1. Most tornadoes in the Northern Hemisphere are best described as violently rotating columns of air surrounded by

   A) clockwise surface winds moving toward the columns
   B) clockwise surface winds moving away from the columns
   C) counterclockwise surface winds moving toward the columns
   D) counterclockwise surface winds moving away from the columns

2. What is the usual surface wind pattern within a Northern Hemisphere low-pressure system?

   A) clockwise and outward
   B) clockwise and inward
   C) counterclockwise and outward
   D) counterclockwise and inward

3. The map below shows an eastern portion of North America. Points *A* and *B* represent locations on the eastern shoreline.

   Which factor is primarily responsible for location *A* having a lower average yearly temperature than location *B?*

   A) nearness to a large body of water
   B) elevation
   C) latitude
   D) prevailing winds

4. Which combination of climate factors generally results in the coldest temperatures?

   A) low elevation and low latitude
   B) low elevation and high latitude
   C) high elevation and low latitude
   D) high elevation and high latitude

5. Most of Earth's weather events take place in the

   A) thermosphere   B) mesosphere
   C) stratosphere   **D) troposphere**

6. The photograph below shows Mt. Kilimanjaro, a volcano in Africa, located near the equator.
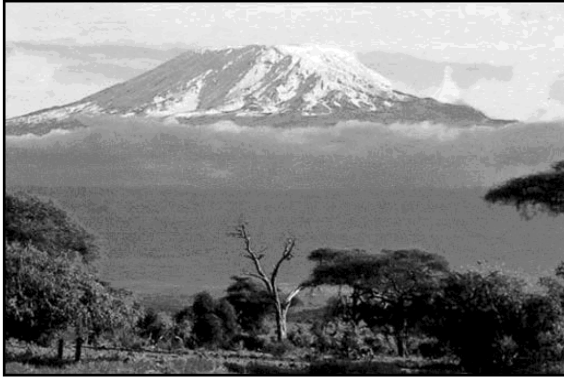
Which climate factor is responsible for the snow seen on Mt. Kilimanjaro?

A) high latitude
B) high elevation
C) nearness to a cold ocean current
D) nearness to a high-pressure weather center

7. The cross section below represents four locations on a mountain. The arrow indicates the prevailing wind direction.
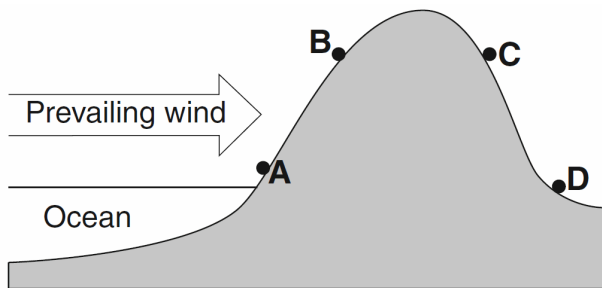
Which location has the warmest and most arid climate?

A) *A*　　B) *B*　　C) *C*　　**D) *D***

8. Which ocean current directly warms Western Europe?

A) North Atlantic Current
B) South Equatorial Current
C) Canary Current
D) Labrador Current

Base your answers to questions **9** and **10** on the reading passage about lake-effect snow and the radar image map below, and on your knowledge of Earth science. The radar map shows areas where snowfall was occurring. The whitest area indicates where snowfall was heaviest.

Lake-Effect Snow

In late fall, cold air originating in Canada and then moving over the Great Lakes often produces lake-effect snow in New York State.

When the cold air mass moves across large areas of warmer lake water, water vapor enters the cold air. When this moist air moves over the cooler land, the moisture comes out of the atmosphere as snow. The effect is enhanced when the air that flows off the lake is forced over higher land elevations. The areas affected by lake-effect snow can receive many inches of snow per hour. As the lakes gradually freeze, the ability to produce lake-effect snow decreases.

Radar Image Map
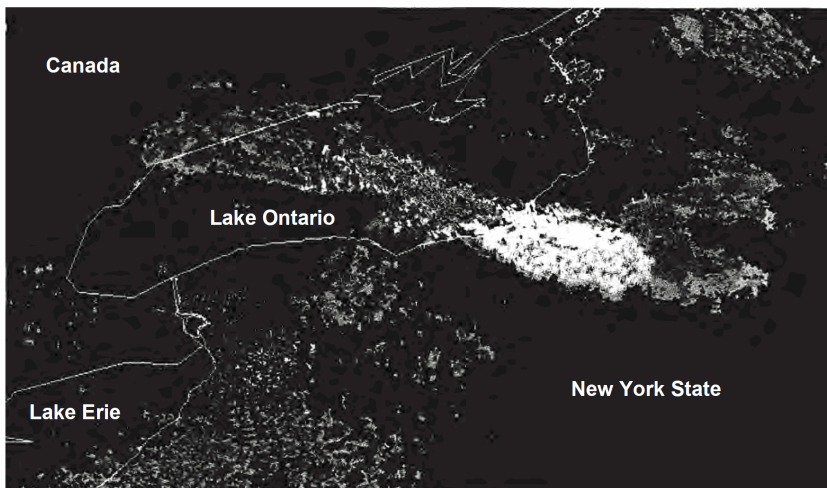
Adapted from: www.erh.noaa.gov

9. Which statement best explains why lake-effect snow *decreases* when lakes freeze gradually?

A) The ice prevents liquid water from evaporating into the atmosphere.
B) The lower temperature of ice makes liquid water condense at a slower rate.
C) More water is available to evaporate.
D) Ice speeds up the air moving above it, so less water can evaporate.

10. What is the most likely two-letter air mass symbol for an air mass from Canada that produces lake-effect snow in New York State?

A) mT   B) mP   C) cT   **D) cP**

11. What controls the direction of movement of most surface ocean currents?

A) density differences at various ocean depths
B) varying salt content in the ocean
**C) prevailing winds**
D) seismic activity

12. The table below shows the average January air temperature from 1901 to 2006 in two different cities in New York State.

Data Table

City	Average January Air Temperature (°F)
Albany	21.4
New York City	29.7

The most likely cause of this air temperature difference is that New York City is located

A) in a different prevailing wind belt
B) at a higher latitude
C) near a large body of water
D) at a higher elevation

13. The cross section below represents a prevailing wind flow that causes different climates on the windward and leeward sides of a mountain range.
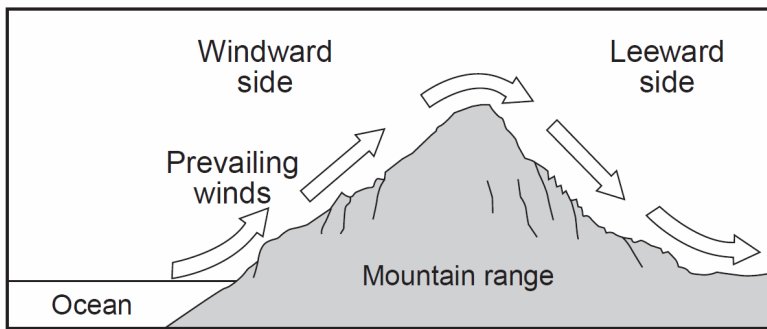
Compared to the temperature and moisture of the air rising on the windward side, the temperature and moisture of the air descending at the same altitude on the leeward side will be

A) warmer and drier
B) warmer and more moist
C) cooler and drier
D) cooler and more moist

14. The cross section below represents prevailing winds moving over a coastal mountain range. Letters *A* through D represent locations on Earth's surface.
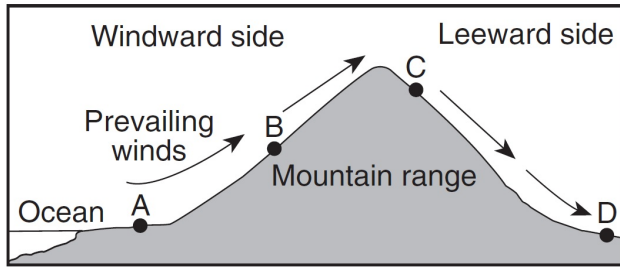
Which location will most likely have the least annual precipitation?

A) *A*   B) *B*   C) *C*   **D) *D***

15. The cross section below shows two cities, *A* and *B* at different elevations.

(Not drawn to scale)
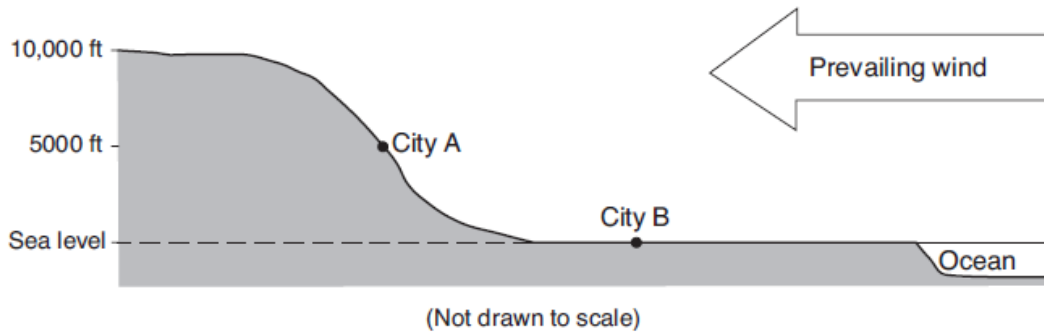
Compared to the yearly temperature and precipitation at city *B,* city *A* most likely has

A) lower temperatures and less precipitation
B) lower temperatures and more precipitation
C) higher temperatures and less precipitation
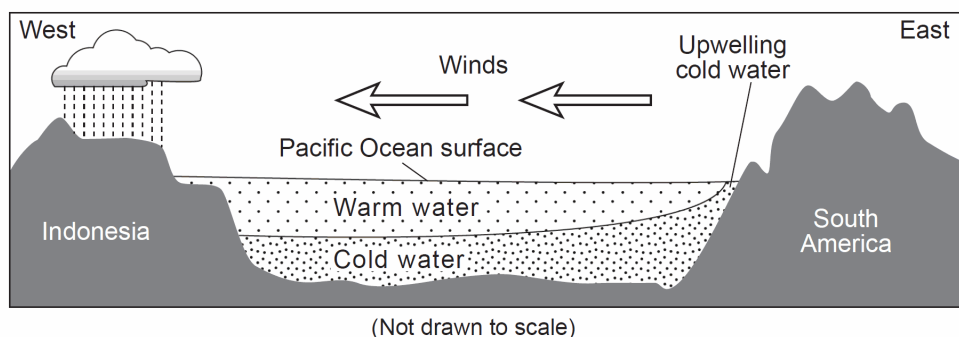D) higher temperatures and more precipitation

16. Base your answer to the following question on the passage and cross section below and on your knowledge of Earth science. The cross section represents a generalized region of the Pacific Ocean along the equator during normal (non-El Niño) conditions. The relative temperatures of the ocean water and the prevailing wind direction are indicated.

El Niño

Under normal Pacific Ocean conditions, strong winds blow from east to west along the equator. Surface ocean water piles up on the western part of the Pacific due to these winds. This allows deeper, colder ocean water on the eastern rim of the Pacific to be pulled up (upwelling) to replace the warmer surface water that was pushed westward.

During an El Niño event, these westward-blowing winds get weaker. As a result, warmer water does not get pushed westward as much, and colder water in the east is not pulled toward the surface. This creates warmer surface ocean water temperatures in the east, allowing the thunderstorms that normally occur at the equator in the western Pacific to move eastward. A strong El Niño is often associated with wet winters along the northwestern coast of South America and in the southeastern United States, and drier weather patterns in Southeast Asia (Indonesia) and Australia. The northeastern United States usually has warmer and drier winters in an El Niño year.

Normal Pacific Ocean Conditions (non-El Niño years)

West — East
Winds
Upwelling cold water
Pacific Ocean surface
Indonesia
Warm water
Cold water
South America

(Not drawn to scale)

During an El Niño year, winter climatic conditions in New York State will most likely be

A) colder and wetter B) colder and drier
C) warmer and wetter **D) warmer and drier**

17. In which planetary wind belt do most storms move toward the northeast?

A) 30° N to 60° N B) 0° to 30° N
C) 0° to 30° S D) 30° S to 60° S

18. The planetary wind belts in the troposphere are primarily caused by the

A) Earth's rotation and unequal heating of Earth's surface
B) Earth's revolution and unequal heating of Earth's surface
C) Earth's rotation and Sun's gravitational attraction on Earth's atmosphere
D) Earth's revolution and Sun's gravitational attraction on Earth's atmosphere

19. Base your answer to the following question on map below, which represents an imaginary continent. Locations *A* and *B* are on opposite sides of a mountain range on a planet similar to Earth. Location *C* is on the planet's equator.
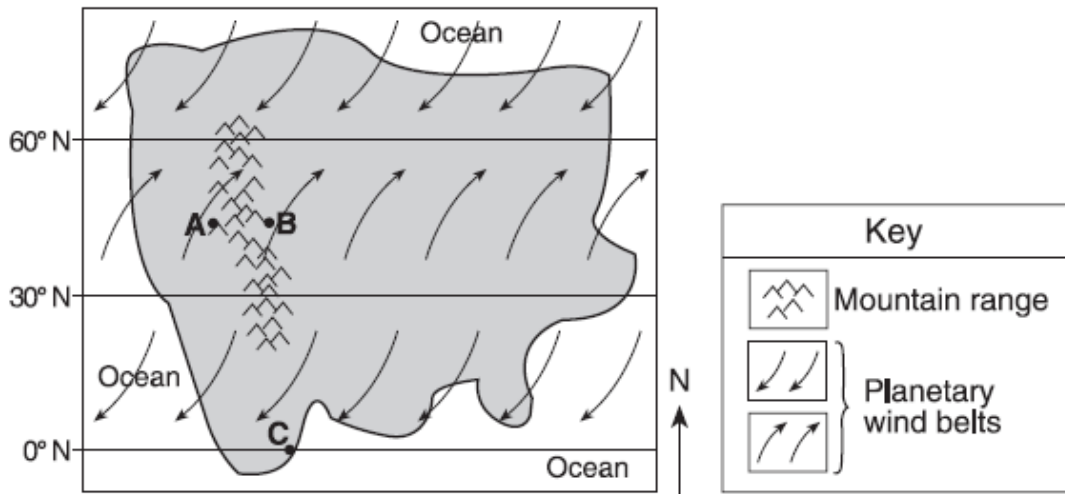
Location *C* most likely experiences

A) low air pressure and low precipitation
B) low air pressure and high precipitation
C) high air pressure and low precipitation
D) high air pressure and high precipitation

20. Which processes are most likely to cause a rise in the water table?

A) runoff and erosion
B) precipitation and infiltration
C) deposition and burial
D) solidification and condensation

21. During a rainstorm, when soil becomes saturated, the amount of infiltration

A) decreases and runoff decreases
B) decreases and runoff increases
C) increases and runoff decreases
D) increases and runoff increases

Base your answers to questions **22** through **24** on the diagram below and on your knowledge of Earth science. The diagram represents setups of laboratory equipment, labeled *A, B, C,* and *D*. This equipment was used to test the infiltration rate and water retention of four different particle sizes. Each column was filled to the same level with uniform-sized dry, spherical particles. Water was poured into each column until the water level rose to the top of the particles. Then, the clamp was opened to allow the water to drain into the beaker beneath each column.
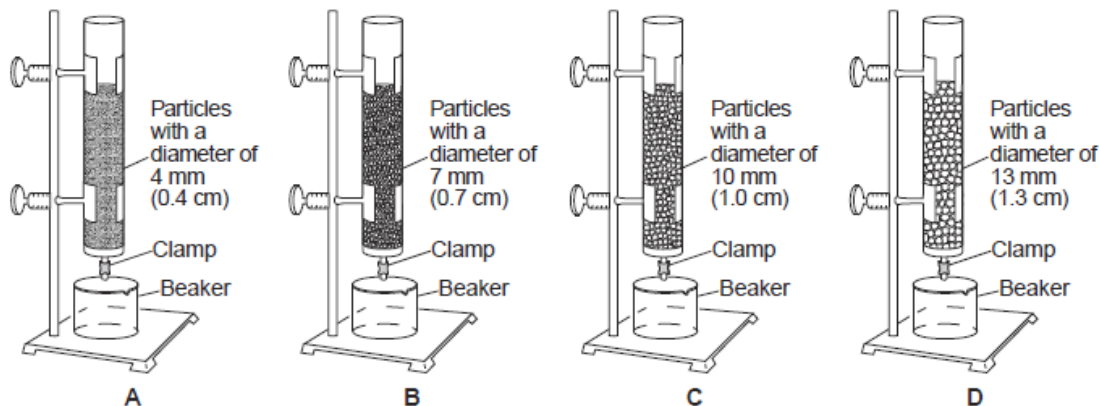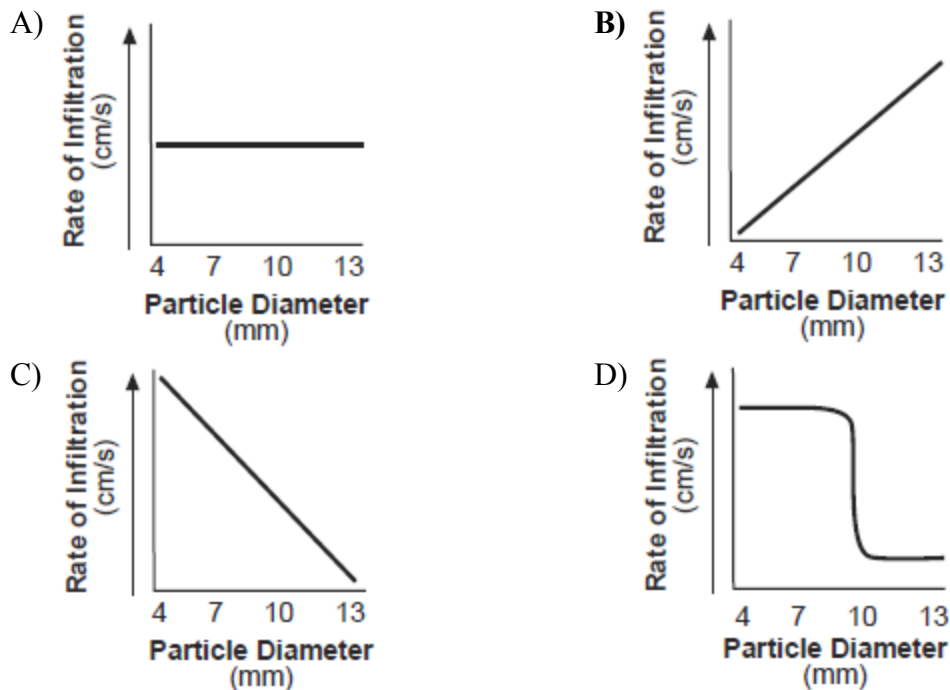

(Not drawn to scale)

22. Which column of particles retained the most water after the clamps were opened and the water was drained into the beakers?

A) *A*   B) *B*   C) *C*   D) *D*

23. Which graph best shows the rate of infiltration of water through the particles in these four columns?
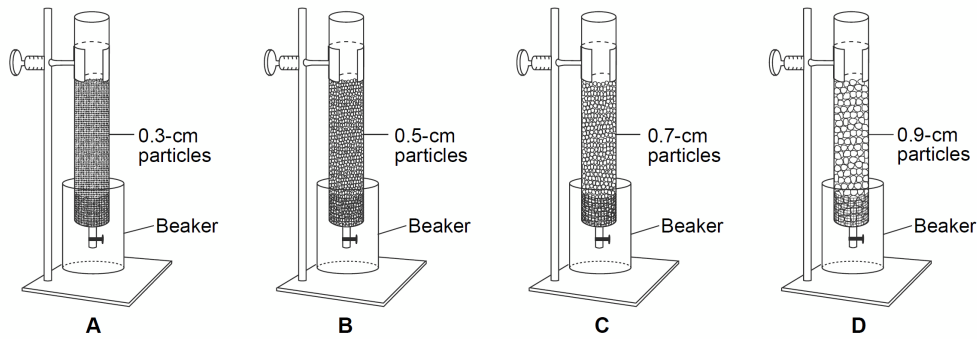

24. All of the particles in these four columns are classified as

A) clay   B) silt   C) sand   **D) pebbles**

25. The diagram below represents the setup for an experiment for studying groundwater. Tubes *A*, *B*, *C*, and *D* contain equal volumes of sediments. Within each tube, the sediments are uniform in size, shape, and packing. A test for water retention was conducted by first filling each tube with water and then draining the water into beakers.

0.3-cm particles — Beaker — A
0.5-cm particles — Beaker — B
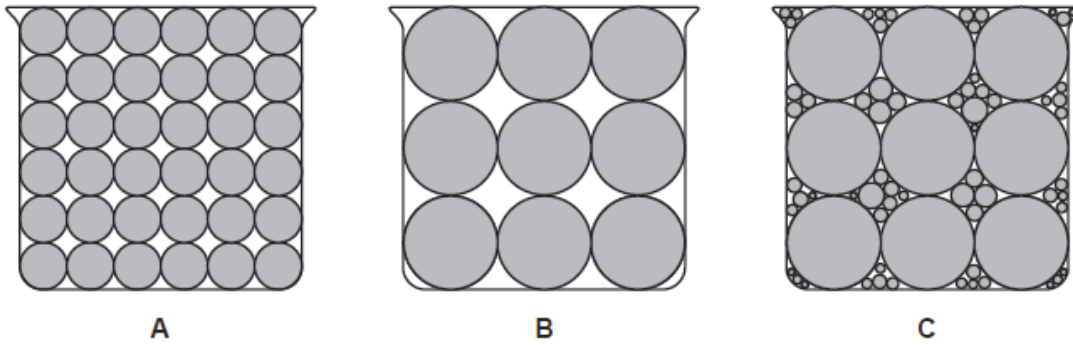0.7-cm particles — Beaker — C
0.9-cm particles — Beaker — D

(Not drawn to scale)

Which graph represents the general relationship between the sediment size and the amount of water retained by the sediments after the tubes had drained?

A)

B)

C)

D)
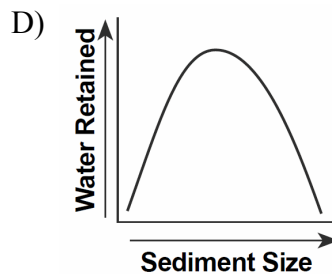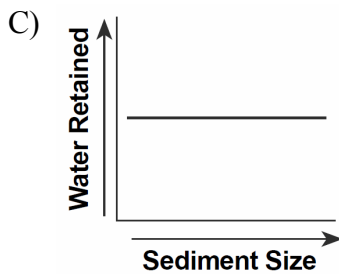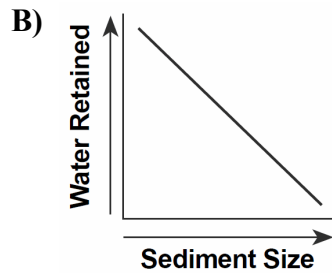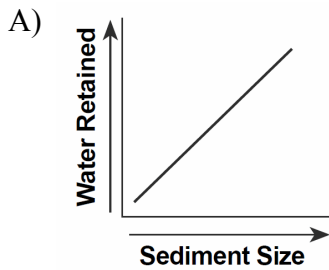
26. The diagram below represents cross sections of equal-size beakers *A*, *B*, and *C* filled with beads.

A   B   C

Which statement best compares the porosity in the three beakers?

A) **Beaker *A* and beaker *B* have the same porosity, and beaker *C* has the least porosity.**
B) Beaker *A* and beaker *B* have the same porosity, and beaker *C* has the greatest porosity.
C) Beaker *B* has the greatest porosity, beaker *A* has less porosity, and beaker *C* has the least porosity.
D) Beaker *C* has the greatest porosity, beaker *B* has less porosity, and beaker *A* has the least porosity.

27. Which graph best indicates the general relationship between soil particle size and the amount of water retention by a permeable soil?

A)

B)

C)

D)
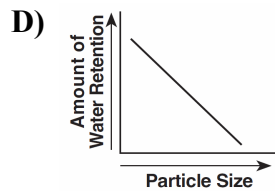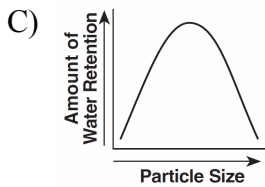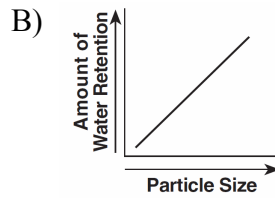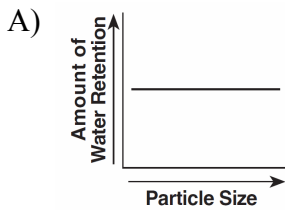
28. The cross sections below represent three beakers that were used to test porosity. Beakers *A, B,* and *C* each contain a different size of bead. Each beaker holds an equal volume of beads. The amount of water needed to fill the total pore space between the beads in each beaker was measured.


A   B   C
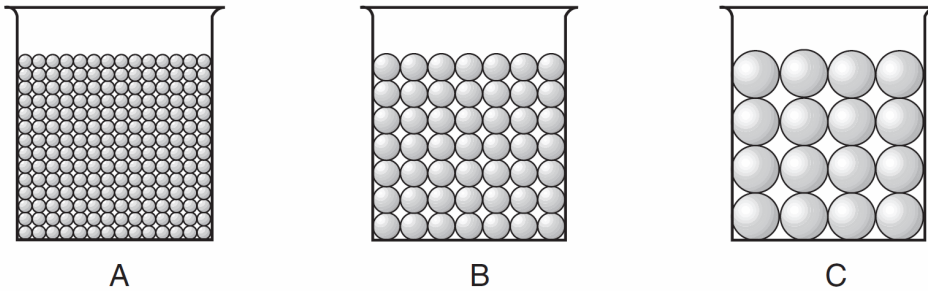
Which statement best describes the porosity that was found for these three samples?

A) *A* had a greater porosity than *B* and *C*.
B) *B* had a greater porosity than *A* and *C*.
C) *C* had a greater porosity than *A* and *B*.
D) All three samples had the same porosity.

29. The diagram below represents three identical beakers, *A, B,* and *C,* each containing an equal volume of uniform-sized spherical beads. Water is poured into each beaker until all of the pore spaces are filled.

A   B   C
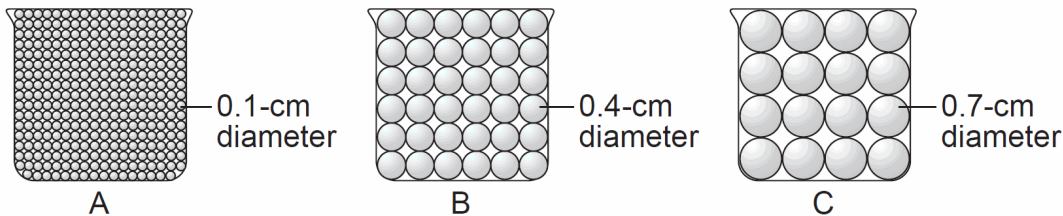
(Not drawn to scale)

Which table best indicates the percentage of pore space compared to the total volume of each beaker?

A)

Beaker	Percentage of Pore Space
A	40
B	40
C	40

B)

Beaker	Percentage of Pore Space
A	60
B	40
C	20

C)

Beaker	Percentage of Pore Space
A	20
B	40
C	60

D)

Beaker	Percentage of Pore Space
A	20
B	40
C	20

30. Which graph shows the general relationship between soil particle size and the capillarity of the soil?

A)

Graph with Capillarity on y-axis and Particle Size on x-axis, showing an upward line.

B)

Graph with Capillarity on y-axis and Particle Size on x-axis, showing a curve that rises then falls.

C)

Graph with Capillarity on y-axis and Particle Size on x-axis, showing a downward line.

D)

Graph with Capillarity on y-axis and Particle Size on x-axis, showing a horizontal line.
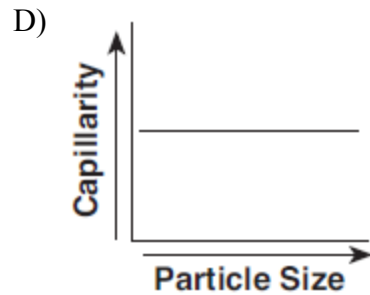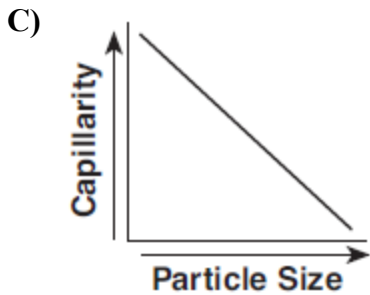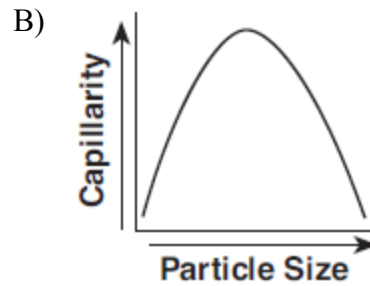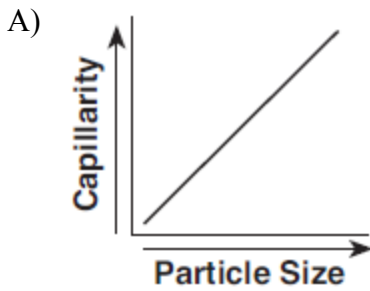
31. Soil composed of which particle size usually has the greatest capillarity?

A) silt   B) fine sand
C) coarse sand   D) pebbles

32. The upward movement of water through tiny spaces in soil or rock is called

A) water retention   **B) capillary action**
C) porosity   D) permeability

33. Flash flooding is most likely to occur when heavy rain falls on

A) deforested landscapes with clay soils
B) deforested landscapes with sandy soils
C) forested landscapes with clay soils
D) forested landscapes with sandy soils

34. The *least* amount of surface water runoff will occur when soil pore spaces are

A) saturated and the slope is steep
B) saturated and the slope is gentle
C) unsaturated and the slope is steep
D) unsaturated and the slope is gentle

35. Base your answer to the following question on the cross section below, which represents part of Earth's water cycle. Letters *A*, *B*, *C*, and *D* represent processes that occur during the cycle. The level of the water table and the extent of the zone of saturation are shown.
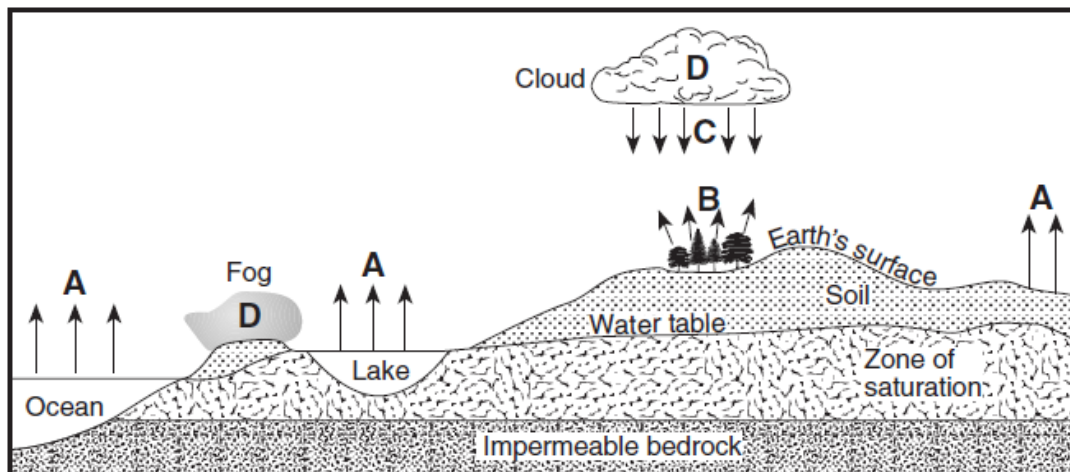
Which two letters represent processes in the water cycle that usually cause a lowering of the water table?

A) *A* and *B*　　　B) *A* and *C*　　　C) *B* and *D*　　　D) *C* and *D*

36. The table below shows the relationship between total yearly precipitation (P) and potential evapotranspiration (E_P) for different types of climates.

Climate Classification

Climate Type	Total Yearly P/E_p Ratio
Humid	Greater than 1.2
Subhumid	0.8 to 1.2
Semiarid	0.4 to 0.8
Arid	Less than 0.4

The total yearly precipitation (P) for a city in Texas is 218 millimeters. The total yearly potential evapotranspiration (E_P) is 951 millimeters. Which type of climate does this city have?

A) humid　　　　　　B) subhumid
C) semiarid　　　　　**D) arid**

37. Which climate conditions are typical of regions near the North Pole and the South Pole?

A) low temperature and low precipitation
B) low temperature and high precipitation
C) high temperature and low precipitation
D) high temperature and high precipitation

Answer Key
T8 Water/Climate

1.	C		37.	A
2.	D			
3.	C			
4.	D			
5.	D			
6.	B			
7.	D			
8.	A			
9.	A			
10.	D			
11.	C			
12.	C			
13.	A			
14.	D			
15.	B			
16.	D			
17.	A			
18.	A			
19.	B			
20.	B			
21.	B			
22.	A			
23.	B			
24.	D			
25.	B			
26.	A			
27.	D			
28.	D			
29.	A			
30.	C			
31.	A			
32.	B			
33.	A			
34.	D			
35.	A			
36.	D			