

# Chapter 18

## Earth's Many Cycles:

### Will we ever run out of fresh water?

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1. What drives the global atmospheric circulation?

- a. ocean circulation
- b. radioactive decay of nuclear particles
- c. energy of the Sun
- d. convection cells within the mantle
- e. tides

Ans: c

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

2. Which is true of an Earth that stops rotating?

- a. The jet stream would bring the southeast United States its weather.
- b. The Gulf Stream would move faster.
- c. The prevailing winds in the northern hemisphere would blow from the north.
- d. Sailors would use the trade winds to sail east.
- e. all of the above

Ans: c

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

3. What is most likely to be associated with the northern hemisphere jet stream?

- a. hurricanes
- b. tornadoes
- c. westerlies.
- d. trade winds.
- e. all of the above

Ans: c

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

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### 4. El Nino

- a. couples the atmospheric and the ocean cycles
- b. brings the South American coast a winter snowstorm.
- c. enhances the fishing economy of Peru.
- d. causes flooding in Australia
- e. all of the above

Ans: a

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

### 5. Weather is defined as the state of the atmosphere's

- a. temperature.
- b. humidity.
- c. pressure.
- d. cloudiness.
- e. all of the above

Ans: e

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

### 6. Which of the following contains the greatest amount of water by volume on the Earth?

- a. oceans and groundwater
- b. oceans, glaciers, and ice caps
- c. oceans, lakes, and rivers
- d. atmosphere and oceans
- e. oceans, lakes, rivers, and atmosphere

Ans: b

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Easy

### 7. Residence time is

- a. the average time an atom remains in a system such as the ocean or a human body.
- b. the same as a Milankovitch cycle.
- c. the amount of time a tropical storm can remain on land before dying out.
- d. the average length of time a glacier stays in one place before it begins to move.
- e. the time it takes for one liter of water to move one horizontal mile in an aquifer.

Ans: a

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Easy

8. Glacial periods are caused by
- changes in the tilt of the Earth's axis.
  - changes in the shape of the Earth's orbit.
  - decreased precipitation and solar energy absorption.
  - presence of large bodies of water.
  - All of the above can cause glacial expansion.

Ans: e

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Easy

9. Which of the following are sedimentary rocks?
- shale and limestone
  - quartz and marble
  - sandstone and basalt
  - quartzite and salt
  - slate and marble

Ans: a

Link To: [The Rock Cycle](#)

Difficulty Level: Easy

10. How is Doppler radar used in meteorology?
- to assess wind speed and direction
  - to predict climate change
  - to locate the site where a tornado touched down
  - to trace the path of global glaciations
  - all of the above

Ans: a

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

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11. Some estimate that the amount of the world's fresh water that is stored as groundwater may be close to

- a. 98%
- b. 57%
- c. 10%
- d. 1%
- e. .01%

Ans: a

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Easy

12. The first rocks that formed on the earth were

- a. sedimentary.
- b. igneous.
- c. metamorphic.
- d. limestone.
- e. granite.

Ans: b

Link To: [The Rock Cycle](#)

Difficulty Level: Easy

13. The surface currents of the ocean

- a. carry warm water to the poles.
- b. carry cold water to the equator.
- c. can move water away from a coastline.
- d. are independent of the tides.
- e. all of the above

Ans: e

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Easy

14. What is one impact of gyres on coastal climates?

- a. England is colder than otherwise expected.
- b. England is warmer than otherwise expected.
- c. The Pacific Ocean near California is warmer than the Atlantic Ocean near Maryland.
- d. Japan's ocean waters are colder than the latitude indicates.
- e. Fresh water near the Arctic sinks and moves toward the equator.

Ans: b

Link To: The Hydrologic Cycle

Difficulty Level: Easy

15. The name Milankovitch is associated with
- a. Global Climate Models (GCMs).
  - b. research on greenhouse climate changes.
  - c. a theory that the Earth's climate is affected by its orbit.
  - d. research on plate tectonics.
  - e. b & c

Ans: c

Link To: The Hydrologic Cycle

Difficulty Level: Easy

16. The ocean is maintaining a constant salinity because
- a. the fresh water from the rivers equals the amount of water evaporated from the ocean.
  - b. chlorine and sodium will not form a salt compound at normal ocean temperatures.
  - c. glaciers are melting and adding fresh water to the system.
  - d. chemical reactions in the oceans combine elements into compounds that are stored in the biota or ocean sediment.
  - e. The ocean is actually increasing in salinity.

Ans: d

Link To: The Hydrologic Cycle

Difficulty Level: Easy

17. The hydrologic, atmospheric, and rock cycles operate independently of each other.

Ans: False

Link To: Cycles Small and Large

Difficulty Level: Easy

18. Igneous rocks may transform into metamorphic rocks if they are subjected to high temperatures and pressures.

Ans: True

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Link To: [The Rock Cycle](#)

Difficulty Level: Easy

19. James Hutton is the father of modern geology because of the many years he spent developing analytical models.

Ans: False

Link To: [The Rock Cycle](#)

Difficulty Level: Easy

20. The problem of beach erosion is caused by coastal development.

Ans: True

Link To: [The Rock Cycle](#)

Difficulty Level: Easy

21. Geologists state that the Earth is now in an interglacial period.

Ans: True

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Easy

22. Weather refers to daily or seasonal changes in the atmospheric cycle, while climate refers to slowly varying trends in weather.

Ans: True

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Easy

23. Volcanic rock and extrusive rock are two names for rocks that are made when molten material solidifies on the Earth's surface.

Ans: True

Link To: [The Rock Cycle](#)

Difficulty Level: Easy

24. Using underground aquifers as water supplies is similar to mining a nonrenewable resource.

Ans: True

Link To: The Hydrologic Cycle

Difficulty Level: Easy

25. Why are strong winds less common near the Equator?
- The westerly trade winds are shifted to the north and east.
  - The equator is under a constant high-pressure system
  - The region has few mountains to deflect air currents.
  - The Equator is under a constant low pressure system.
  - Convection cells are broken by the Earth's rotation.

Ans: d

Link To: The Atmospheric Cycle

Difficulty Level: Medium

26. Which of the following is cycled through time?
- coal
  - water
  - calcium
  - sand
  - all of the above

Ans: e

Link To: Cycles Small and Large

Difficulty Level: Medium

27. Which of the following statements describes features on the Earth?
- There has always been at least one polar ice cap.
  - There have always been tropical rain forests.
  - The Atlantic Ocean was formed a billion years ago.
  - All the Earth's features are constantly changing.
  - The solid surface of the Earth is one feature that never changes.

Ans: d

Link To: Cycles Small and Large

Difficulty Level: Medium

28. Which of the following determines the climate of a region?
- industrial pollution

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- b. presence of cows
- c. land formations
- d. phase of the moon
- e. all of the above

Ans: c

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

29. There is about half a million dollars of gold in every cubic kilometer of ocean. Why is it not mined?

- a. Mining gold would pollute the global oceans.
- b. The global market for gold has diminished.
- c. The mining technology is not economically feasible.
- d. International law of the sea prohibits mining.
- e. all of the above

Ans: c

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Medium

30. Limestone, such as that found on the cliffs of Lookout Mountain in Tennessee, is evidence of

- a. a volcanic eruption millions of years ago.
- b. an ancient sand dune.
- c. a closed marble quarry from the 1920s.
- d. early tropical environments.
- e. a prehistoric inland sea.

Ans: e

Link To: [The Rock Cycle](#)

Difficulty Level: Medium

31. Which type of material is no longer part of the rock cycle?

- a. metamorphic rocks
- b. igneous rocks
- c. sedimentary rocks
- d. beach sand
- e. All of the above continue to be part of the rock cycle.

Ans: e



Link To: The Rock Cycle  
Difficulty Level: Medium

32. The hazard of wind shear at airports has been mitigated by
- GCMs.
  - infrared radiation.
  - laser beams.
  - the Doppler radar.
  - ultraviolet light.

Ans: d

Link To: The Atmospheric Cycle  
Difficulty Level: Medium

33. What would be typical conditions during an ice age?
- The ocean level drops.
  - Ocean currents stop redistributing heat energy.
  - The snow absorbs rather than reflects solar radiation.
  - Large ice sheets cover the land from the poles to the tropics.
  - The ozone level increases.

Ans: a

Link To: The Hydrologic Cycle  
Difficulty Level: Medium

34. Water at the bottom of the ocean moves more slowly than water at the surface.

Ans: True

Link To: The Hydrologic Cycle  
Difficulty Level: Medium

35. Marble is chosen for tombstones because it is the most stable of all the rocks.

Ans: False

Link To: The Rock Cycle  
Difficulty Level: Medium

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36. Earth's surface has about 10% more water now than it did before the volcanic outgassing period of Earth's early history.

Ans: False

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Medium

37. Winters in the northern hemisphere are colder than summers because the Earth is farther away from the Sun in the winter.

Ans: False

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Medium

38. Sedimentary rocks may become metamorphic rocks, but metamorphic rocks never become sediments.

Ans: False

Link To: [The Rock Cycle](#)

Difficulty Level: Medium

39. When you plan an outdoor picnic you hope that the weather will be under an area of high atmospheric pressure.

Ans: True

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

40. The resident time of nitrogen in the human body is much longer than the resident time of mercury.

Ans: False

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Medium

41. Give an example of a long-term and a short-term variation in the atmospheric cycle.

Ans: The short-term variations include any weather phenomenon from thunderstorms to tornadoes. An example of the long-term variation in the atmospheric cycle is the onset of an ice age or global warming.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

42. How is Doppler radar an improvement over ordinary radar?

Ans: Doppler radar can detect motions of air by analyzing reflected microwaves for their frequency as well as their intensity. Therefore, Doppler can assess the velocity and direction of movement of high winds and air turbulence from many miles away. Ordinary radar also sends out microwaves, but is only reflected back by objects in the air, like snow particles or ice, and cannot detect the motion of air particles.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

43. How does the rotation of the Earth affect the atmospheric cycle?

Ans: The rotation of the Earth changes the direction of the prevailing winds and elongates the pattern of air circulation in global convection cells.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

44. What are the five variables that define weather?

Ans: Temperature, air pressure, humidity, cloudiness and prevailing winds.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

45. Give one example of how computers are used to analyze natural cycles.

Ans: Answers may vary. Computers are used to model global circulation, to compile satellite photographs, and in weather forecasting.

Link To: [The Rock Cycle](#)

Difficulty Level: Medium

46. Compare the atmospheric cycles of Earth and Jupiter. Why is there a difference in number?

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Ans: Cycles are caused by differences in temperature as well as planet rotation. Jupiter spins faster therefore has more cycles.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Medium

47. With so much water covering the planet (about 75%), how is it that scientists and planners are concerned about a water shortage?

Ans: Less than 1% is available for human consumption and much of it is polluted, so to be able to use water for agriculture or cooking or human consumption requires extensive, and expensive, procedures to reclaim water as a viable resource.

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Medium

48. How do GCMs model the atmosphere?

Ans: Global Circulation Models (GCMs) are computer models that divide the surface of the Earth into 100 km squares and the atmosphere into 10 vertical units. The laws of motion and thermodynamics are applied to each box to calculate the heat flux and water vapor within each box. The models balance the numbers unit-by-unit to predict long-term and large-scale trends in climate.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Hard

49. Are the Earth's oceans becoming saltier? Why or why not?

Ans: The oceans have had a fairly constant salinity for millions of years even though they continue to receive minerals and salts from the rivers. The ocean biota, the hydrologic, the atmospheric, and the tectonic processes all drive the ocean cycles that return minerals to the land, lock minerals into animal bones and shells, or store minerals in the ocean basin sediment. Calcium, for example, can become part of a shell or limestone reef; chloride combines with sodium to form a salt and is returned to the shore in bubbles of sea foam.

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Hard

50. Describe one of the ways that sedimentary rocks are formed.

Ans: Answers may vary. The first sedimentary rock was formed when small grains of igneous rock were washed away by rain and were deposited in streams. Layers of sediment, which

eventually washed into the ocean, accumulated until the increasing temperature, pressure and mineral cementation welded the bits of sediment into layered rocks.

Link To: [The Rock Cycle](#)

Difficulty Level: Hard

51. Why is most of the rock in Hawaii made from basalt?

Ans: Basalt is a type of igneous rock common to ocean volcanoes and fissures. The Hawaiian Islands are of volcanic origin.

Link To: [The Rock Cycle](#)

Difficulty Level: Hard

52. What is the jet stream and how does it affect weather in the United States?

Ans: Boundaries between layers of air in the upper atmosphere create fast-moving air currents known as the jet stream. As the jet stream moves toward the east across North America it brings with it the air masses and their atmospheric conditions from the west. For example, cold and dry air from Canada pulled along by the jet stream can make Virginia's weather colder and dryer.

Link To: [The Atmospheric Cycle](#)

Difficulty Level: Hard

53. What events began the rock cycle on Earth?

Ans: The temperature of the molten Earth dropped, allowing the planet's outer crust to begin to solidify into the first igneous rocks. Water that was in gaseous form condensed to form clouds and global precipitation. The primordial rains eroded bits of the igneous rock and washed the igneous sediment away, depositing it elsewhere. The sediment was cemented by silicon dioxide and turned to sedimentary rock. Under an overburden of accumulating sediment, the sedimentary rock turned to metamorphic rock. This was the beginning of the Earth's rock cycle.

Link To: [The Rock Cycle](#)

Difficulty Level: Hard

54. What effect does "residence time" have on human health?

Ans: Answers may include reference to the fact that, because certain essential elements like calcium and iron leave the body, they must be replaced. In addition, because harmful elements such as lead and mercury leave the human body very slowly, concentrations of these atoms can build up over time and become toxic to an individual.

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Link To: [The Hydrologic Cycle](#)

Difficulty Level: Hard

55. Using Earth cycles as examples, elaborate upon the statement, “The more things change, the more they stay the same.”

Ans: While each cycle remains constant, entities affected by the cycles change.

Link To: [Cycles Small and Large](#)

Difficulty Level: Hard

56. How can some rock formations provide an insight into the age of the Earth?

Ans: Answers will vary but might include that undisturbed rock layers in the Grand Canyon allow for analysis of sedimentation times.

Link To: [The Rock Cycle](#)

Difficulty Level: Hard

57. Draw a sketch of the oceanographic and atmospheric cycles occurring in the southern Pacific Ocean. Use labels and arrows to show the direction of the processes.

Ans: Answers will vary but should include all parts of each cycle and where these overlap.

Link To: [The Hydrologic Cycle](#)

Difficulty Level: Hard

58. Describe how Earth’s natural cycles can be disrupted when houses are built on beaches.

Ans: Answers will vary. Houses disrupt the erosion/deposition process of waves, which affects the rock cycle. They also have an impact on the hydrological in that more water may be pulled from the soil or added to it in an effort to water the grass.

Link To: [The Rock Cycle](#)

Difficulty Level: Hard

59. What have you observed around your campus or home that is a result of the water or rock cycles? Describe changes that you have noticed over time.

Ans: Answers will vary but should include weathering/erosion and water usage.

Link To: Cycles Small and Large  
Difficulty Level: Hard

60. Weather reports on television and in the newspaper are often accompanied by weather maps showing locations of high- and low-pressure areas. What effect does air pressure have on the local weather?

Ans: As these pressure areas move through the areas, they bring or take away the chance of moisture.

Link To: The Atmospheric Cycle  
Difficulty Level: Hard

61. What characteristics would you look for in a rock to classify it as igneous, metamorphic, or sedimentary?

Ans: Answers will vary but should include that igneous rocks are fire formed with either large or small crystals depending on where they cooled; that metamorphic rocks are 'changed' with crystal structures deformed in some manner; and that sedimentary rocks are made of sediments cemented together.

Link To: The Rock Cycle  
Difficulty Level: Hard

62. Compare the discoveries of Milutin Milankovitch and James Hutton. How did each of their ideas change a scientific discipline?

Ans: Milankovitch and Hutton theorized that the present had the same processes at work, as did the past. Hutton showed that long periods of time went into formation of rock while Milankovitch showed that glaciation was a long, yet cyclic process. Previously the idea of 'deep time' in either of these fields was not one scientists had embraced.

Link To: The Rock Cycle, The Hydrologic Cycle  
Difficulty Level: Hard

63. Discuss how each of these is connected in Earth's hydrologic cycle: groundwater, trees, lakes, infiltration, wells, oceans, evaporation, solar radiation, clouds, precipitation, transpiration, topography, factories, glaciers, volcanoes, rivers, parking lots, and humans.

Ans: Answers will vary, but should include ideas about the evaporation of water, absorption by the ground, or runoff. These should also include how water use changes with population demands.

Link To: The Hydrologic Cycle

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Difficulty Level: Hard

64. Explain how on Earth is there no 'away'.

Ans: Because everything on Earth is part of a cycle and it reappears again in some part of the cycle.

Link To: Cycles Small and Large

Difficulty Level: Hard

65. Explain the statement, "All the water we have is all the water we have ever had."

Ans: Water recycles through the water cycle, and other than comets entering the atmosphere and leaving a very small volume, no significant amount of extra water has become a part of the Earth's water cycle.

Link To: The Hydrologic Cycle

Difficulty Level: Hard

66. How is it that pumping water from aquifers may not be a solution to the demands of exploding populations?

Ans: Because rains must replenish the water, in drought conditions people pump more water than is replenished and eventually the aquifers could be exhausted.

Link To: The Hydrologic Cycle

Difficulty Level: Hard

67. Explain how the oceans are governing the climate of the world. Give an example.

Ans: Answers will vary but the global ocean conveyor redistributes heat across the surface of the planet and in doing so determines the climate.

Link To: The Hydrologic Cycle

Difficulty Level: Hard

68. In what manner does the concept of 'resident time' speak to our pollution problems?



Ans: The ions that are captured by the bipolar water molecule will have a similar recycling time measured beyond human lifetimes, therefore the concept of 'away' is obsolete. Everything in our environment eventually recycles and water is usually the medium.

Link To: The Hydrologic Cycle

Difficulty Level: Hard

69. If ice ages were a part of our past, could they be part of our future? Explain.

Ans: Yes! There is no reason to believe the Milankovitch cycles will suddenly stop and the various variables of the Earth's orbit stop functioning. Therefore the variables acting in the future should produce ice ages as they have in the past.

Link To: The Hydrologic Cycle

Difficulty Level: Hard

70. In what manner should the oceans and atmosphere be considered together in modeling the Earth's climate?

Ans: Carbon dioxide and water vapor are the two greenhouse gases that act as thermostats to govern the Earth's climate. The high specific heat of the oceans act as a moderating effect and carbon dioxide and water vapor in the atmosphere (gas) to act as heat sponges to absorb and release energy beyond the area source of absorption.

Link To: The Atmospheric Cycle

Difficulty Level: Hard