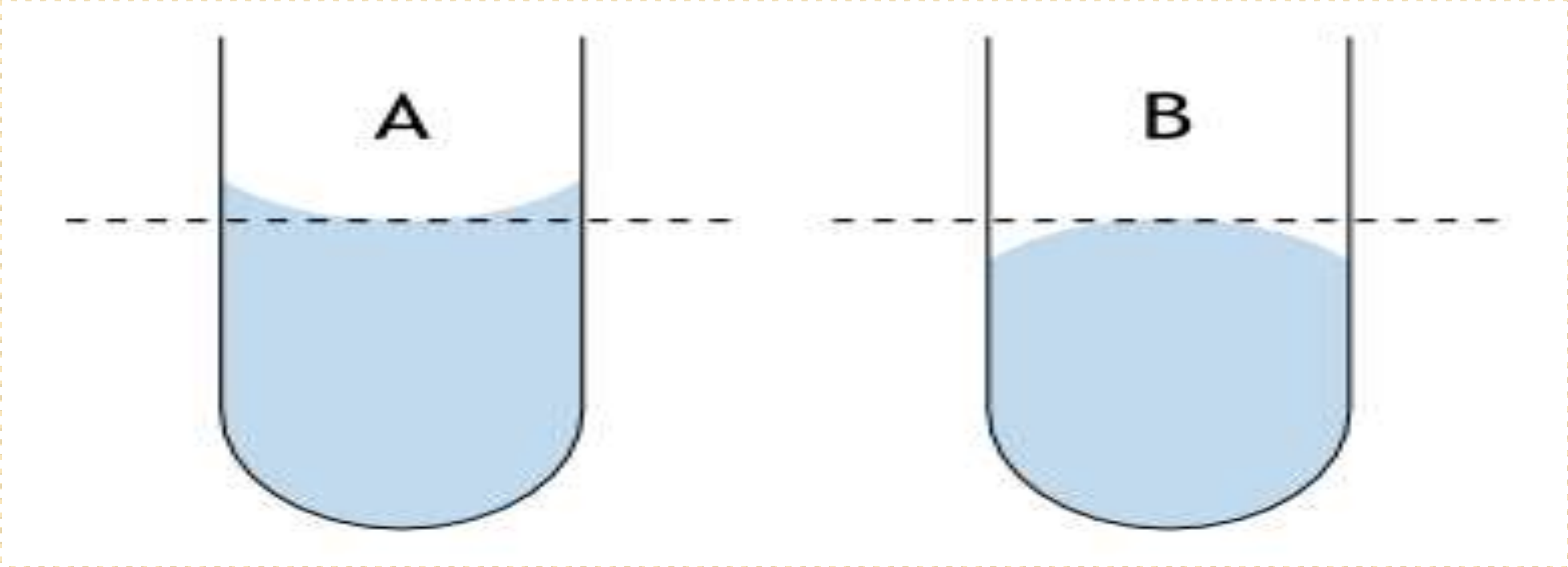
Why the surface of water in a measuring cylinder is curved?

That is called a meniscus.

It comes from the Greek word for “crescent”.

It is a curve in the surface of a molecular substance and is produced in response to the surface of the container or another object.

Meniscus

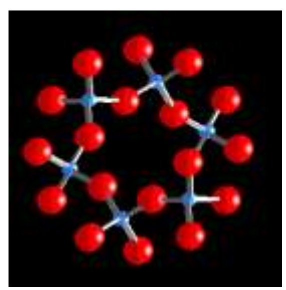


It can be either concave or convex.

A) A concave meniscus.

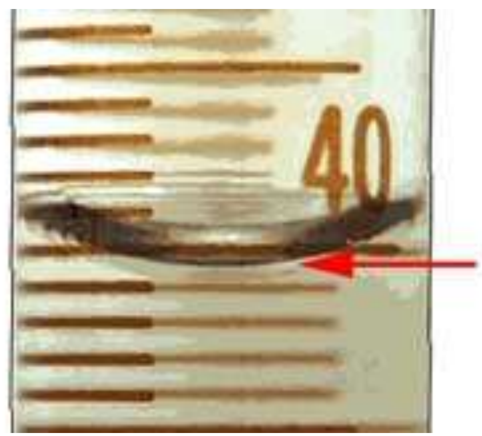
B) A convex meniscus.

- A convex meniscus occurs when the molecules have a stronger attraction to each other than to the container.

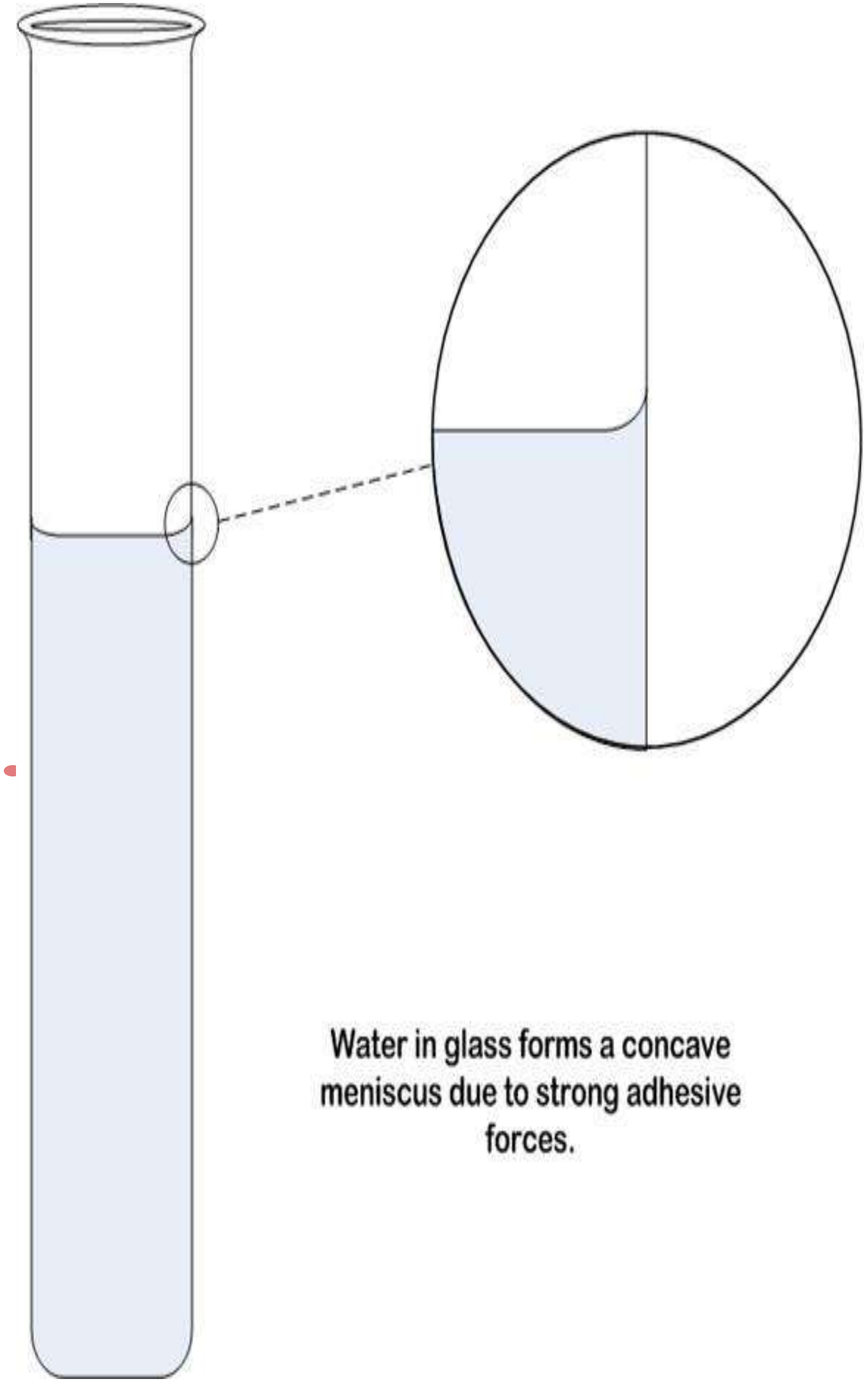


- This may be seen between mercury and glass in barometers.

- A concave meniscus occurs when the molecules of the liquid attract those of the container.

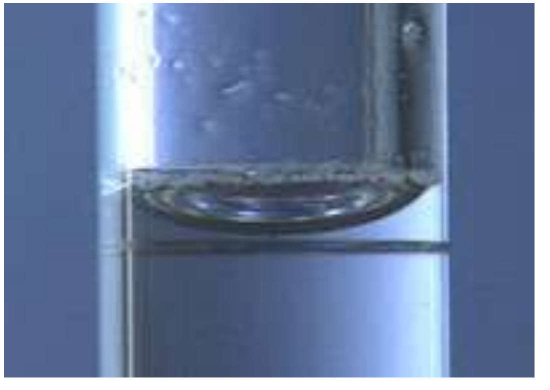


- This can be seen between water and an unfilled glass.

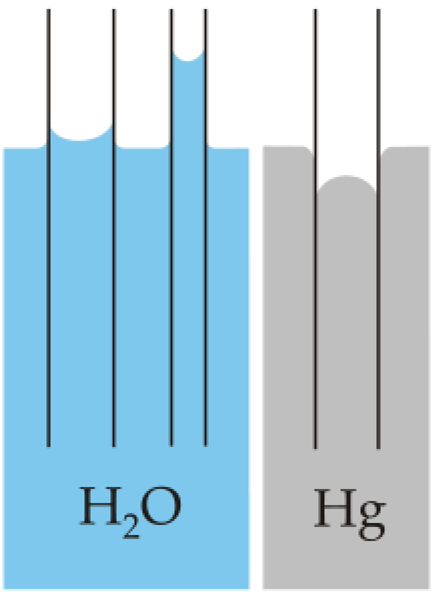


Water in glass forms a concave meniscus due to strong adhesive forces.

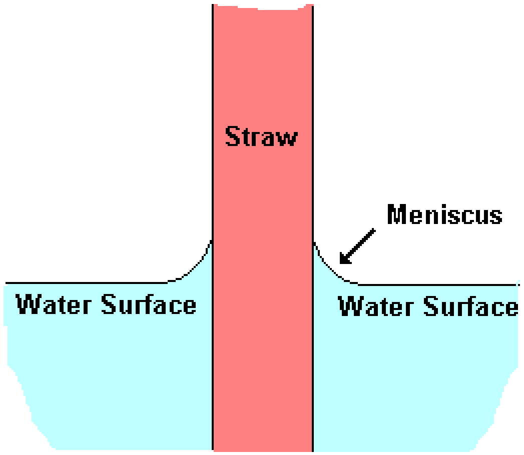
- ✓ Capillary action acts on concave menisci to pull the liquid up, increasing the amount of energetically favorable contact area between liquid and container.



- ✓Capillary action acts on convex menisci to pull the liquid down, reducing the amount of contact area.



- This is an example that shows how a meniscus can rise up instead of going down.



Surface tension is measured as the energy required to increase the surface area of a liquid by a unit of area. The surface tension of a liquid results from an imbalance of intermolecular attractive forces, the ***cohesive forces*** between molecules

A molecule in the bulk liquid experiences cohesive forces with other molecules in all directions

A molecule at the surface of a liquid experiences only net inward cohesive forces

cohesive forces between molecules of a liquid are stronger than the adhesive forces between the molecules of a liquid and those of the container

Convex Meniscus

Cohesive forces between molecules of a liquid is weaker than the adhesive forces between the molecules of a liquid and those of the container

Concave Meniscus

- Surface Tension

- arises due to the cohesive forces in the liquid

- minimize the surface area of the liquid, preferring a spherical shape

Adhesion between the liquid and the container

also known as wetting

encourages as much liquid as possible to be in contact with the container

A meniscus starts to form

decreased surface between the liquid and the container and increased surface between the container and the gas by the same amount

determines whether the meniscus is convex or concave is whether the gas-container surface or the liquid-container surface is more costly

The units of the cost is known as free energy. The more things lower their free energy when they are in contact, the more they stick together

Meniscus

(Concave/Convex)

Mercury

- It has very small adhesive forces with most container materials, and strong cohesive forces. Little drops of mercury will form into almost spheres when spilled on most surfaces (gravity will bend them out of shape)

Water and other liquids

- Water is made up of electrically polar molecules

Water

Glass is electrically “polarizable”, and attracts charged objects, so water sticks to glass.

Some containers may attract water molecules much less. Many kinds of plastics, called "hydrophobic", (e.g. teflon) have very small adhesive forces with water , and if you make a container out of these you will get a convex meniscus with water, too.

Putting water in a plastic beaker

No Meniscus Curve

Adhesion is responsible for a meniscus and this has to do in part with water's fairly high surface tension. Water molecules are attracted to the molecules in the wall of the glass beaker. They'll travel up the glass as far as water's cohesive forces will allow them. Cohesion is an intermolecular attraction between like molecules. Water molecules just aren't attracted to plastic molecules as much as glass molecules.

Transportation of groundwater from wet soil to dry soil

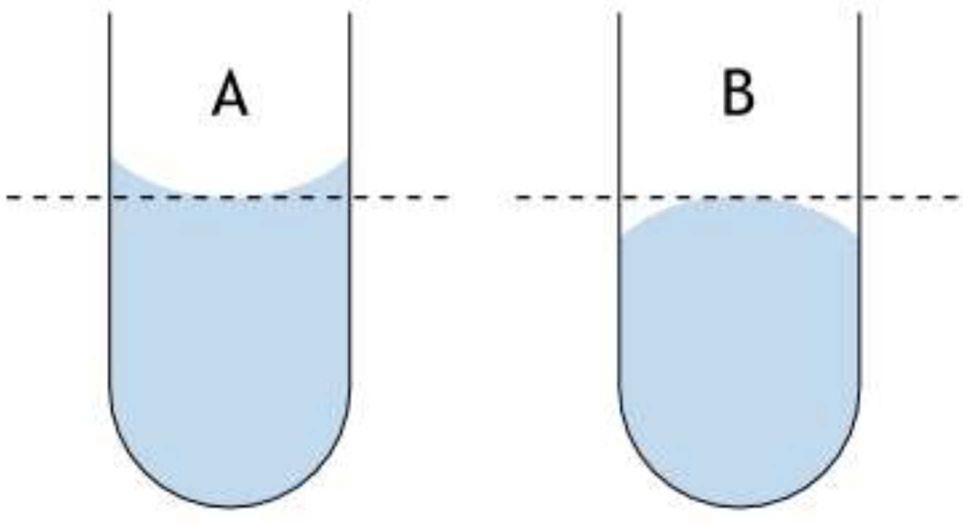
Dry Soil

Wet soil

<u>Why is this so?</u>

Capillary action is responsible for moving groundwater from wet areas of the soil to dry areas. Differences in soil potential (Ψ_m) drive capillary action in soil.

How to read a meniscus?



Measure the meniscus at eye level from the center of the meniscus. In the case of water and most liquids, the meniscus is concave. Mercury produces a convex meniscus.

Sources: www.google.com
www.scirus.com
www.yahoo.com

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