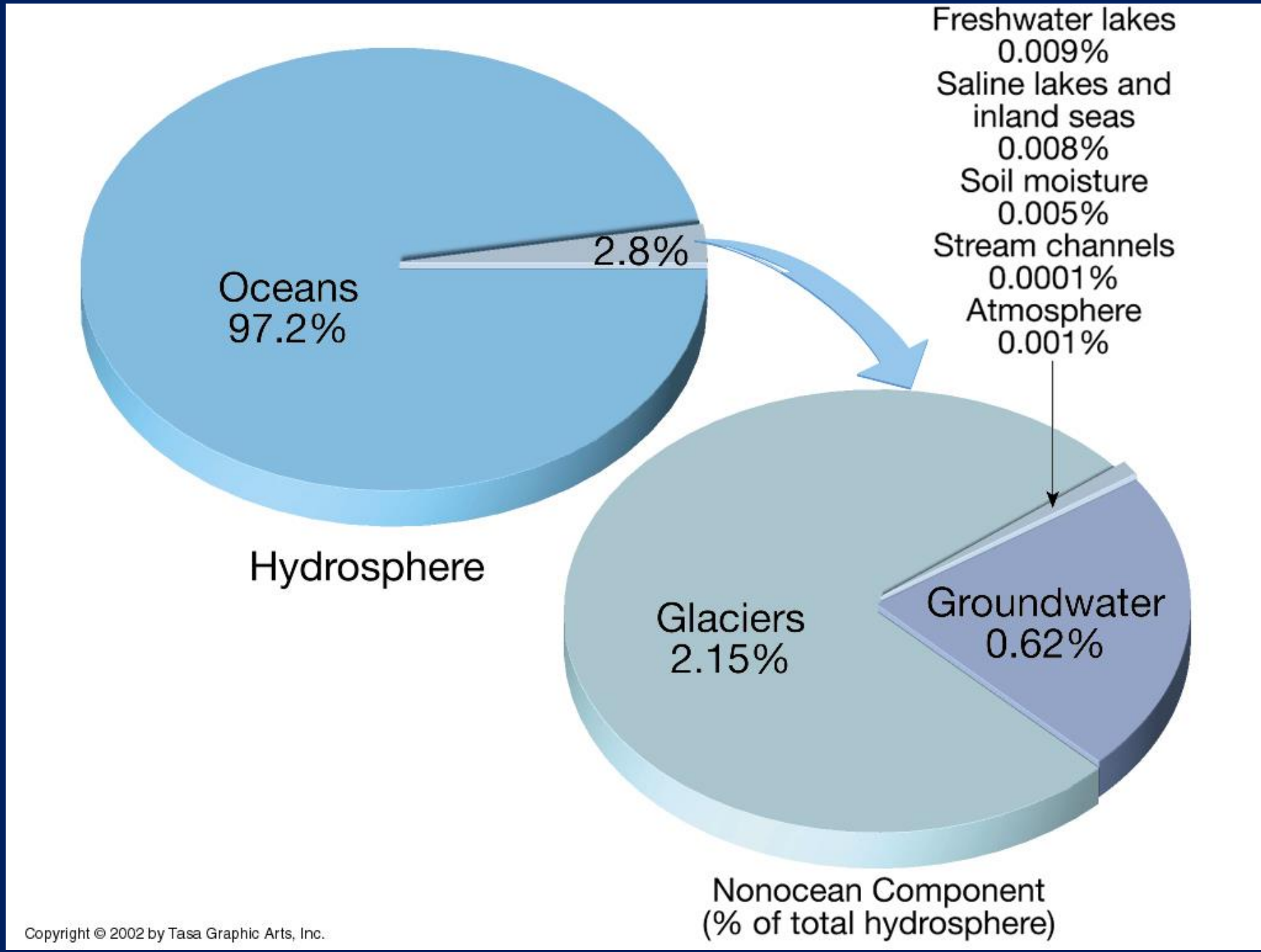
Water of the Earth



The Hydrologic Cycle

The **Hydrologic Cycle**, also called the **Water Cycle**: is a model used to show the movement and phase change of water at and near the earths surface.

http://www.leapingmedia.com/groundwater.html

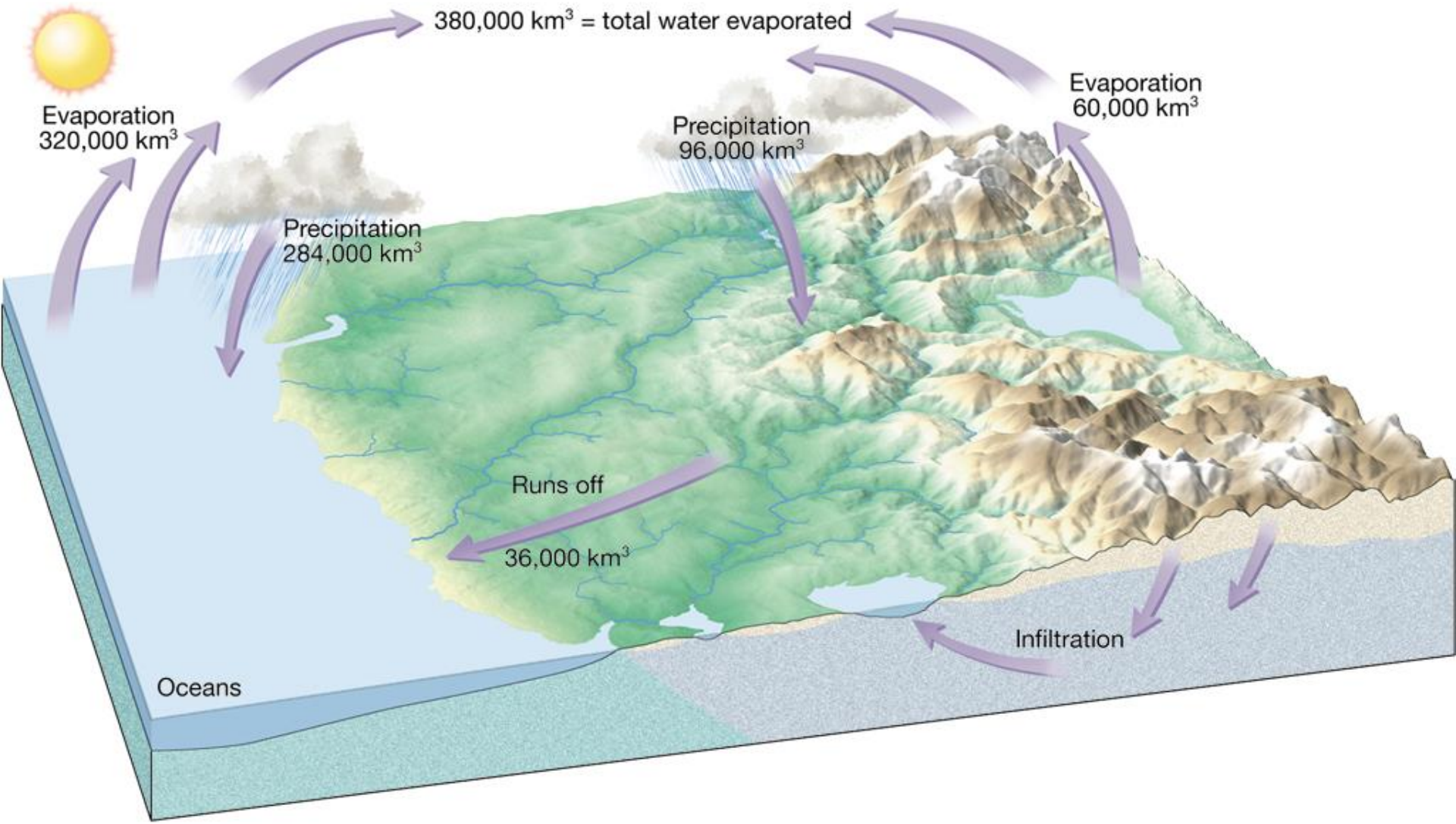
The Hydrologic Cycle

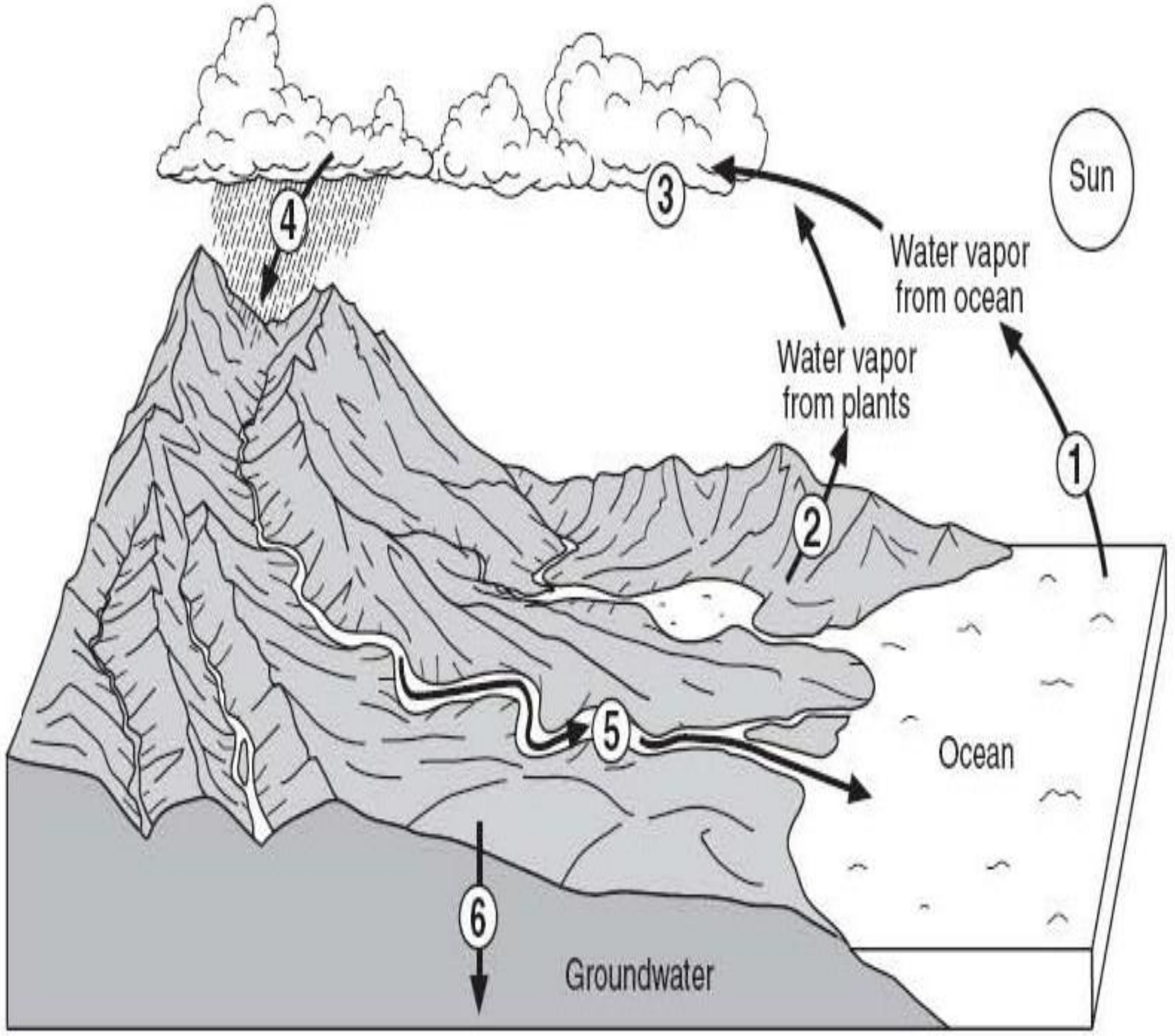
It is fueled by **solar energy** which changes…

Liquid Water→ Water Vapor

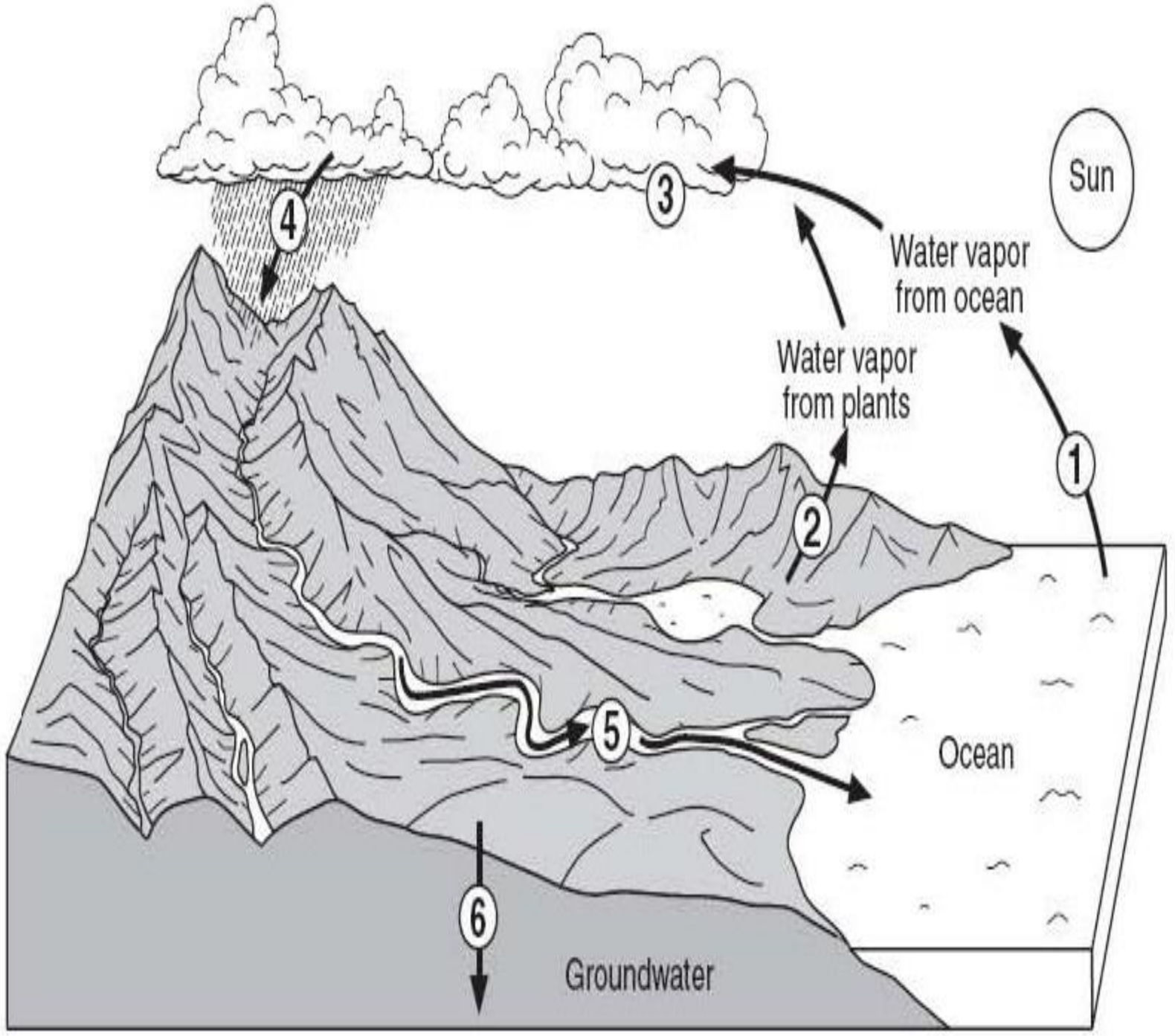
http://www.leapingmedia.com/groundwater.html

https://www.youtube.com/watch?v=9e5CaIkrqWU




Sun
Water vapor
from ocean
Water vapor
from plants
1
2
3
4
5
6
Ocean
Groundwater

No.	Water Cycle Process	Description or Example
1	Evaporation -	The change from liquid water to water vapor.
2	-	
3	-	
4	-	
5	-	
6	-	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No.	Water Cycle Process	Description or Example
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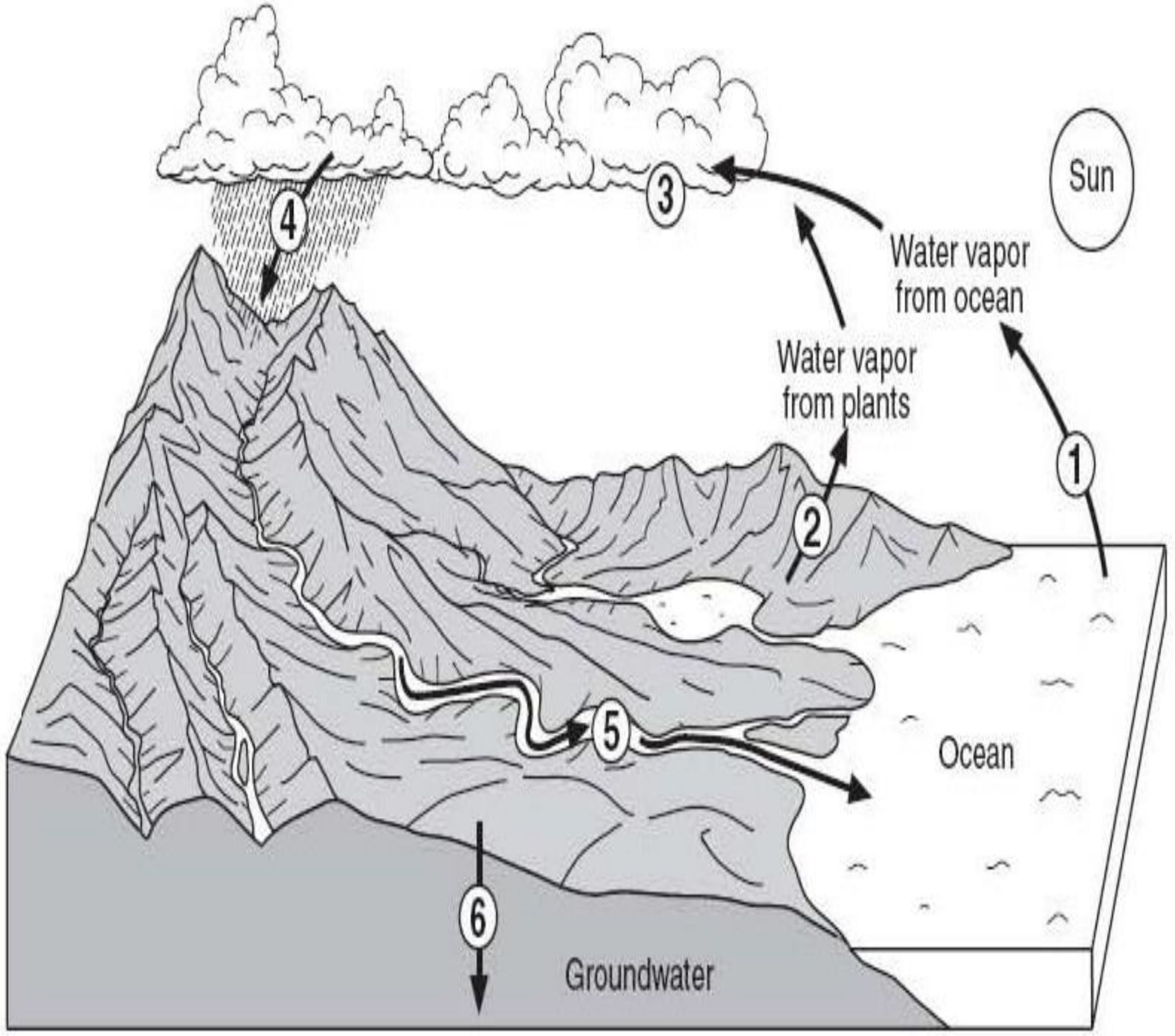
2	Transpiration -	Water vapor that enters the atmosphere from plants
3	-	
4	-	
5	-	
6	-	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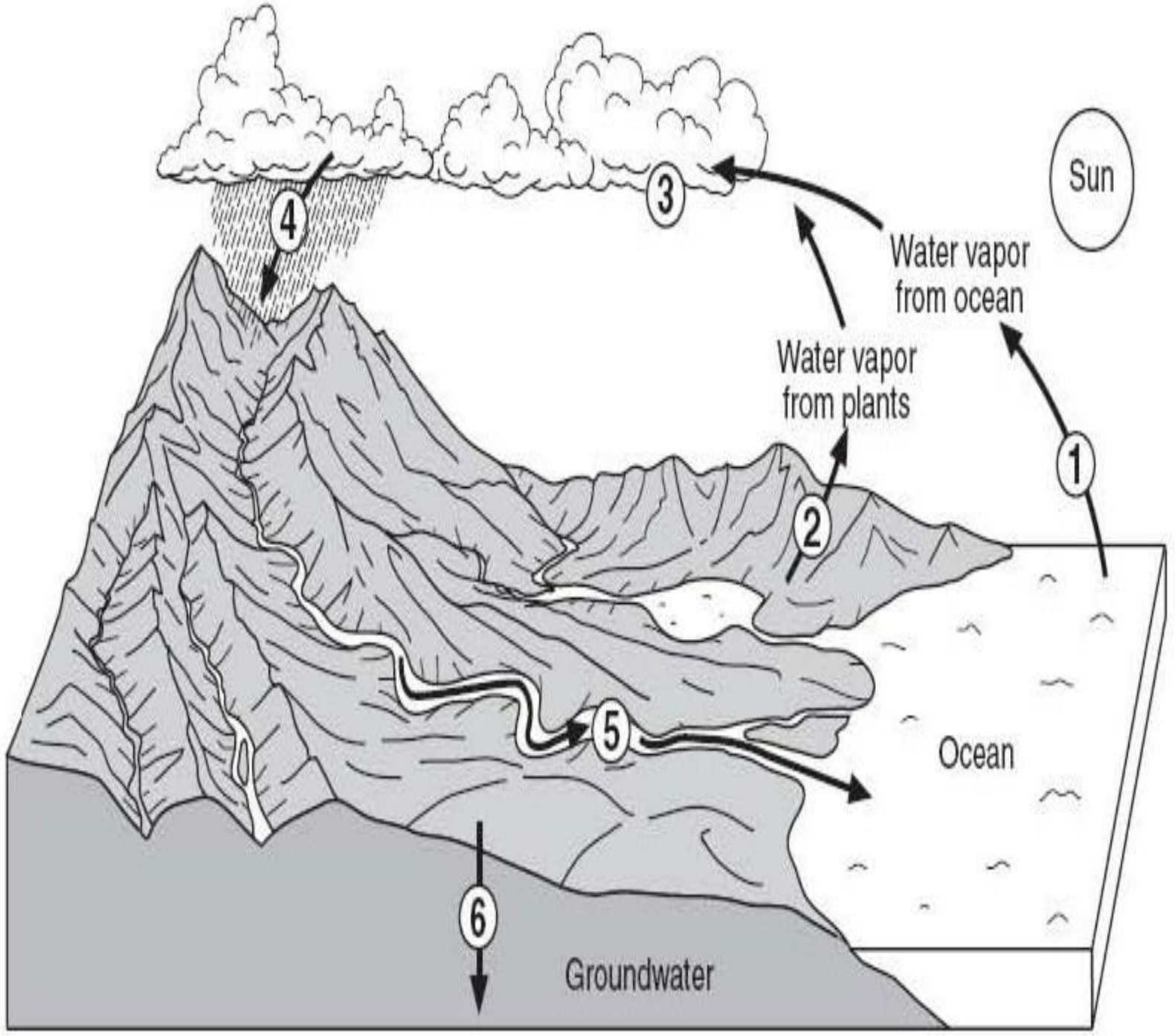
2	Transpiration	-	Water vapor that enters the atmosphere from plants
3	Condensation	-	Water droplets form (condense) on dust particles (clouds)
4		-	
5		-	
6		-	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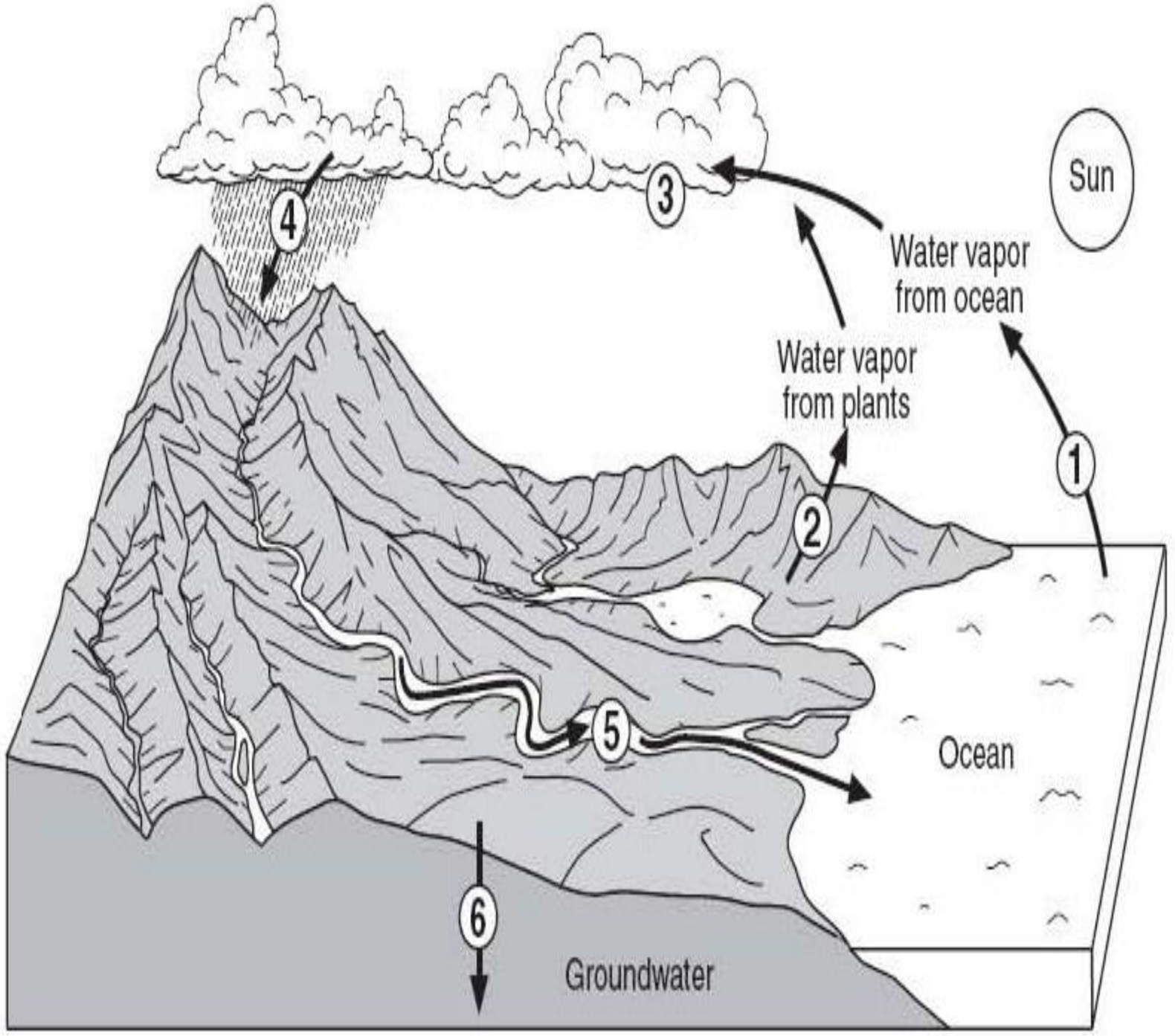
6		-	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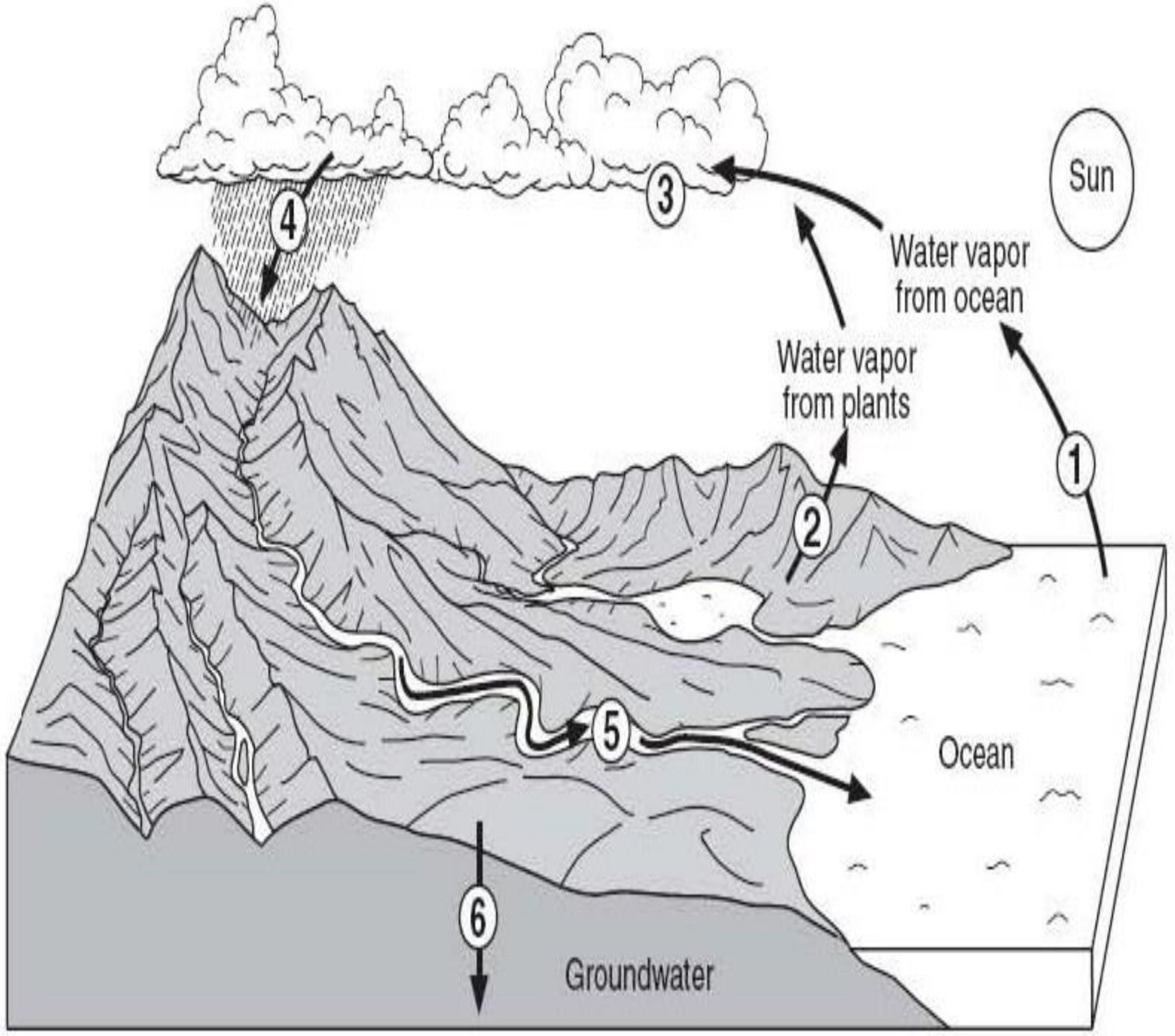
5	Runoff	-	Water that flows over the land into a larger body of water
6		-	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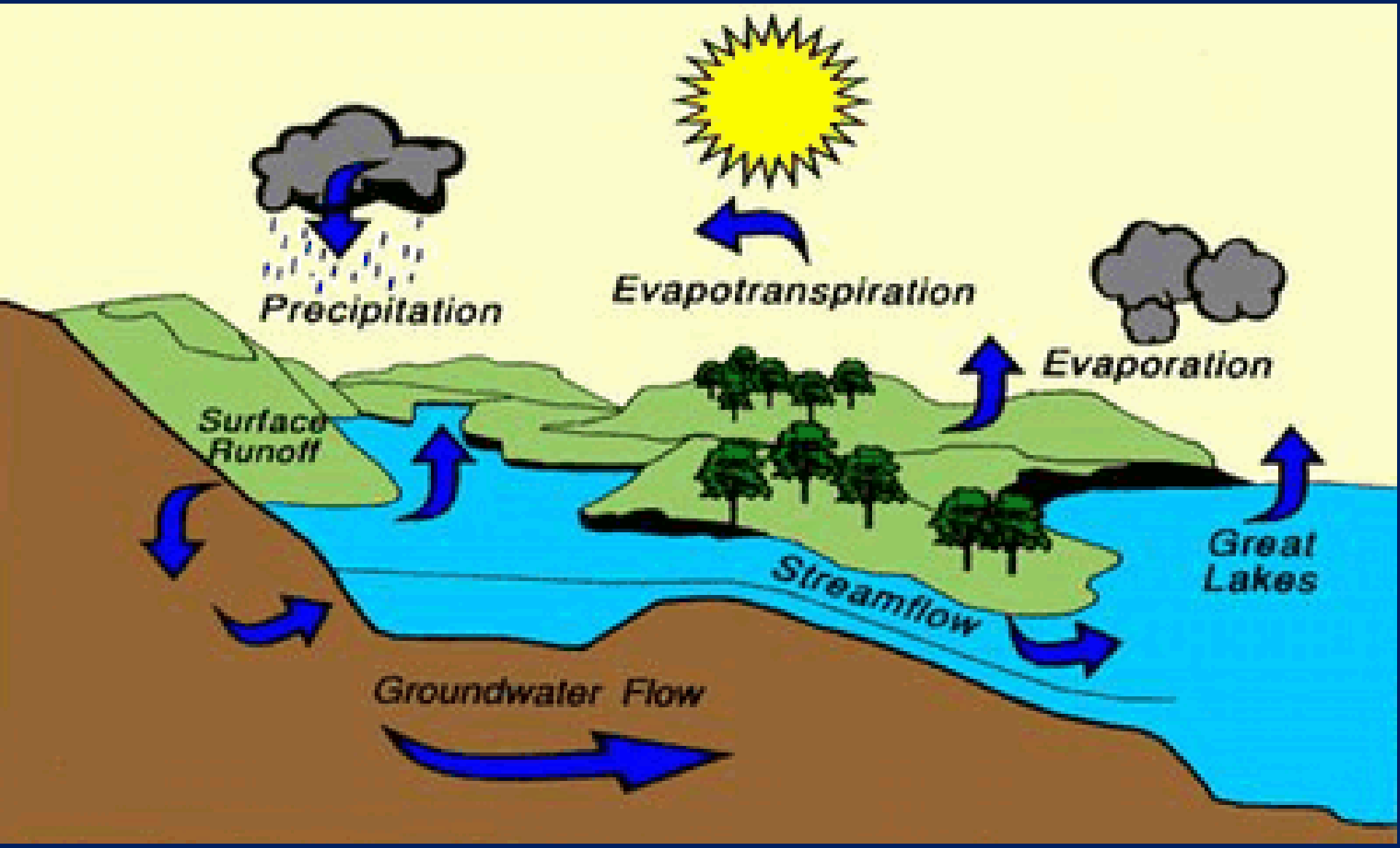
5	Runoff	-	Water that flows over the land into a larger body of water
6	Infiltration	-	Water that soaks into the ground (becomes groundwater)

When precipitation hits the ground

Four things that can happen to precipitation:


Precipitation
Evapotranspiration
Evaporation
Surface Runoff
Streamflow
Great Lakes
Groundwater Flow

Conditions that increase the rate of evaporation:

(1) Dry air

(2) Wind

(3) Higher temperatures

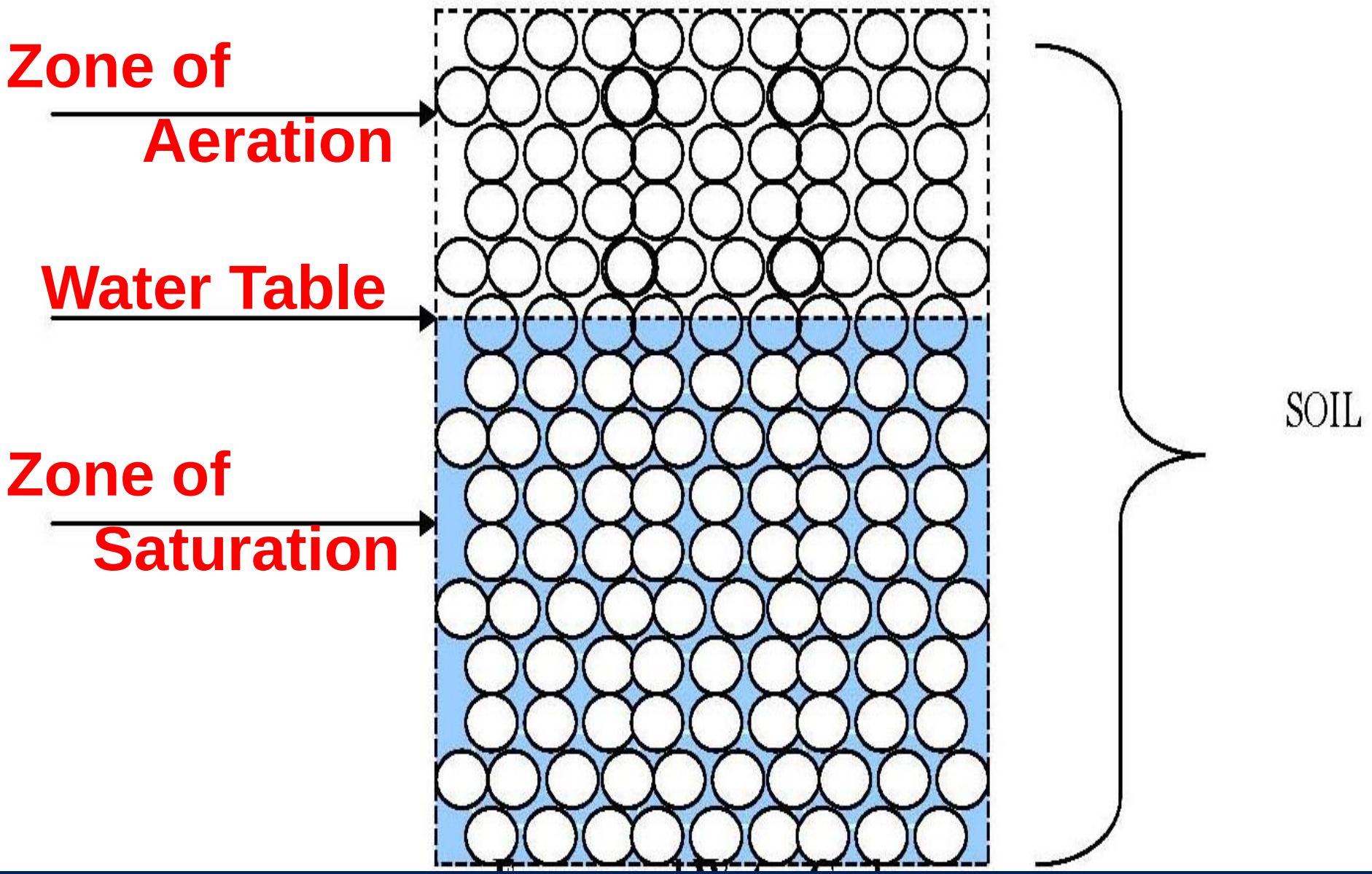
(4) Greater surface area

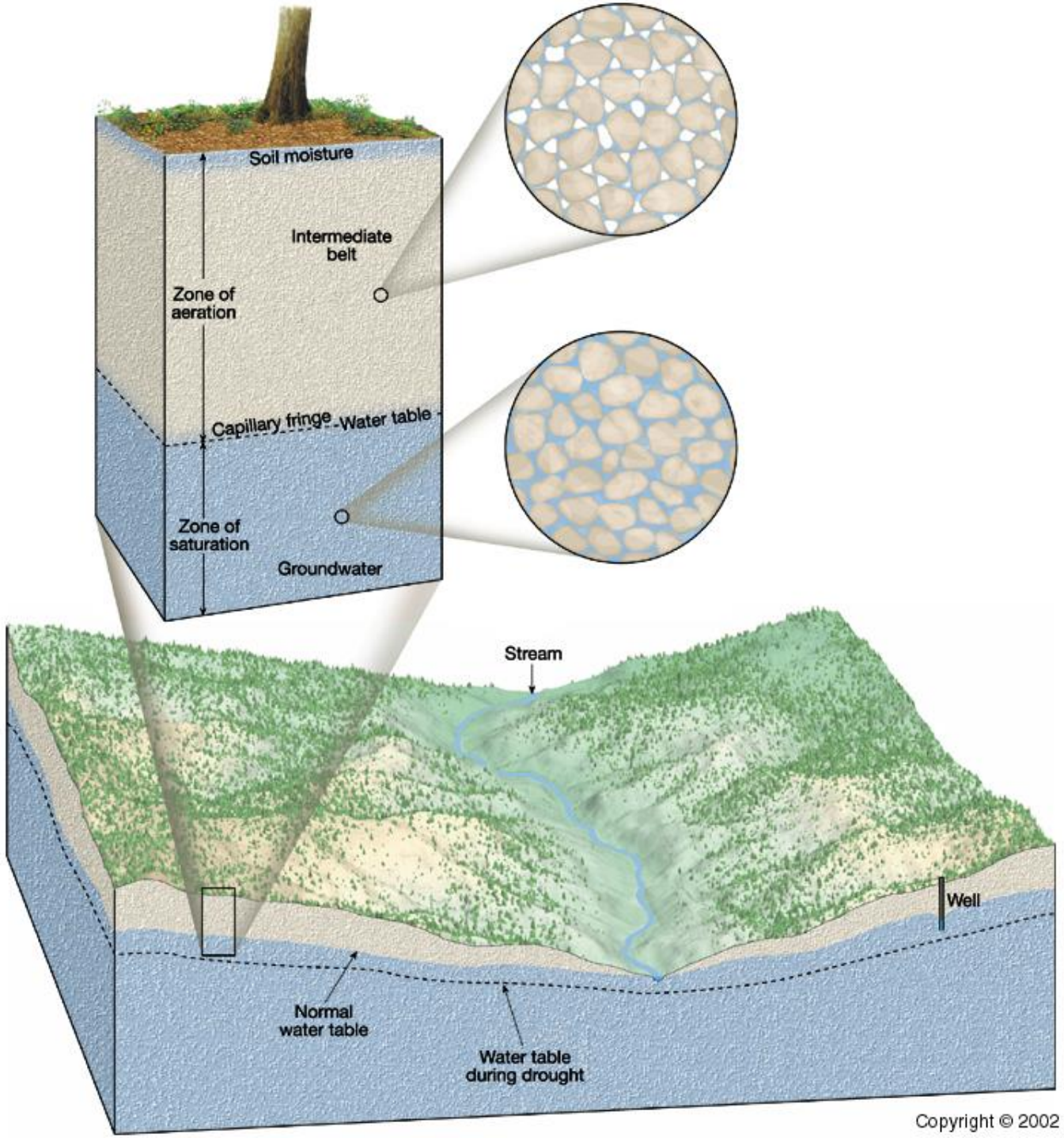
Underground Water Terms

1. Zone of Aeration — The amount of air space at the top of the soil

2. Zone of Saturation — The area that is filled with water

3. Water Table — The top of the zone of saturation


Zone of
Aeration
Water Table
Zone of
Saturation
SOIL



Infiltration

- The soaking or sinking of water into the ground.

- The surface must be permeable.

- Occurs in **regolith** at or near the surface

Ground water & Infiltration & Factors

1. Permeability — The ability for water to be able to flow through the soil or other materials

2. Permeability rate — How fast the water flows through the material

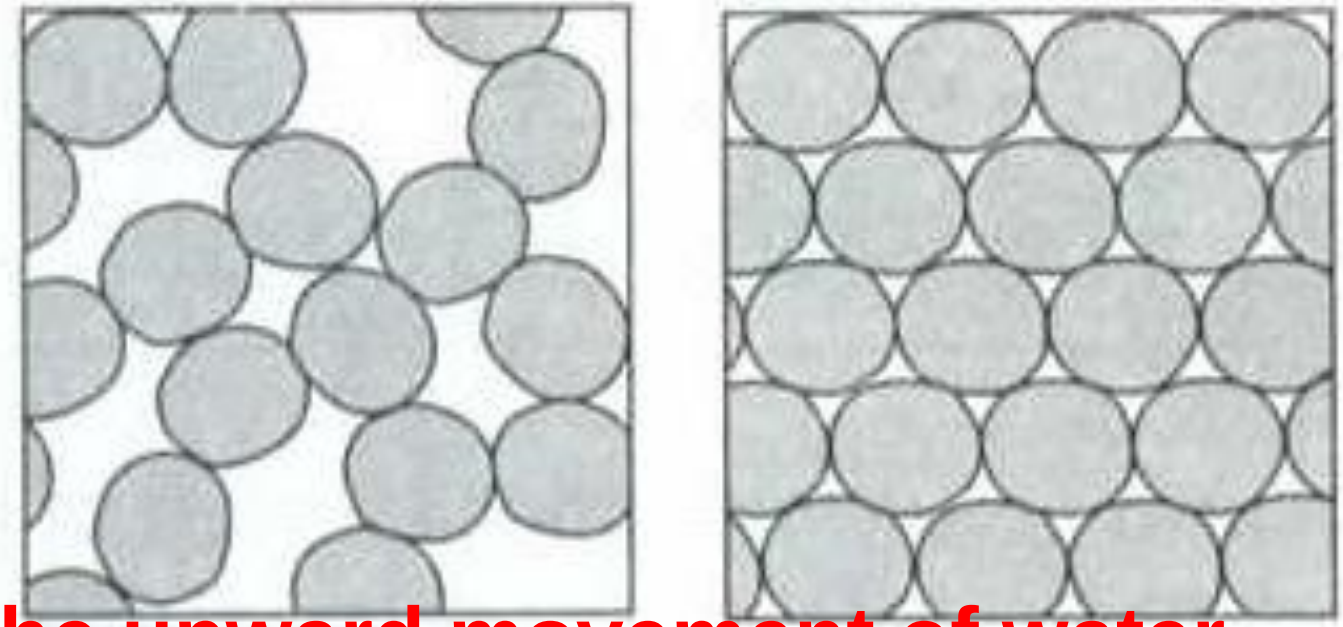
3. Impermeable — Water can not go through the ground
   - Concrete / pavement, tightly packed soil, saturated soil

3. Porosity

- The amount of open space between the soil particles (air space)

- A

st



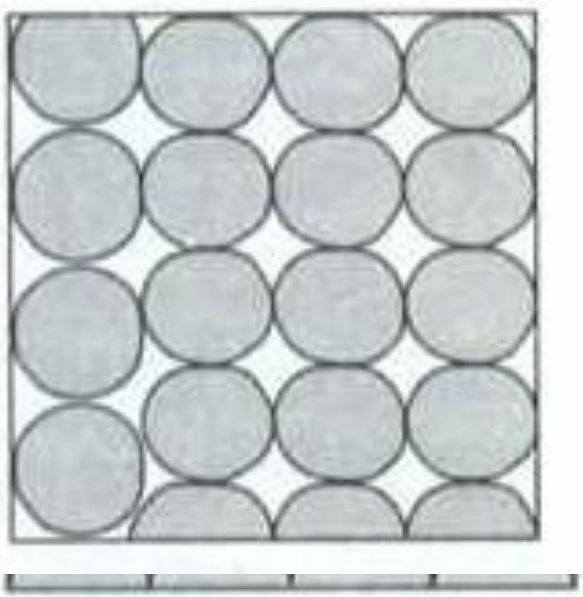
4. Capillarity

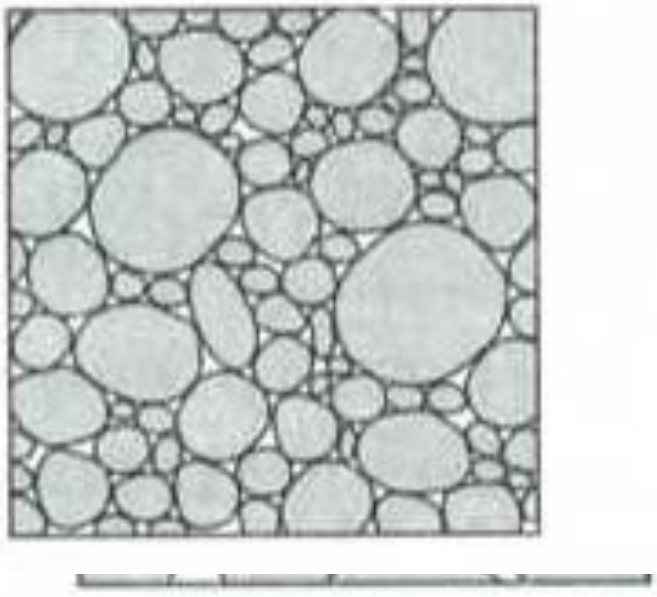
The upward movement of water through very tiny pore spaces

smaller particles = greater capillarity

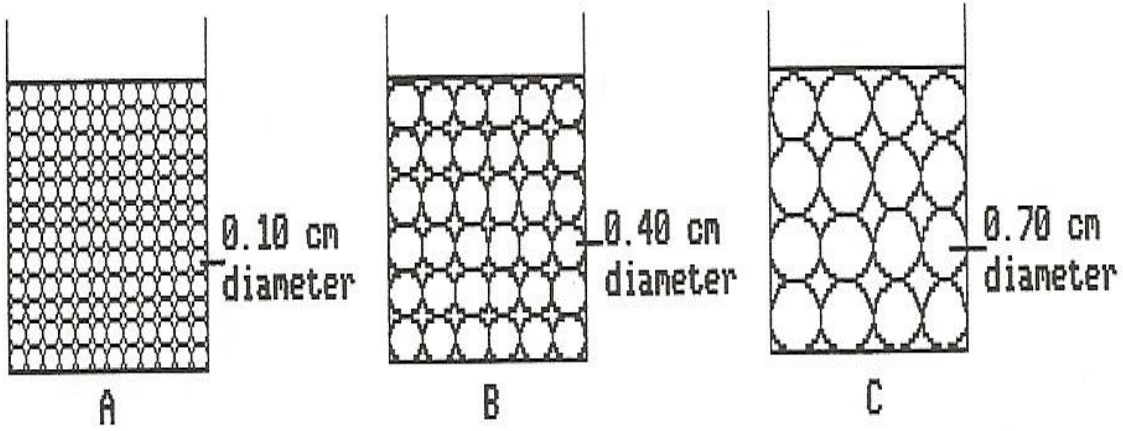
Factors Effecting Infiltration and Permeability

Factor that effect infiltration	Permeability rate (infiltration) is *greatest* when the following characteristics are true
(a)	Sorted
(b)	C
(c)	Unsorted
(d)	**Packing** - **Loosely packed**





1) The diagrams below represent three identical beakers, *A*, *B*, and *C*. Each beaker contains solid plastic spheres. The diameter of the spheres in each beaker is shown.

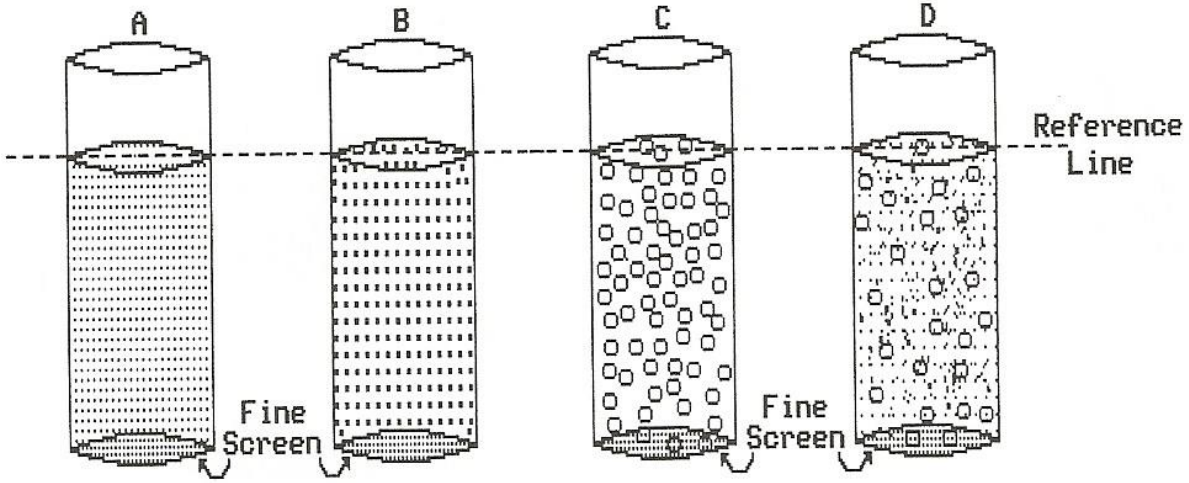


Which beaker contains material with the *greatest* permeability?

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

2) The diagrams below which describe an investigation with soils.

Three similar tubes, each containing a specific soil of uniform particle size and shape were used to study the effect that different particle size has on porosity, capillarity, and permeability. A fourth tube containing soil which was a mixture of the same sizes found in the other tubes was also studied and its data are recorded in the table. [Assume that the soils were perfectly dry between each part of the investigation.]



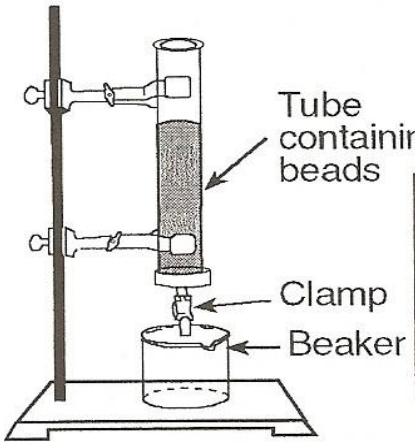
Tube	Paricle Size (diameter in cm)	Porosity (%)	Capillarity (mm)	Permeability (sec)
A	Fine (0.025 cm)	40	20	14
B	Medium (0.1 cm)	40	15	8
C	Coarse (0.3 cm)	40	7	6
D	Mixed (0.025 to 0.3 cm)	20	12	20

When water was poured into the top of each tube at the same time, which tube allowed the water to pass through most quickly?

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

3) The diagram below represents part of the laboratory setup for an activity to investigate the effects of particle size on permeability, porosity, and water retention. Three separate tubes were used (only one example is shown), each containing 300 milliliters of beads of uniform size. Bead sizes were 4 millimeters, 7 millimeters, and 12 millimeters in diameter, respectively.

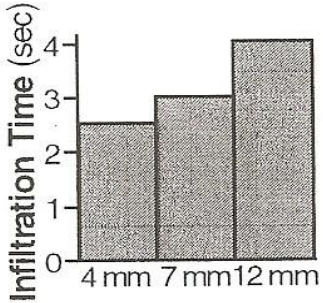
The amount of water added to each tube to cover the beads was determined. The clamp was then removed, the flow of the water was timed, and its volume was measured. Data are shown in the table below. (The amount of water retained on the 7-millimeter beads has been omitted.)



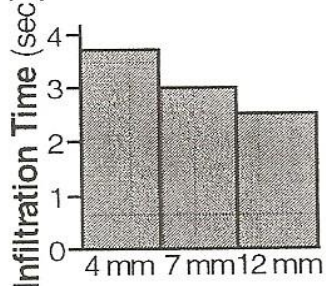
	PARTICLE SIZE		
	4 mm beads	7 mm beads	12 mm beads
Infiltration time (seconds)	3.7	3.0	2.4
Amount of water needed to cover all beads (ml)	147	145	147
Water recovered from tube after clamp was removed (ml)	111	123	135
Water retained on beads (ml)	36		12

Which graph *best* represents the infiltration times for these three particle sizes?

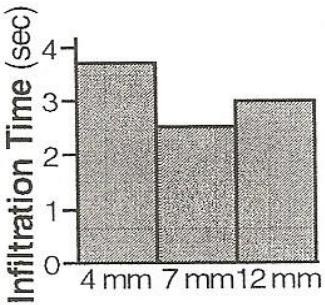
A)



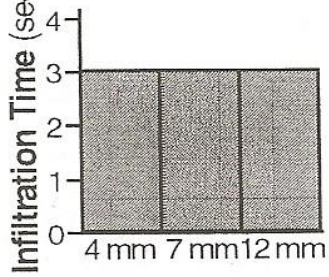
B)



C)



D)



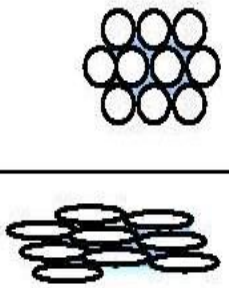
Factors that cause runoff		Runoff increases (infiltration decreases) when the following conditions occur
(a) Saturated Ground	-	no room for any more water
(b) Slope	-	Steep slope
(c) Temperature	-	Ground is frozen
(d) Weather	-	When it rains faster than the soil can take it in
(e) Location	-	Pavement (concrete)

Factors that Effect Porosity

(a)

Shape

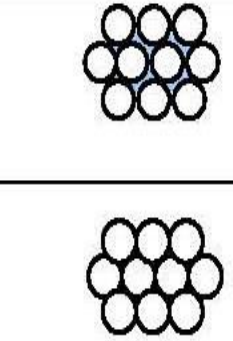
Rounder particles allow more water to infiltrate or be stored



(b)

How tightly packed they are

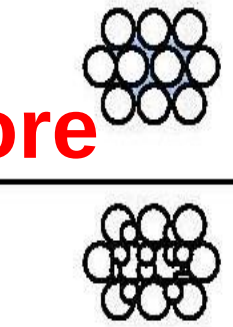
Loosely packed allows more infiltration and room for storage



(c)

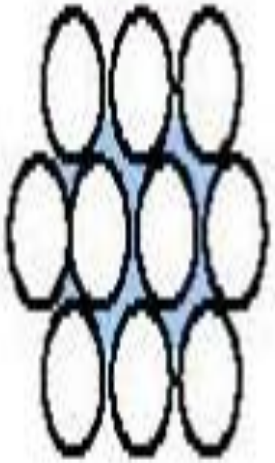
Sorting

Sorted particles allow more room in between them



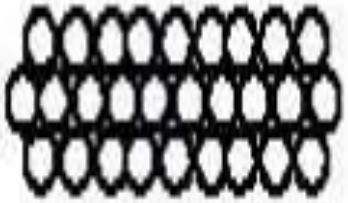
Size does NOT affect Porosity when particles are sorted!!!

Large Particles



Larger particles have larger holes in between but not as many as the smaller particles.

Small Particles



Smaller particles have smaller holes but a lot more than the larger particles

Factors that Effect Capillarity

The smaller the pore space the greater the capillarity