

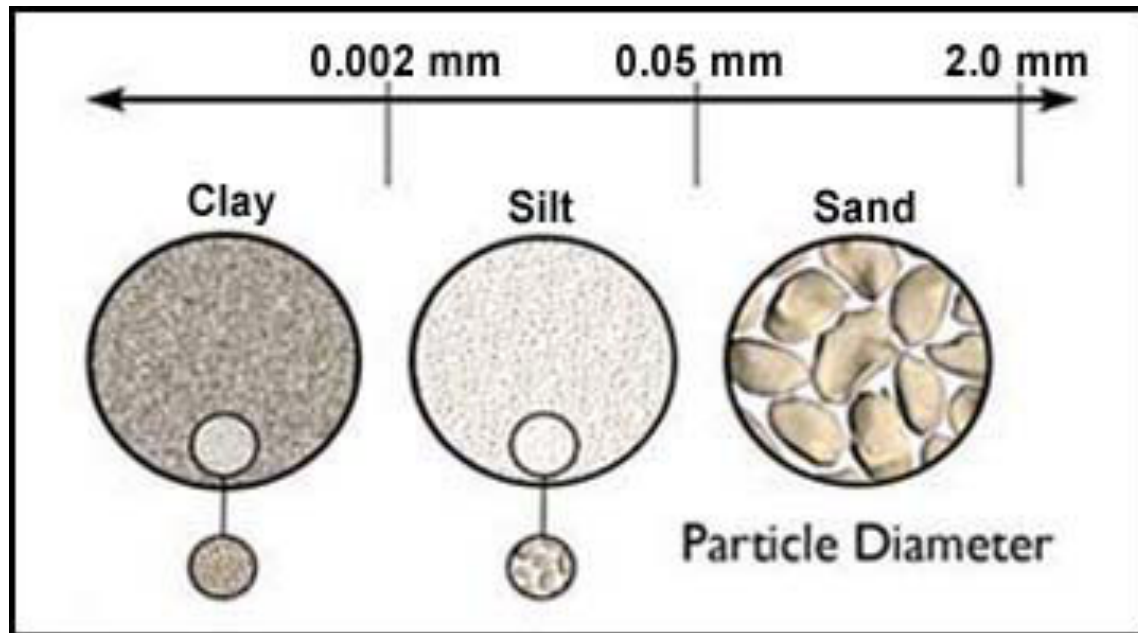
Guided Notes

Water Cycle & Groundwater

Permeability
Porosity
Capillarity
Water Retention

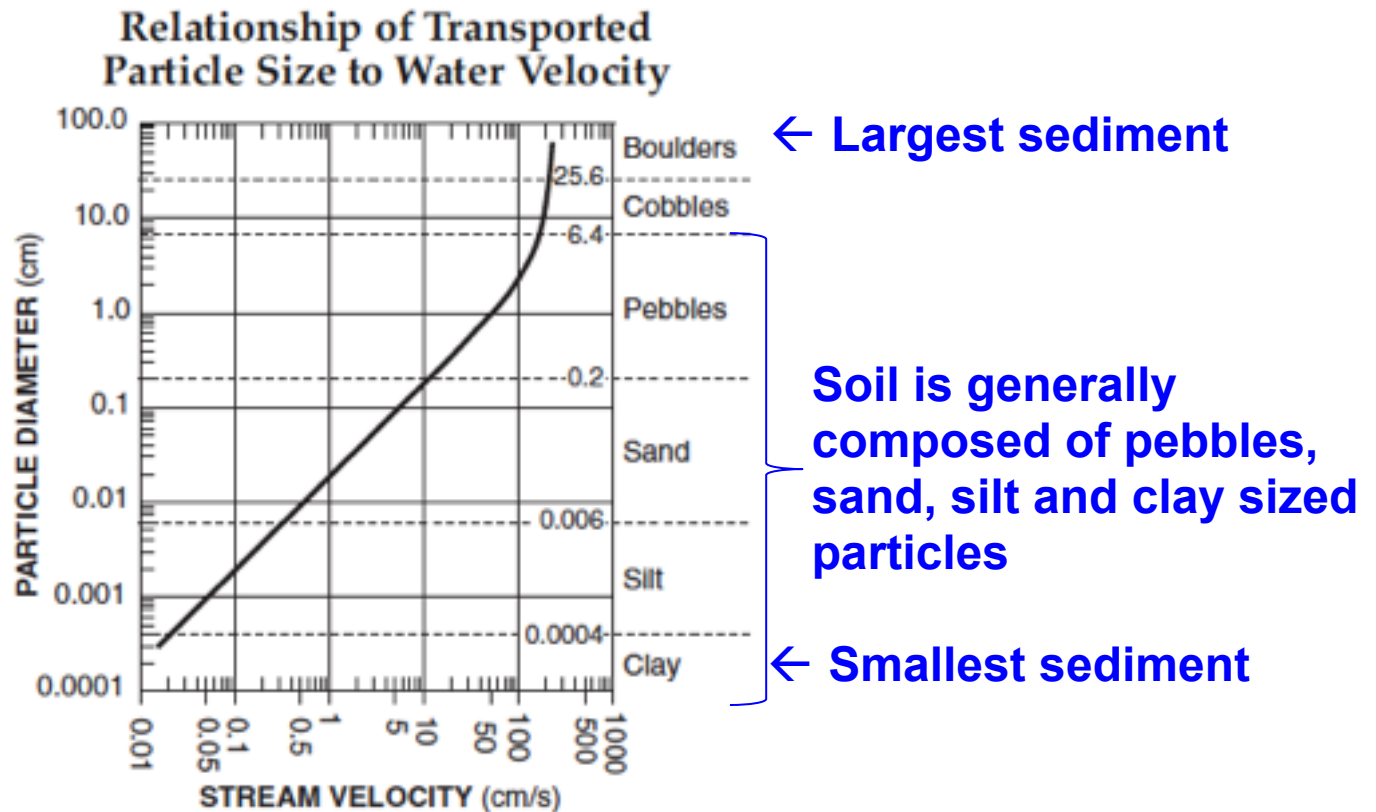
11. Why can water infiltrate some soils quicker than others?

- The sizes of the sediments (fragments of rock) determine how much water can move into the ground.



12. How are the sizes of sediments defined?

*Use ESRT page 6 for grain size comparison:



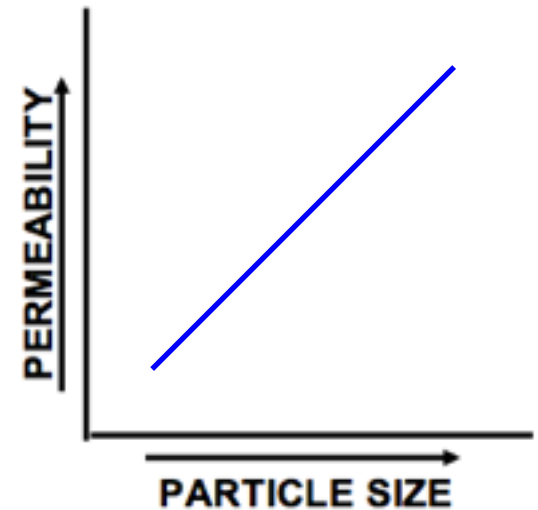
This generalized graph shows the water velocity needed to maintain, but not start, movement. Variations occur due to differences in particle density and shape.

13. How is permeability determined?

- **Permeable**: water can infiltrate the ground
- **Impermeable**: water cannot infiltrate the ground and will remain on the surface

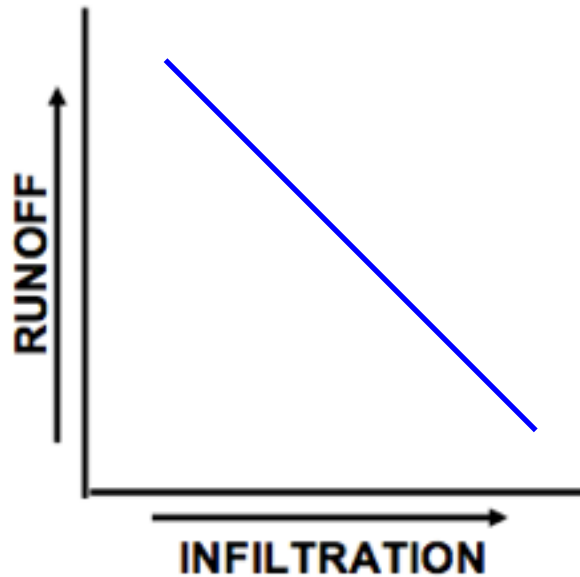
13. How is permeability determined?

- **As soil size increases, the permeability rate increases.**
 - Greater permeable sediments: **pebbles & sand (larger)**
 - Less permeable sediments: **silt & clay (small)**



14. How are runoff and infiltration related?

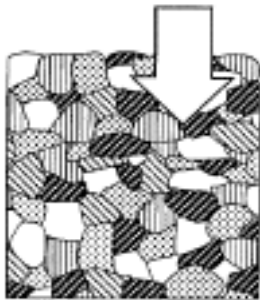
- **Indirect relationship: as the amount of infiltration increases, the amount of runoff decreases**



15. What factors affect infiltration & runoff?

Factor	Increase Infiltration, Decrease Runoff	Increase Runoff, Decrease Infiltration
Permeability	Highly permeable	Low permeability

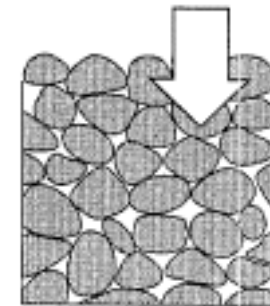
**Low
permeability**



Granite bedrock

OR

**High
permeability**

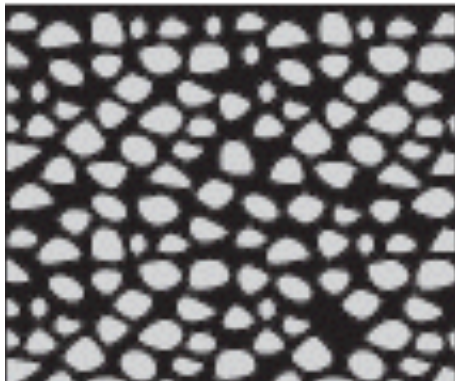


Pebble soil

15. What factors affect infiltration & runoff?

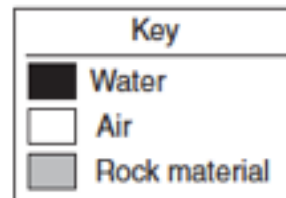
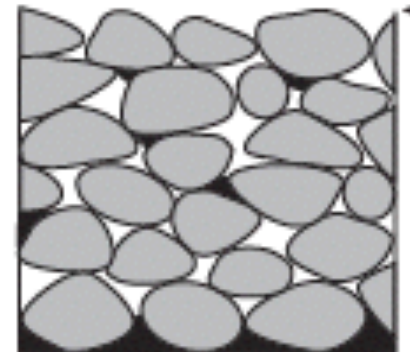
Factor	Increase Infiltration, Decrease Runoff	Increase Runoff, Decrease Infiltration
Saturation	Unsaturated	Saturated

Saturated



OR

Unsaturated



15. What factors affect infiltration & runoff?

Factor	Increase Infiltration, Decrease Runoff	Increase Runoff, Decrease Infiltration
Slope	Gentle slope	Steep slope

Steep slope



Gentle slope



OR

15. What factors affect infiltration & runoff?

Factor	Increase Infiltration, Decrease Runoff	Increase Runoff, Decrease Infiltration
Temperature	Warm soil	Cold or frozen soil

Warm soil



www.shutterstock.com · 56007085

**Cold or frozen
soil**

OR



15. What factors affect infiltration & runoff?

Factor	Increase Infiltration, Decrease Runoff	Increase Runoff, Decrease Infiltration
Vegetation	Large amount of vegetation	Small amount of vegetation

**Small Amount
of Vegetation**

**Large Amount
of Vegetation**

OR



15. What factors affect infiltration & runoff?

Factor	Increase Infiltration, Decrease Runoff	Increase Runoff, Decrease Infiltration
Location	Soils and sands	Concretes, pavement, buildings

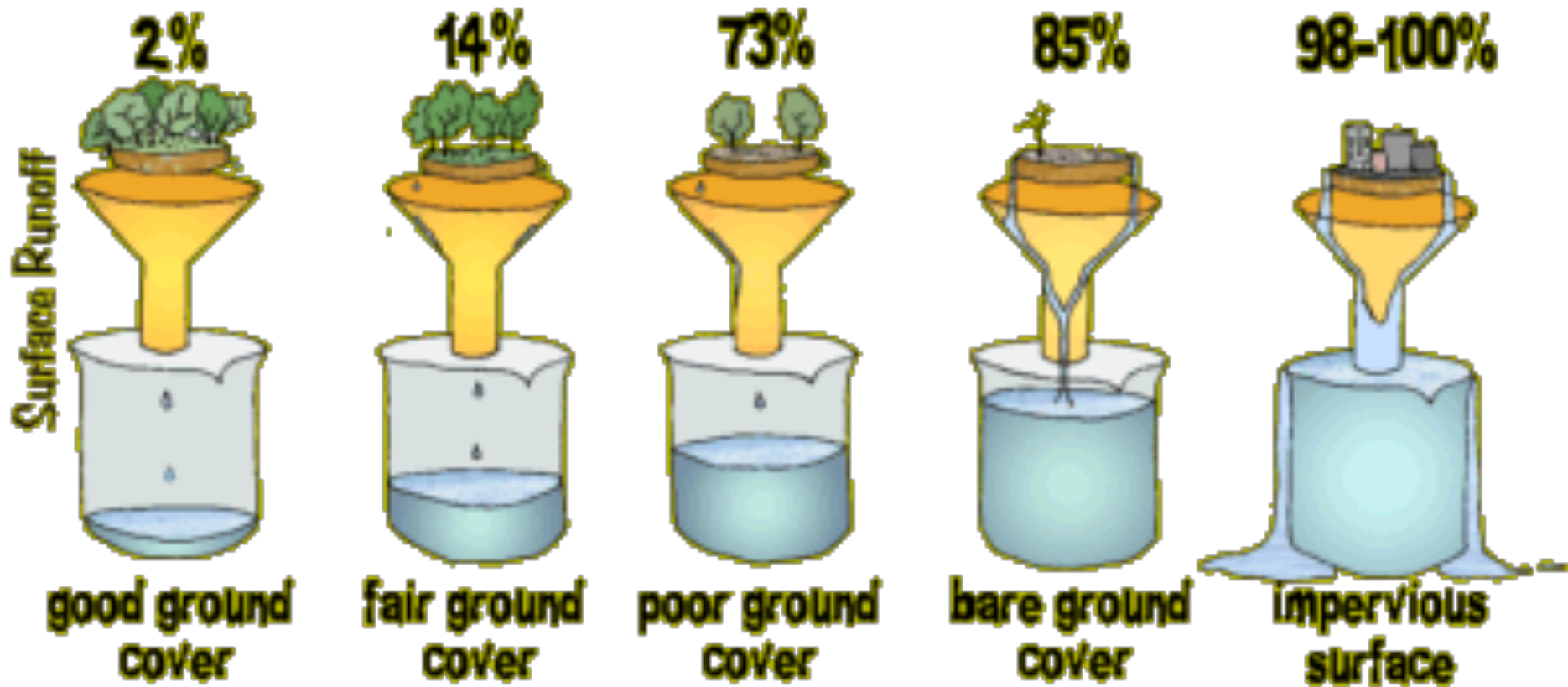
Soils and sands

**Concrete, pavement,
buildings**

OR

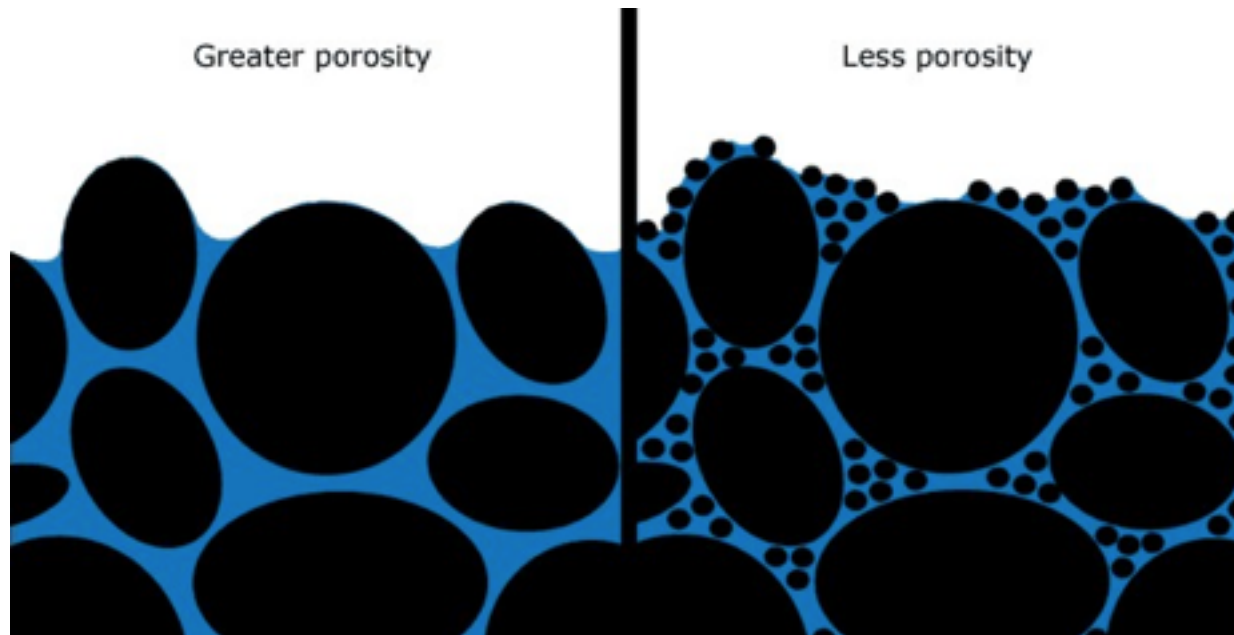


Percentage of Surface Runoff on a Variety of Surfaces



16. How much water can soil hold?

- **Porosity**: the amount of space between sediments



- Porosity depends upon **shape, packing, & sorting** of soil particles.

17. What are the three factors that determine porosity?

1) Shape

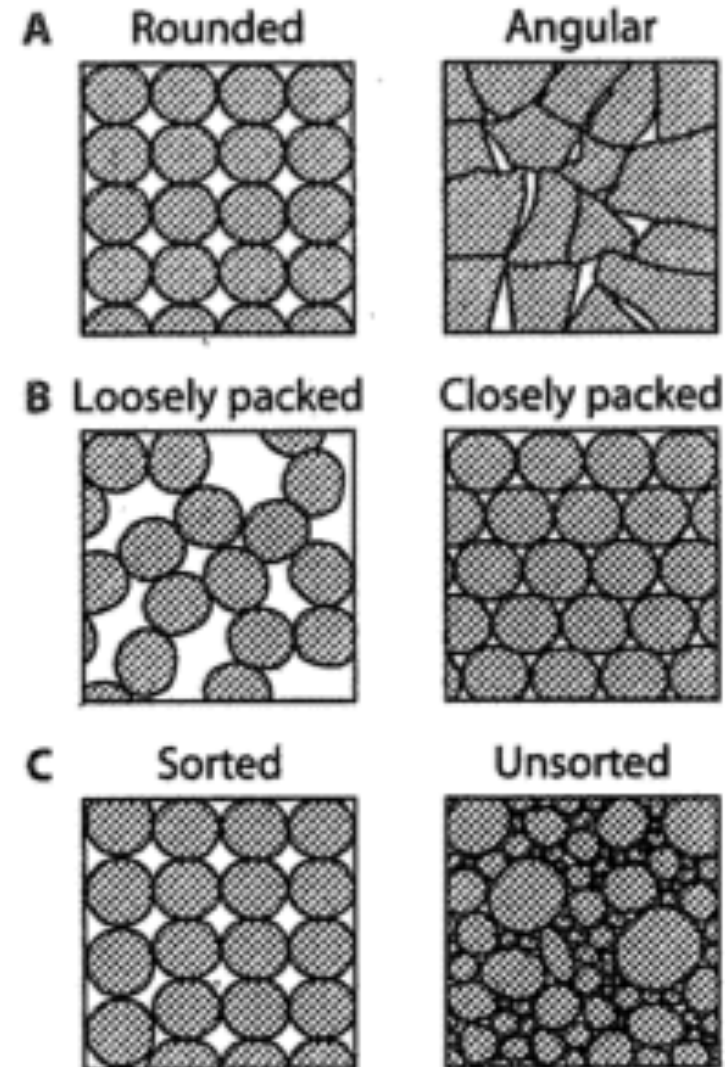
- Rounded particles have more porosity than particles with angular shapes.

2) Packing

- Loosely packed particles have more porosity than closely packed particles.

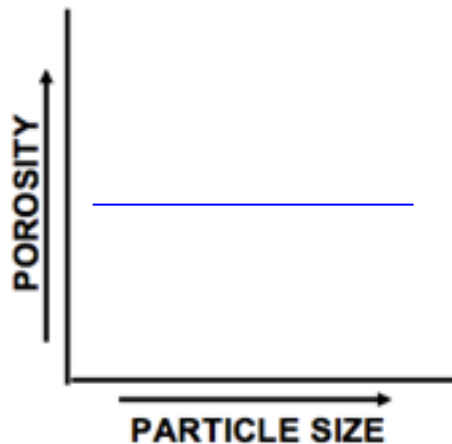
3) Sorting

- Well-sorted particles have more porosity than unsorted particles.

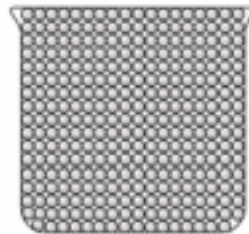


18. How does size affect porosity if shape, packing, and sorting are uniform?

- **Size DOES NOT** affect porosity because it does not change the amount of empty space between particles!

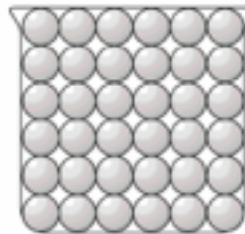


Beads of
0.15-cm diameter



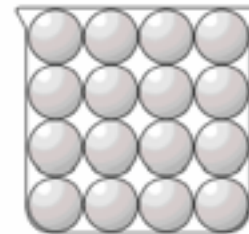
A

Beads of
0.45-cm diameter



B

Beads of
0.70-cm diameter

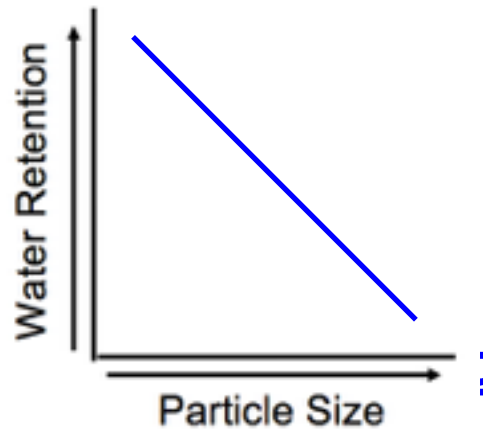


C

These all have the same porosity because they have the same shape, packing, and sorting!

19. How much water remains in the soil?

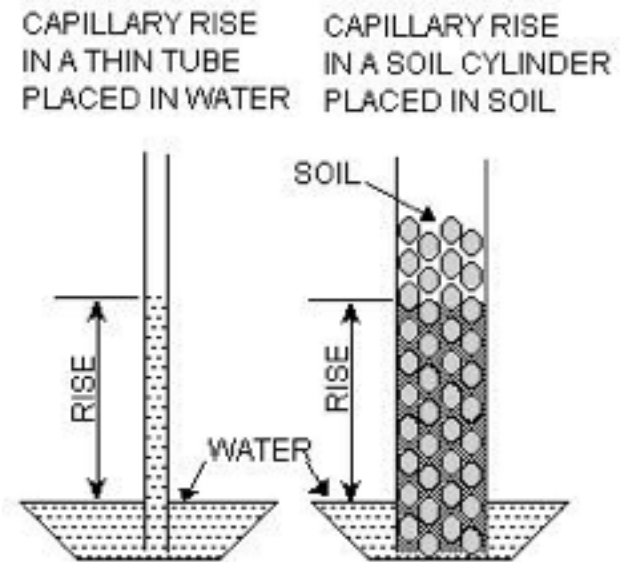
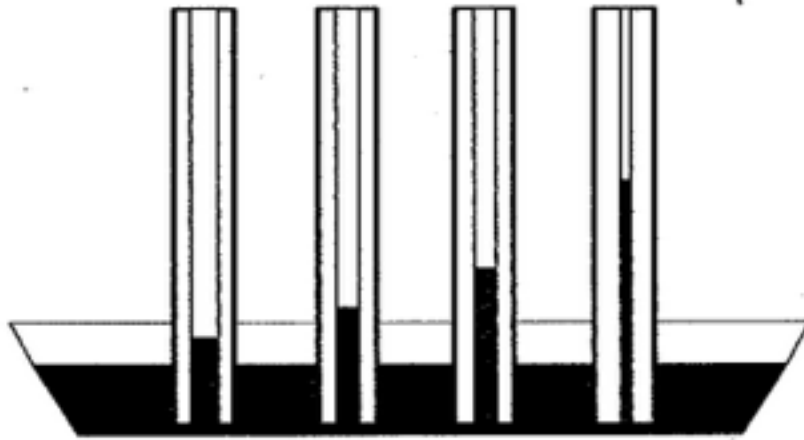
- **Water retention: the ability for soil to hold water**
- **The smaller the sediments, the greater the water retention.**



- **Greatest retention: clay, silt**
- **Lowest retention: sand, pebbles**

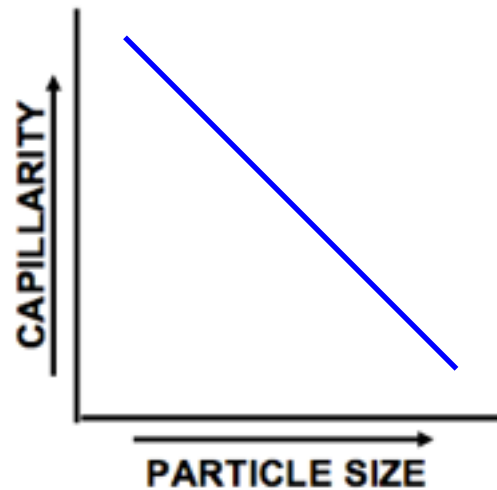
20. How does water rise in between particles?

- **Capillarity**: Upward movement of water through tiny spaces in soil or rock



20. How does water rise in between particles?

- **The smaller the sediments, the greater the capillarity.**



- **Greatest capillarity: clay, silt**
- **Lowest capillarity: sand, pebbles**

✓ Review: Groundwater

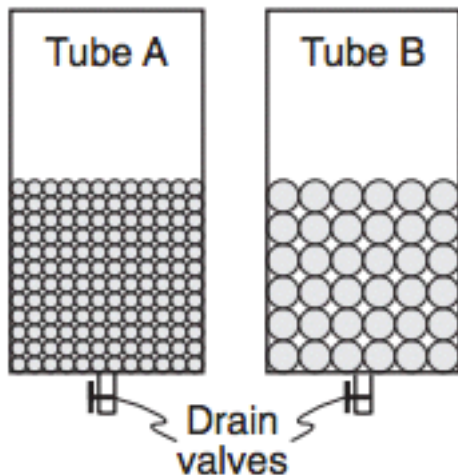
1) Describe the permeability and saturation that would allow the most:

a. Infiltration:

b. Runoff:

✓ Review: Groundwater

2) The diagram below shows tubes A and B partly filled with equal volumes of round plastic beads of uniform size. The beads in tube A are smaller than the beads in tube B. Water was placed in tube A until the pore spaces were filled. The drain valve was then opened, and the amount of time for the water to drain from the tube was recorded. The amount of water that remained around the beads was then calculated and recorded. Data table 1 shows the measurements recorded using tube A.



water required to fill pore spaces	124 mL
time required for draining	2.1 sec
water that remained around the beads after draining	36 mL

✓ Review: Groundwater

If the same procedure was followed with tube B, which data table shows the measurements most likely recorded?

Data Table 2: Tube B	
water required to fill pore spaces	124 mL
time required for draining	1.4 sec
water that remained around the beads after draining	26 mL

(1)

Data Table 2: Tube B	
water required to fill pore spaces	124 mL
time required for draining	3.2 sec
water that remained around the beads after draining	36 mL

(3)

Data Table 2: Tube B	
water required to fill pore spaces	168 mL
time required for draining	3.2 sec
water that remained around the beads after draining	46 mL

(2)

Data Table 2: Tube B	
water required to fill pore spaces	168 mL
time required for draining	1.4 sec
water that remained around the beads after draining	36 mL

(4)