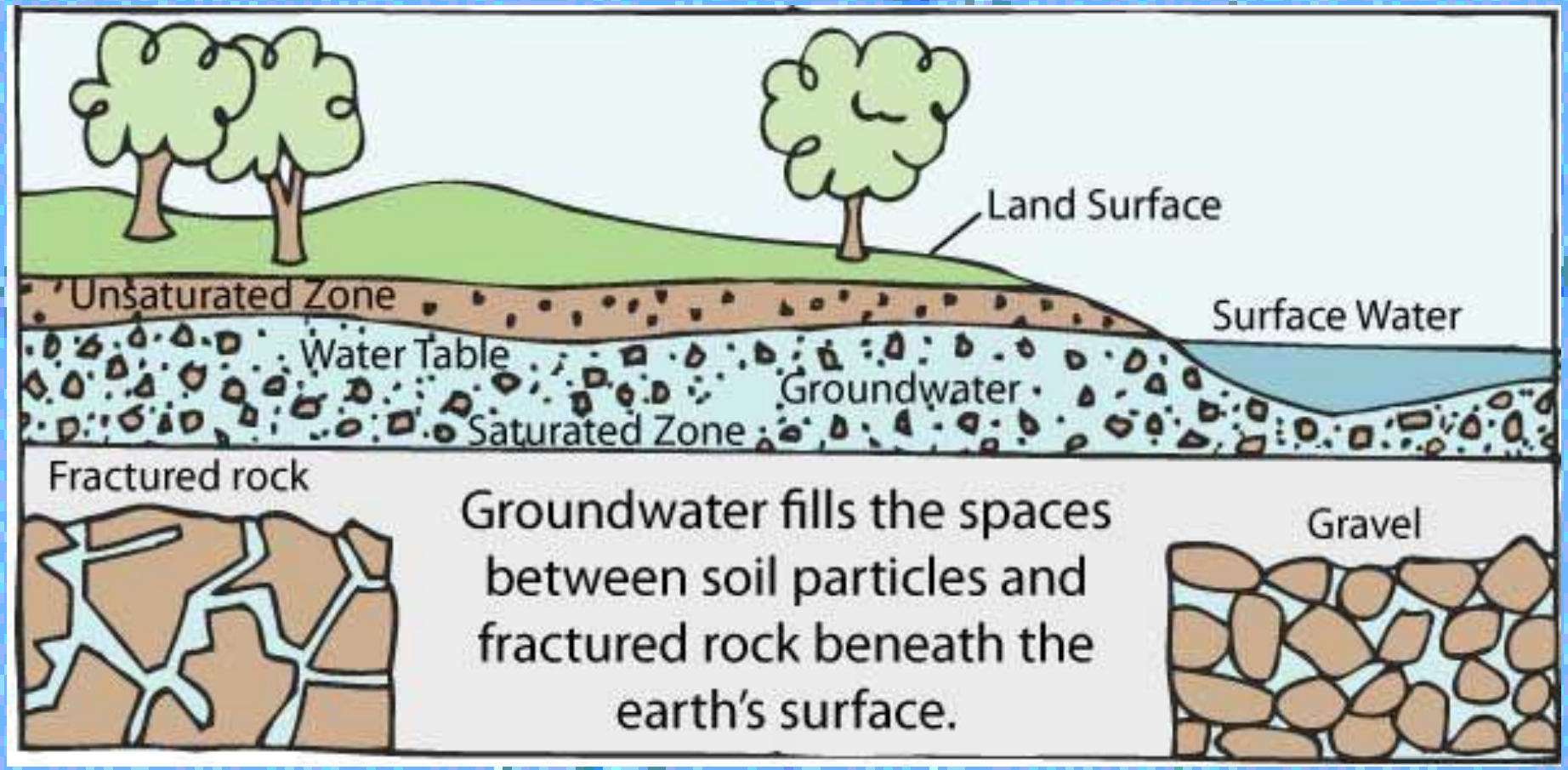
Water and the Ground



Water Cycle

Water enters the atmosphere by…….

- Evaporation
  (90% of evaporation is from oceans)

- Transpiration (from plants)

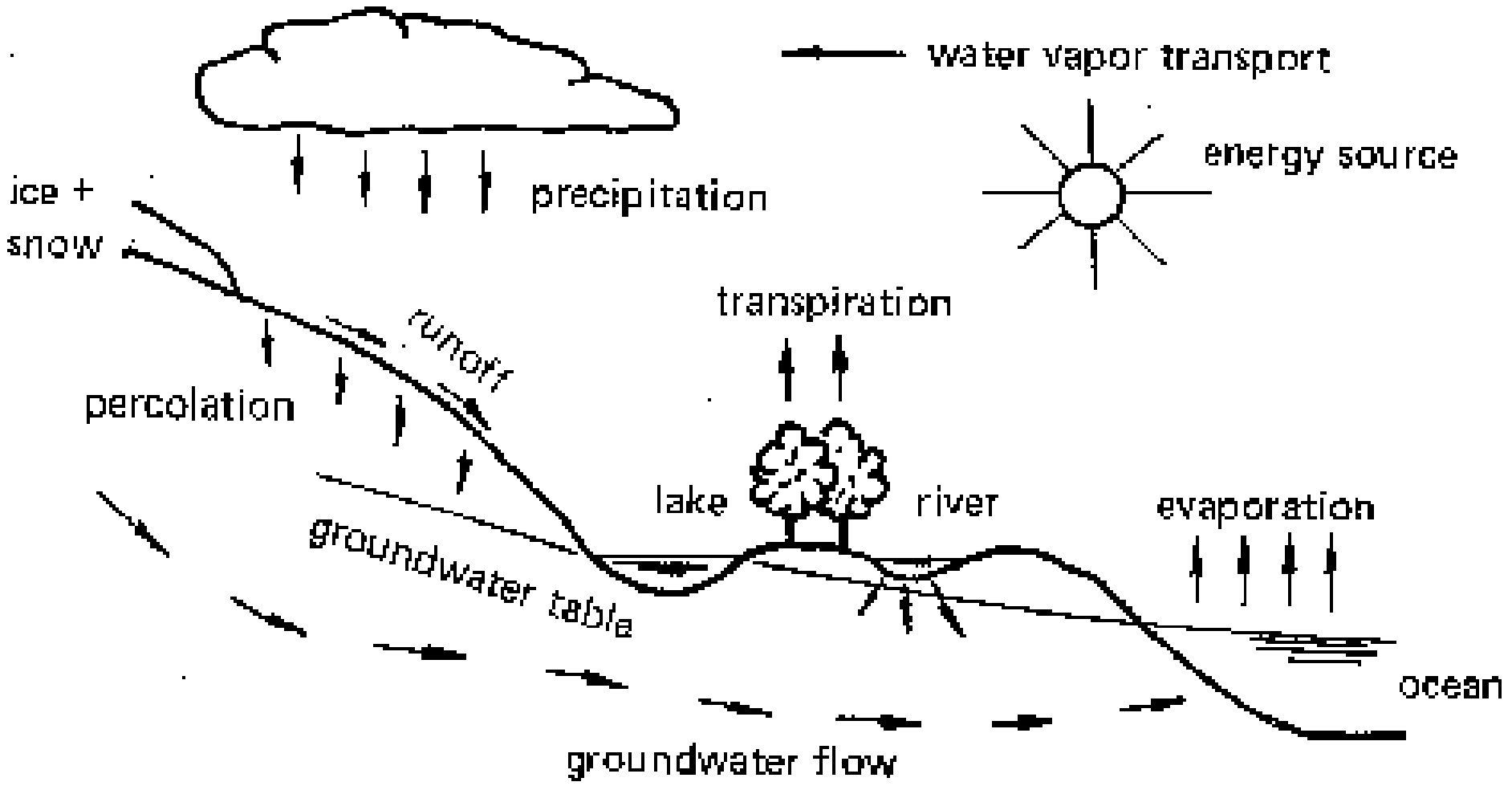
- Combine the above terms:
  EVAPOTRANSPIRATION

Water Cycle

Water returns to earth by…….

- Precipitation

- Rain, Snow, etc.


water vapor transport
energy source
precipitation
ice +
snow
transpiration
runoff
percolation
lake
river
evaporation
groundwater table
ocean
groundwater flow

Once water is on the ground it can

Runoff: Flow along Earth's surface (river)

Infiltrate: Sink into the ground and become part of the ground water supply

Evaporate or transpire back into the atmosphere.

Collect on the surface in puddles or as ice and snow if its cold enough.

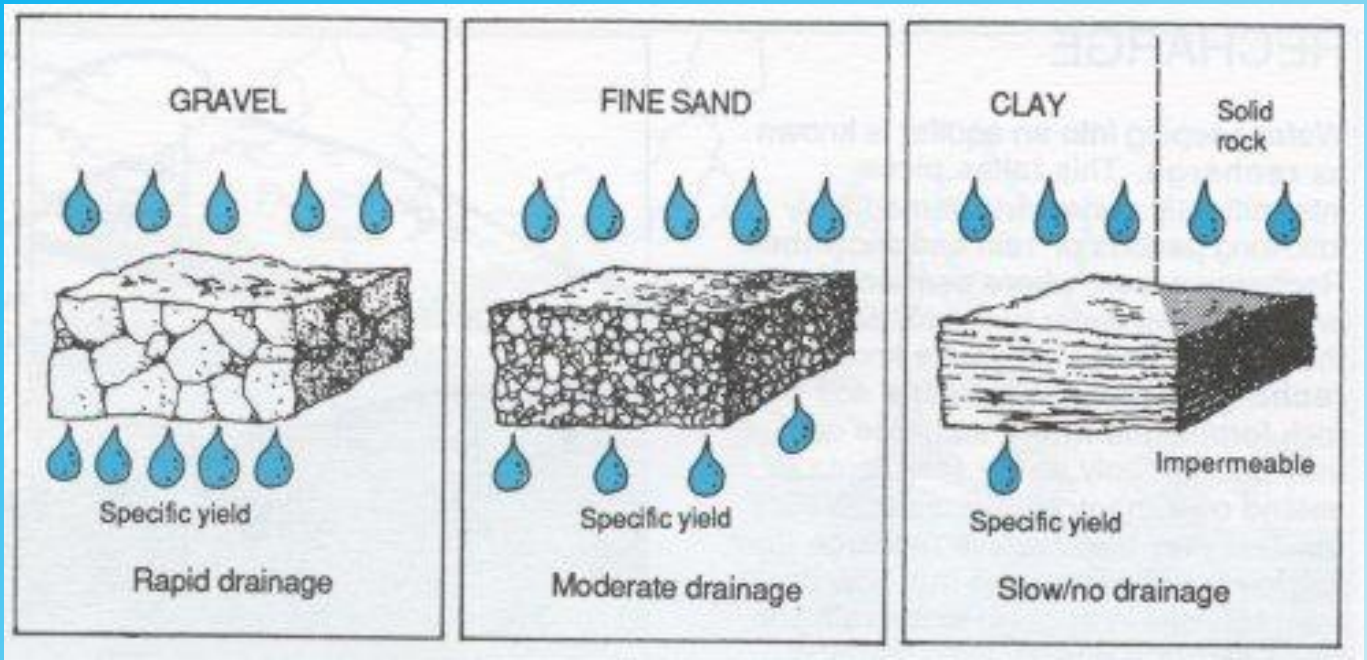
Collect on the surface in a lake or reservoir.

Why does rain runoff of a paved parking lot?

- The cement is not permeable
- The cement is impermeable

- **Permeability:** The ability to allow water to pass through.

- Flooding occurs when the ground is impermeable or saturated with water (holding all that it can)



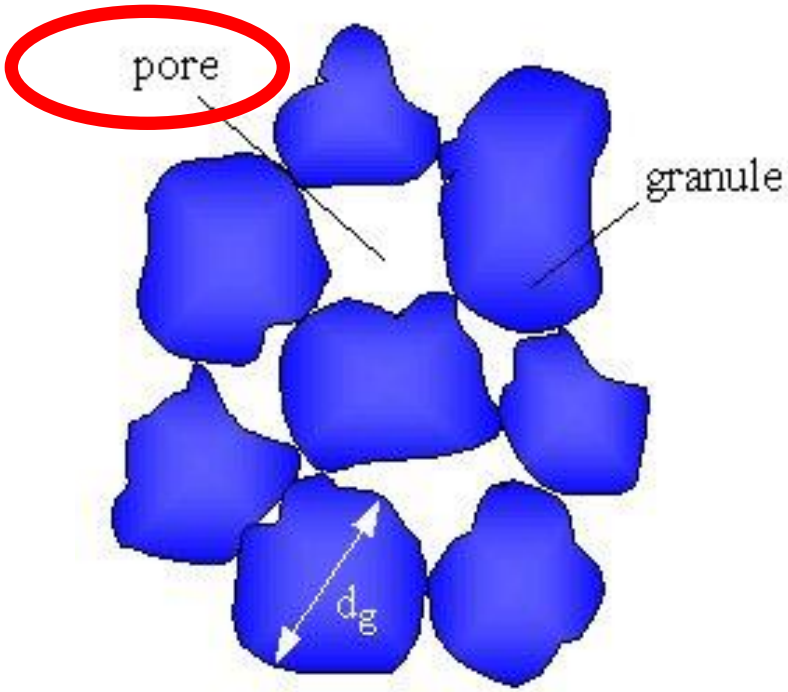
Larger Particles → Smaller Particles

More permeability → Less Permeability

Permeability is affected by particle size:

- Large particles allow water to pass through more quickly than small because the pore spaces are also larger.

Porosity: The amount of open space between soil particles.



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A sponge is very porous because it has many spaces between particles

Water in the ground is stored in the pores between soil particles. (Like a sponge)

- many pores or spaces means it can hold a lot of water.

Porosity depends on:

- Particle Packing (how loose or compact the spoil particles are)
- Particle Shape (Rounded or Angular)
- Particle Sorting (Particles of the same size, or a mix of particle sizes)

Porosity depends on…

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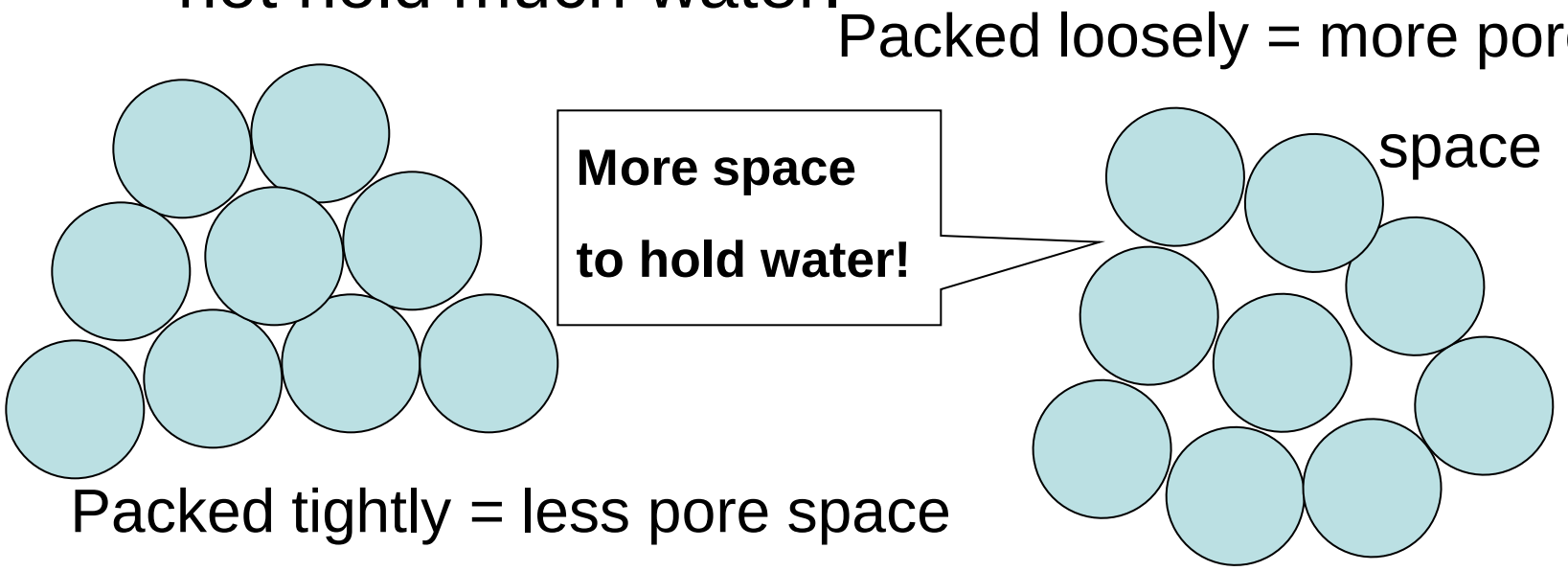
Packing:

- Tightly packed particles have less porosity than loose soil particles.

- This means that tightly packed particles will not hold much water.



Porosity also depends on…

Particle shape:

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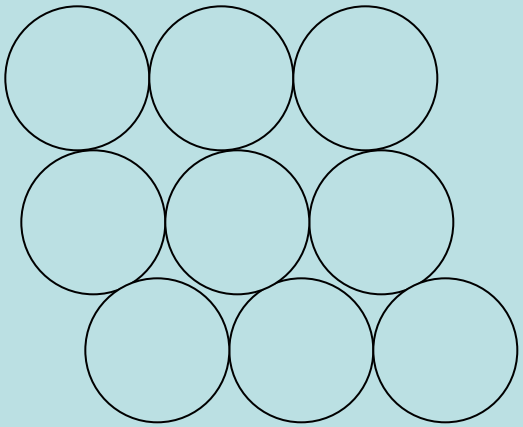
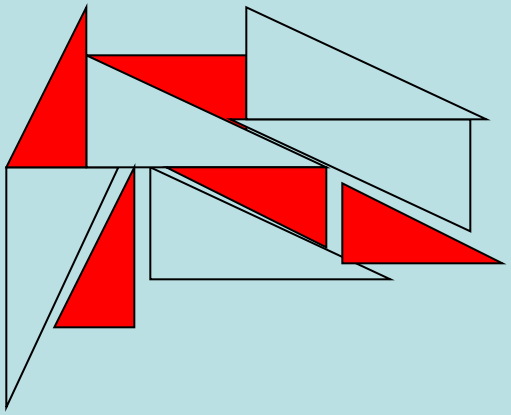
- Round particles have greater porosity because they do not fit together as well as angular particles.
- Round particles have larger spaces between soil particles to hold water.





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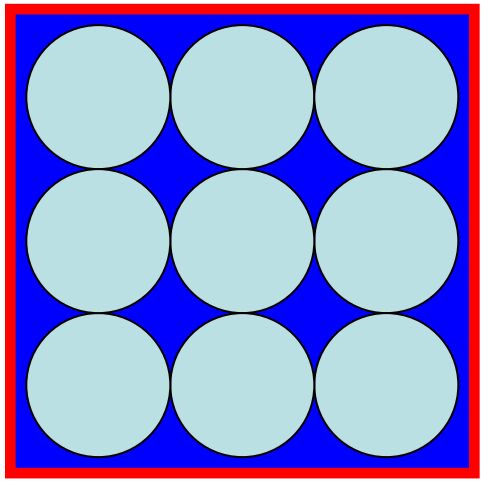
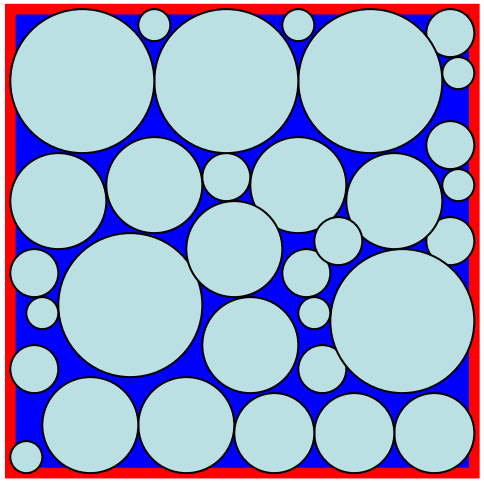
Porosity depends on…

Sorting: Who has more pores? Sorted or Unsorted?

- Sorted particles of the same size have more porosity than unsorted or mixed size particles.
- Mixing different sizes or shapes of particles reduces porosity or the amount of water the soil can hold.



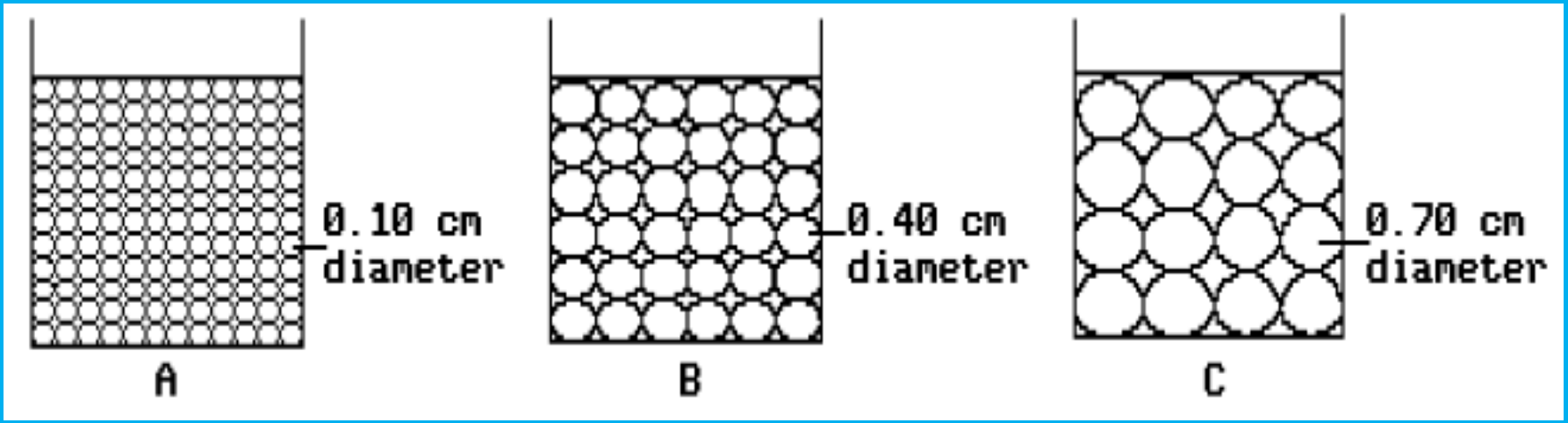
Sorted = More Pore Space



Unsorted = Less Pore Space

Particle Size does NOT affect Porosity

An equal volume of large particles and an equal volume of small particles will have the same porosity



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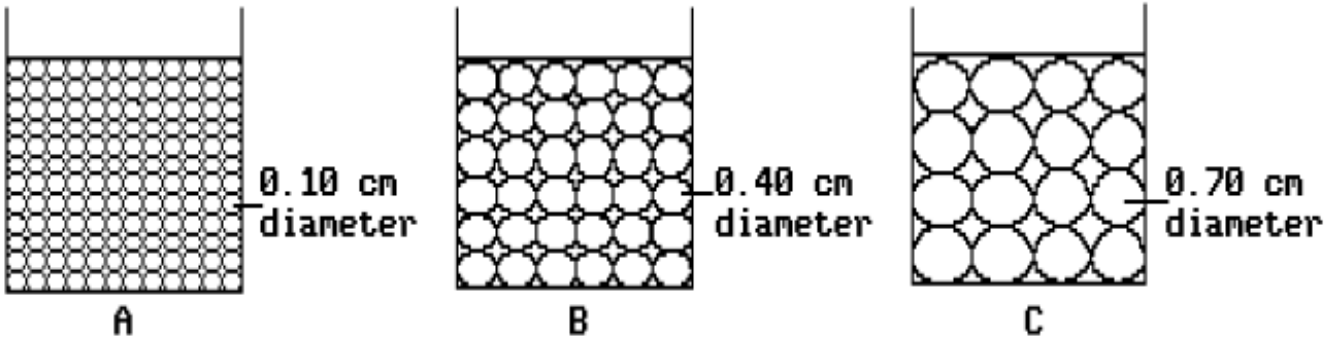
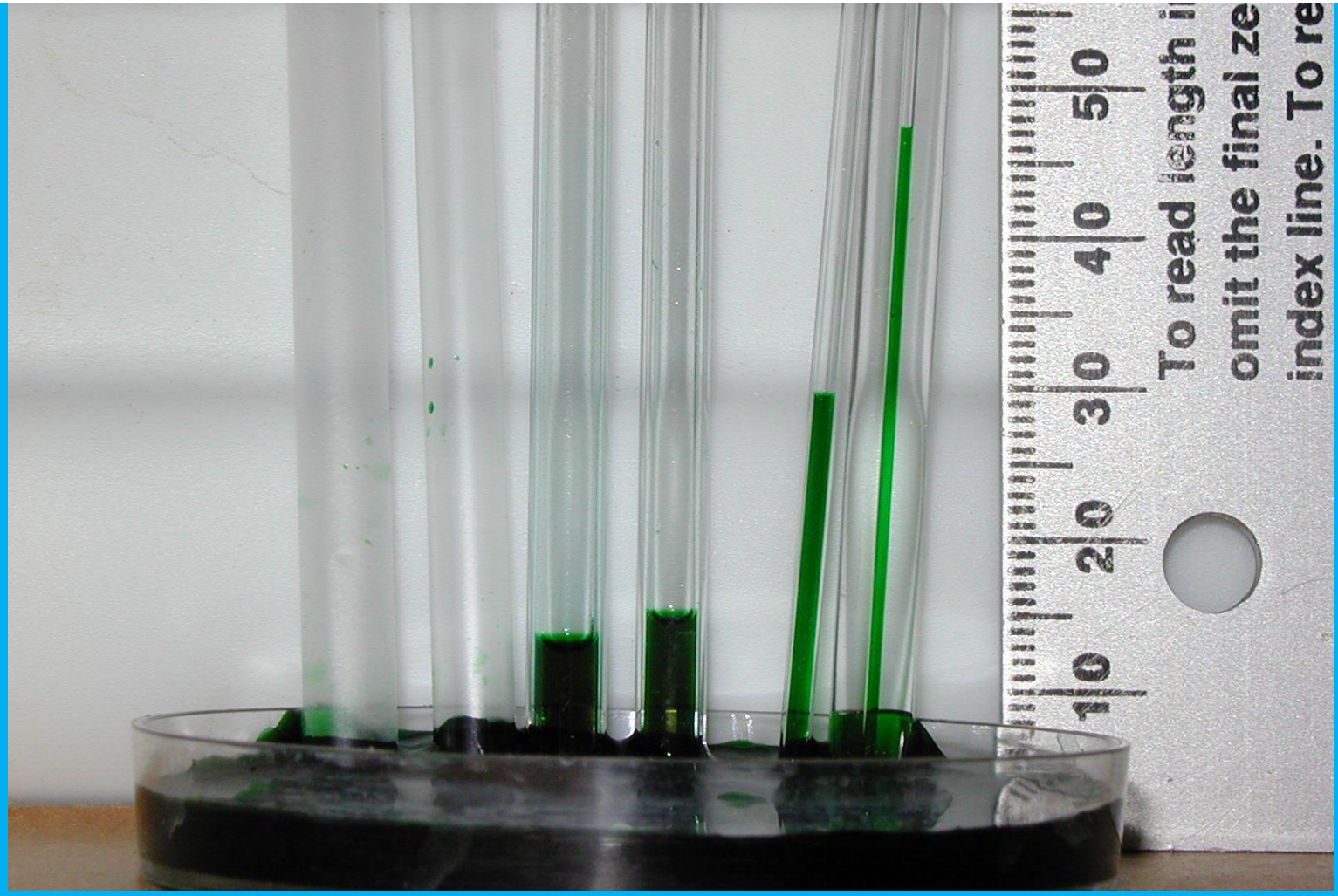
Particle size does not affect porosity!



- These all have the same porosity.
- The large particles have larger pores but there are fewer of them
- The small particles have small pores but there are many of them.

Porosity of LARGE particles = Porosity of small particles

Capillarity: The ability of water to rise up in very small openings.



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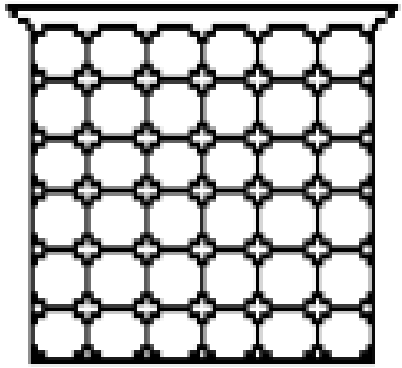
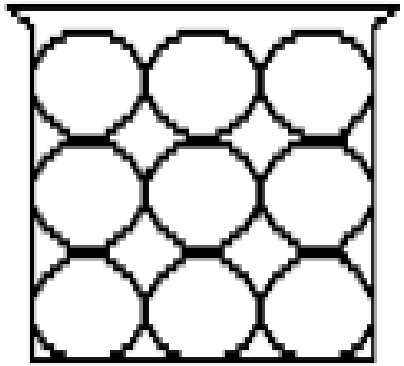
Capillarity Example:

Soda moves up the straw on its own.

Capillarity Relationship:

- Small particles = small pores = high capillarity
- Large particles = large pores = low capillarity





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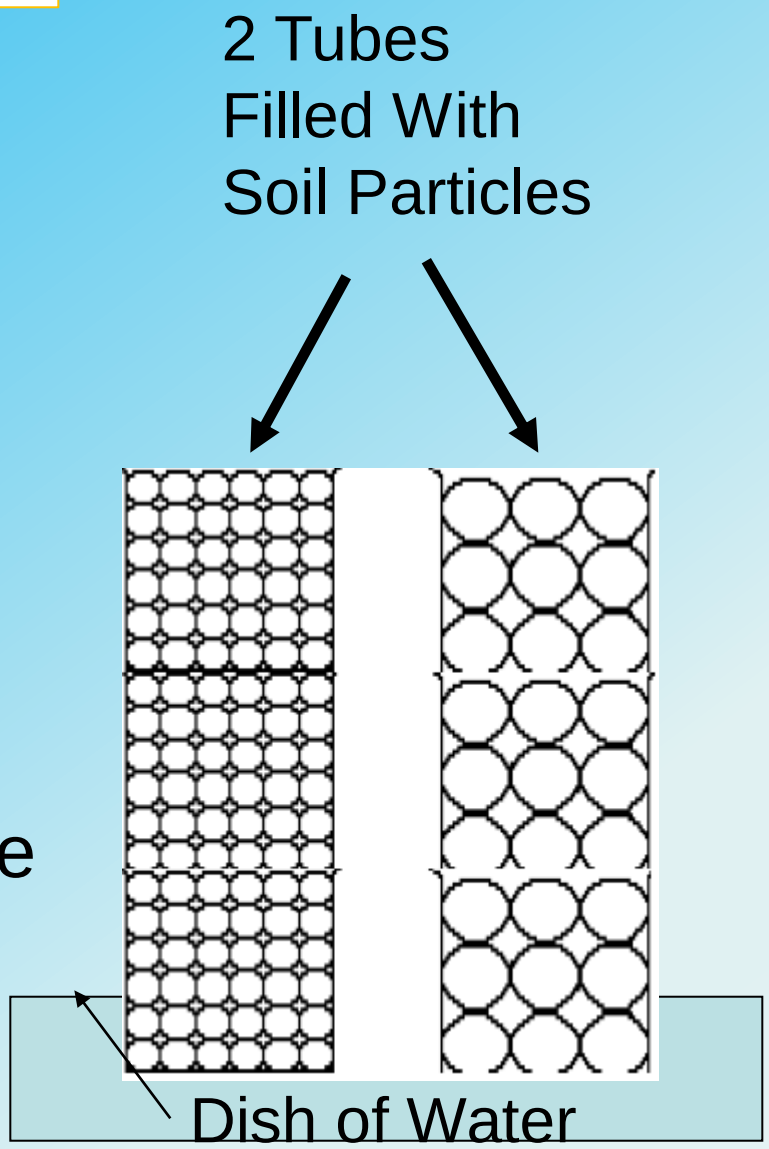
In which tube will water climb up higher (capillarity)??

Water will climb up higher in the tube with smaller particles.

This is because capillarity is greater when pore space is small.

Smaller particles have smaller pore space.



Capillarity and Water Retention

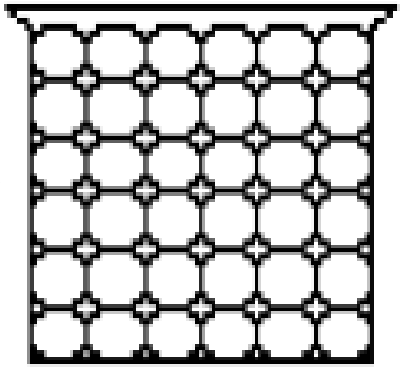
Water Retention is the soil's ability to hold onto water.

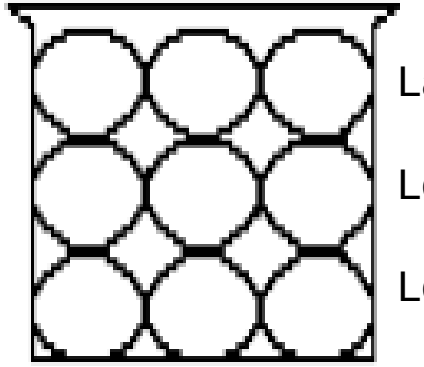
When pore spaces are small, there is more surface area.
More surface area means more water sticks to the soil particles.

Capillarity and Water Retention are directly proportional to each other.

Smaller Pores means Greater Capillarity and greater Water Retention.
Larger Pores means less Capillarity and less Water Retention.

Smaller Pores
Greater Capillarity
Greater Retention





Larger Pores
Less Capillarity
Less Retention