.  
True False
43. Groundwater withdrawal that exceeds recharge really has no impact on the water table.  
True False
44. A perched water table is a highly desirable and reliable source of ground water.  
True False
45. Karst topography develops in dry climates with very little surface or subsurface water.  
True False
46. Karst terrains consists of materials that are insoluble in water.  
True False
47. If the rate of groundwater recharge exceeds the rate of withdrawal, regional water tables may be lowered.  
True False
48. Conservation of water is not all that important as water can be a renewable resource.  
True False
49. If urbanization occurs over the limited recharge area of a confined aquifer, water availability may be reduced.  
True False
50. Recharge basins are most often built in areas of abundant surface water, to keep lakes and ponds from overflowing.  
True False
51. Most of the water actually consumed each day in the United States is what people and livestock need, biologically, to live.  
True False
52. Water in the High Plains (Ogallala) aquifer system has been equitably divided by treaty among the states overlying it.  
True False
53. Existing treaties actually allocate more Colorado River water than its typical total annual stream flow.  
True False

54. Obstacles to interbasin water transfer schemes commonly include cost and political conflicts.  
True False
55. One of the problems associated with the desalination of water for irrigation applications is the cost.  
True False
56. The Aral Sea provides a good illustration of international cooperation in water-resource management, with the additional benefit of enhancing commercial fishing opportunities.  
True False
57. Where groundwater withdrawal has caused surface subsidence, if groundwater use is curtailed, recharge will, in time result in rebound of the land surface.  
True False
58. Treated wastewater can be recycled for irrigation or even as drinking water to extend water supplies.  
True False

## 11 Key

1. The ease with which fluids pass through a rock is determined by the rock's  
A. Porosity.  
**B. Permeability.**  
C. Malleability.  
D. Age.

*Montgomery - Chapter 11 #1*

2. Which of the following would probably have the highest porosity?  
**A. Sandstone**  
B. Rock salt  
C. Unfractured granite  
D. Unfractured gneiss

*Montgomery - Chapter 11 #2*

3. Most of the water in the hydrosphere is found in  
**A. The oceans.**  
B. The polar ice caps.  
C. The atmosphere.  
D. Aquifers.

*Montgomery - Chapter 11 #3*

4. Properly, groundwater is  
A. All subsurface water.  
B. Water in the vadose zone.  
**C. Water in the saturated zone.**  
D. Soil moisture.

*Montgomery - Chapter 11 #4*

5. The zone of saturation is also commonly referred to as  
A. Aeration zone.  
**B. Phreatic zone.**  
C. Aphreatic zone.  
D. Vadose zone.

*Montgomery - Chapter 11 #5*

6. The vadose zone is also known as the  
**A. Unsaturated zone.**  
B. Saturated zone.  
C. Confined zone.  
D. Recharge zone.

*Montgomery - Chapter 11 #6*

7. The set of processes by which ground water is replenished is termed  
A. Discharge.  
**B. Recharge.**  
C. Saturation.  
D. Transpiration.

*Montgomery - Chapter 11 #7*

8. The water table  
**A. Is the top of the zone of saturation.**  
B. Is the top of the zone of aeration.  
C. Is a hard rock layer within the zone of aeration.  
D. Is a perfectly flat sheet of water below the ground surface.

*Montgomery - Chapter 11 #8*

9. When the groundwater leaves the aquifer via escaping the surface in a spring or flowing into a stream it results in  
A. Recharge.  
**B. Discharge.**  
C. Soil moisture.  
D. Aquitard.

*Montgomery - Chapter 11 #9*

10. The top of the zone of aeration is  
A. The water table.  
**B. The surface of the ground.**  
C. The vadose zone.  
D. The bottom of the zone of saturation.

*Montgomery - Chapter 11 #10*

11. Groundwater discharge does not occur naturally  
A. Through springs and seeps.  
B. Through stream and river bottoms and sides.  
C. Into marshes and swamps.  
**D. Through water wells.**

*Montgomery - Chapter 11 #11*

12. To be useful as a source of water, a rock must be  
A. Porous but not too permeable.  
B. Permeable but not too porous.  
**C. Both porous and permeable.**  
D. Low in both porosity and permeability.

*Montgomery - Chapter 11 #12*

13. Artesian conditions require  
**A. A confined aquifer.**  
B. An unconfined aquifer.  
C. Very pure water.  
D. A nearby body of surface water.

*Montgomery - Chapter 11 #13*

14. If the water were unconfined, the height to which the water's pressure would raise the surface is called as the \_\_\_\_\_ surface.  
**A. Potentiometric**  
B. Artesian  
C. Hydraulic  
D. Permeable

*Montgomery - Chapter 11 #14*

15. "Underground rivers" may exist  
A. In all types of aquifers.  
B. In soluble aquifers, such as limestone, gypsum or halite, where large-diameter continuous paths can exist.  
C. In lava tubes.  
**D. Both in soluble aquifers, such as limestone, gypsum or halite, where large-diameter continuous paths can exist and in lava tubes are correct.**

*Montgomery - Chapter 11 #15*

16. Groundwater flow is best explained by  
A. Newton's law.  
B. Ohm's law.  
C. Archimedes' principle.  
**D. Darcy's law.**

*Montgomery - Chapter 11 #16*



17. Karst aquifers  
A. Develop within fractured granite.  
B. Develop within glacial outwash gravels.  
C. Develop within fractured metamorphic rock, in particular a kyanite schist.  
**D.** Develop within fractured limestone.

Montgomery - Chapter 11 #17

18. Where abundant groundwater percolates through limestones, \_\_\_\_\_ may be formed.  
A. Artesian wells  
B. Aquicludes  
**C.** Sinkholes and caverns  
D. Perched water tables

Montgomery - Chapter 11 #18

19. Hard water is  
**A.** Water containing high levels of dissolved calcium and magnesium.  
B. Hard to drink because it tastes bad.  
C. Hard to extract from aquifers because of all the dissolved minerals.  
D. All of the choices are correct.

Montgomery - Chapter 11 #19

20. Limitations on the use of surface water as a water source include  
A. Basic lack of surface water in some regions.  
B. Seasonality of stream flow.  
C. Past use of some lakes and streams for dumping wastewater.  
**D.** All of the choices are correct.

Montgomery - Chapter 11 #20

21. The largest reservoir of unfrozen freshwater is  
A. The water in all lakes and streams.  
**B.** Groundwater.  
C. Water in the atmosphere.  
D. Water in the biosphere.

Montgomery - Chapter 11 #21

22. Around an actively pumped well in an unconfined aquifer, a \_\_\_\_\_ may develop in the water table.  
A. Sinkhole  
B. Recharge  
**C.** Cone of depression  
D. Zone of saturation

Montgomery - Chapter 11 #22

23. A drop in the potentiometric surface of an aquifer  
A. Occurs only in an unconfined aquifer.  
B. Occurs only in very dry regions.  
**C.** Reflects water use exceeding recharge.  
D. All of the choices are correct.

Montgomery - Chapter 11 #23

24. Possible consequences of excessive groundwater withdrawal include  
**A.** Surface subsidence.  
B. Swelling of aquifer rocks.  
C. Increased permeability of aquifer rocks.  
D. All of the choices are correct.

Montgomery - Chapter 11 #24

25. Recharge of groundwater  
A. Is fast, so that ground water supplies are generally plentiful and consist of water that has been underground for only a few years.  
B. Is slow, so that nearly all ground water has been underground millions of years.  
C. Varies according to the geology and climate of the region and so groundwater may have been underground a few years (Karst regions) to 10,000 years or more (southwestern USA).  
D. Is unpredictable.
- Montgomery - Chapter 11 #25*
26. Most of the water consumed in the United States is consumed by  
A. Agricultural Activities.  
B. Thermoelectric power generation.  
C. Municipal water supply systems.  
D. Hydroelectric power generation.
- Montgomery - Chapter 11 #26*
27. A problem associated with aquifers in coastal regions is  
A. Compaction.  
B. Surface subsidence.  
C. Groundwater mining.  
D. Saltwater intrusion.
- Montgomery - Chapter 11 #27*
28. The quality of water can be measured using which of the following ways:  
A. Parts per million (ppm) and parts per billion (ppb)  
B. pH  
C. Total dissolved solids (TDS)  
D. All the choices are correct
- Montgomery - Chapter 11 #28*
29. The region of the U.S. that uses the most water for irrigation  
A. The northeastern states (east of the Mississippi River and north of the Ohio River).  
B. The southeastern states (east of the Mississippi River and south of the Ohio River).  
C. The southwestern states including southern California (west of the Mississippi River and south of 40°N latitude).  
D. The northwestern states (west of the Mississippi River and north of 40°N latitude).
- Montgomery - Chapter 11 #29*
30. Lake Chad, on the border of the Sahara Desert,  
A Is the last surviving deep-water lake in Africa and represents an important and stable water source for Chad, Niger, Nigeria and Cameroon.  
B Is a good analogy to Lake Erie, in that it has undergone extensive rehabilitation after being severely polluted and is now a healthy water source.  
C. Was originally a glacier that melted and so the water supply is dwindling.  
D Is a shrinking, shallow-water lake, depleted both by withdrawals for irrigation and by lack of recharge during a multi-decade period of declining rainfall.
- Montgomery - Chapter 11 #30*
31. The membrane-filtration method of desalination  
A. Works well only on water with low concentrations of dissolved impurities.  
B. Is efficient but extremely slow compared to other methods.  
C. Is prohibitively expensive; it would increase the cost of water beyond the reach of most homeowners.  
D. All of the choices are correct.
- Montgomery - Chapter 11 #31*

32. Solar-powered distillation of water  
**A.** Works even on very saline water, including seawater.  
B. Is not energy-efficient.  
C. Is very fast.  
D. Requires the same amount of land area as any other method of water distillation.

Montgomery - Chapter 11 #32

33. Along its length, the Colorado River  
A. Becomes less saline toward its confluence with the Sea of Cortez.  
**B.** Is greatly reduced in volume by heavy use and evaporation loss from reservoirs.  
C. Flows entirely over insoluble igneous rocks.  
D. Receives considerable water through ground water discharge.

Montgomery - Chapter 11 #33

34. Radium in groundwater  
A. Occurs only near leaking radioactive-waste dumps.  
**B.** Can be removed by water softeners.  
C. Makes the water unsafe for bathing.  
D. All of the choices are correct.

Montgomery - Chapter 11 #34

35. Water use for irrigation in the region of the Aral Sea has resulted in  
A. Decreased water salinity.  
B. Increased crop yields because of nutrient salts deposited on fields.  
**C.** Health problems from blowing toxic dust.  
D. All of the choices are correct.

Montgomery - Chapter 11 #35

36. Poorly cemented sandstones often have high porosity and permeability.  
**TRUE**

Montgomery - Chapter 11 #36

37. Water stored in aquifers is stationary and does not take part in the hydrologic cycle.  
**FALSE**

Montgomery - Chapter 11 #37

38. By definition, the water table never extends above the ground surface.  
**FALSE**

Montgomery - Chapter 11 #38

39. An aquitard is a rock that is low in permeability, so water does not readily pass through it.  
**TRUE**

Montgomery - Chapter 11 #39

40. Artesian water is desirable because it is unusually pure and clean.  
**FALSE**

Montgomery - Chapter 11 #40

41. Hard water is so named because it has an alkaline pH.  
**TRUE**

Montgomery - Chapter 11 #41

42. A water softener removes calcium and elements such as magnesium that show similar chemical behavior.  
**TRUE**

Montgomery - Chapter 11 #42

43. Groundwater withdrawal that exceeds recharge really has no impact on the water table.  
**FALSE**

Montgomery - Chapter 11 #43

44. A perched water table is a highly desirable and reliable source of ground water.  
**FALSE**

Montgomery - Chapter 11 #44

45. Karst topography develops in dry climates with very little surface or subsurface water.  
**FALSE**
46. Karst terrains consists of materials that are insoluble in water.  
**FALSE**
47. If the rate of groundwater recharge exceeds the rate of withdrawal, regional water tables may be lowered.  
**FALSE**
48. Conservation of water is not all that important as water can be a renewable resource.  
**FALSE**
49. If urbanization occurs over the limited recharge area of a confined aquifer, water availability may be reduced.  
**TRUE**
50. Recharge basins are most often built in areas of abundant surface water, to keep lakes and ponds from overflowing.  
**FALSE**
51. Most of the water actually consumed each day in the United States is what people and livestock need, biologically, to live.  
**FALSE**
52. Water in the High Plains (Ogallala) aquifer system has been equitably divided by treaty among the states overlying it.  
**FALSE**
53. Existing treaties actually allocate more Colorado River water than its typical total annual stream flow.  
**TRUE**
54. Obstacles to interbasin water transfer schemes commonly include cost and political conflicts.  
**TRUE**
55. One of the problems associated with the desalination of water for irrigation applications is the cost.  
**TRUE**
56. The Aral Sea provides a good illustration of international cooperation in water-resource management, with the additional benefit of enhancing commercial fishing opportunities.  
**FALSE**
57. Where groundwater withdrawal has caused surface subsidence, if groundwater use is curtailed, recharge will, in time result in rebound of the land surface.  
**FALSE**

Montgomery - Chapter 11 #45

Montgomery - Chapter 11 #46

Montgomery - Chapter 11 #47

Montgomery - Chapter 11 #48

Montgomery - Chapter 11 #49

Montgomery - Chapter 11 #50

Montgomery - Chapter 11 #51

Montgomery - Chapter 11 #52

Montgomery - Chapter 11 #53

Montgomery - Chapter 11 #54

Montgomery - Chapter 11 #55

Montgomery - Chapter 11 #56

Montgomery - Chapter 11 #57

58. Treated wastewater can be recycled for irrigation or even as drinking water to extend water supplies.

**TRUE**

# 11 Summary

<u>Category</u>	<u># of Questions</u>
Montgomery - Chapter 11	58