

The Movement of Water



The Hydrosphere -

All of the Earth's waters.

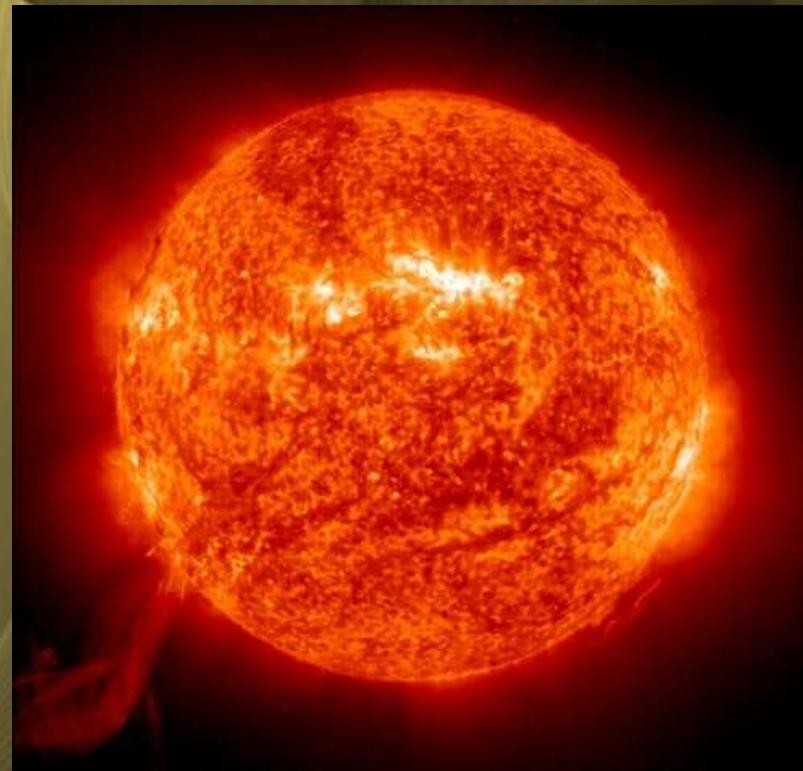


The Hydrologic (Water) Cycle -

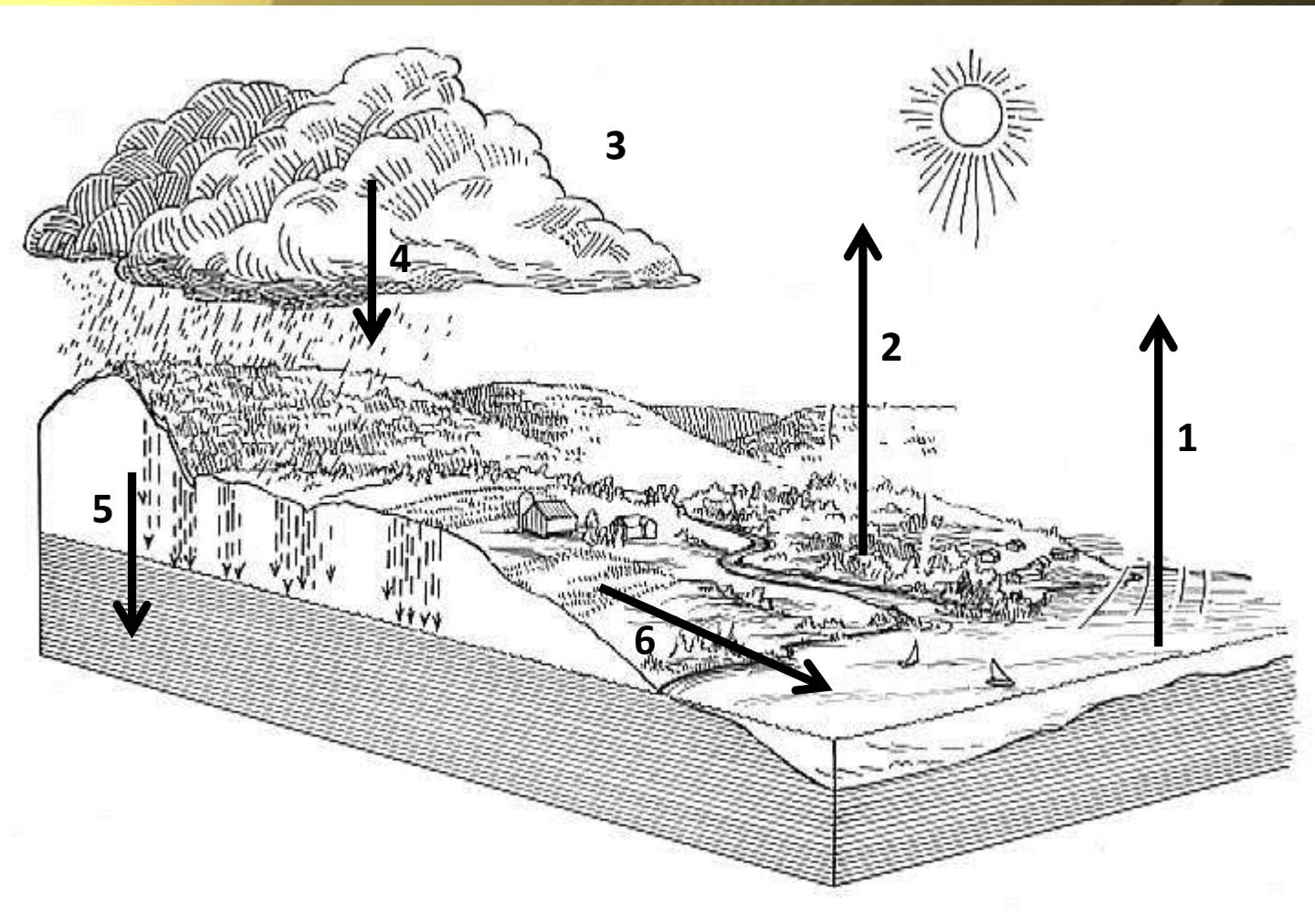
The way water moves and is cleaned on Earth.

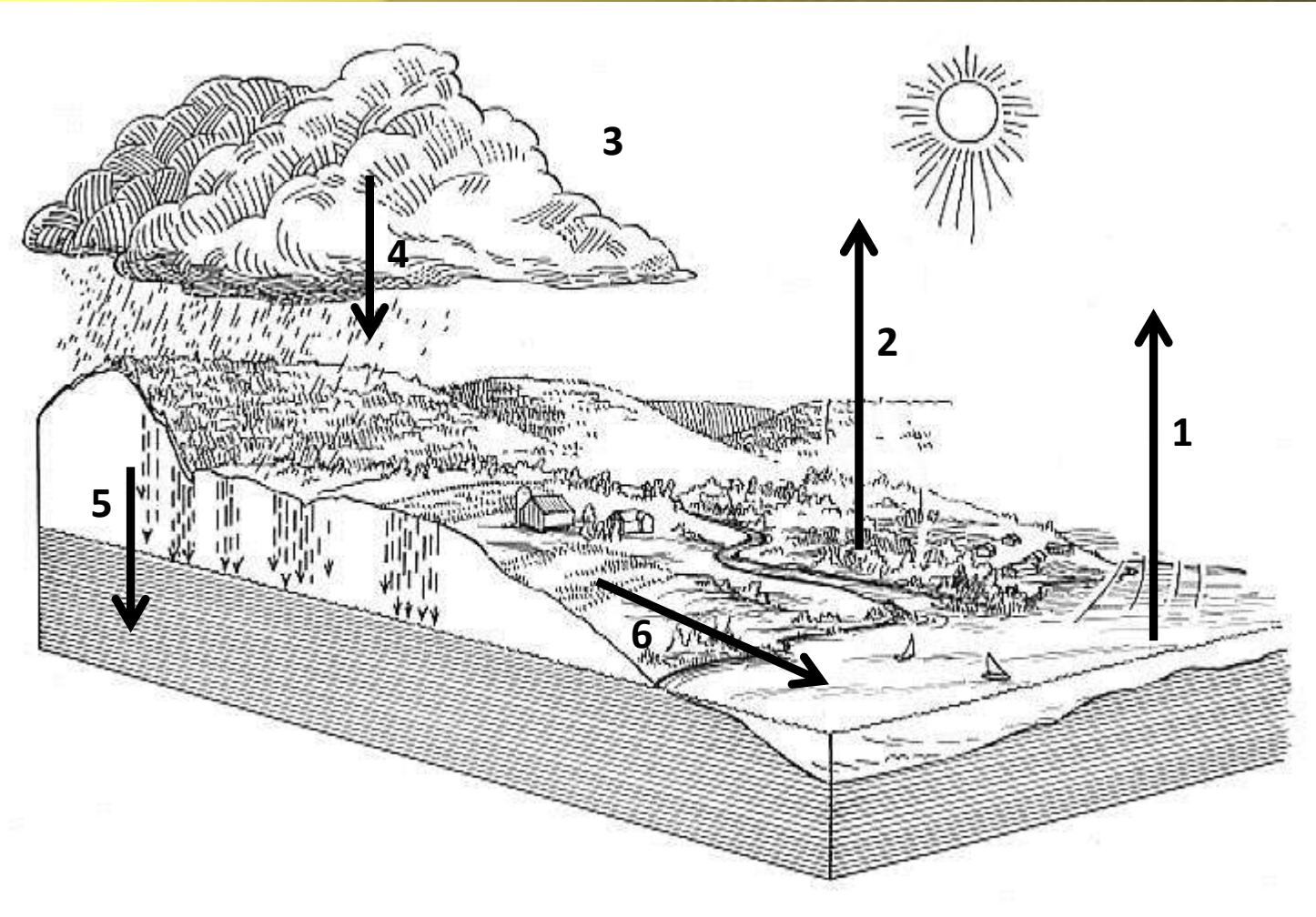
What provides the energy that drives the Hydrologic Cycle?

The sun

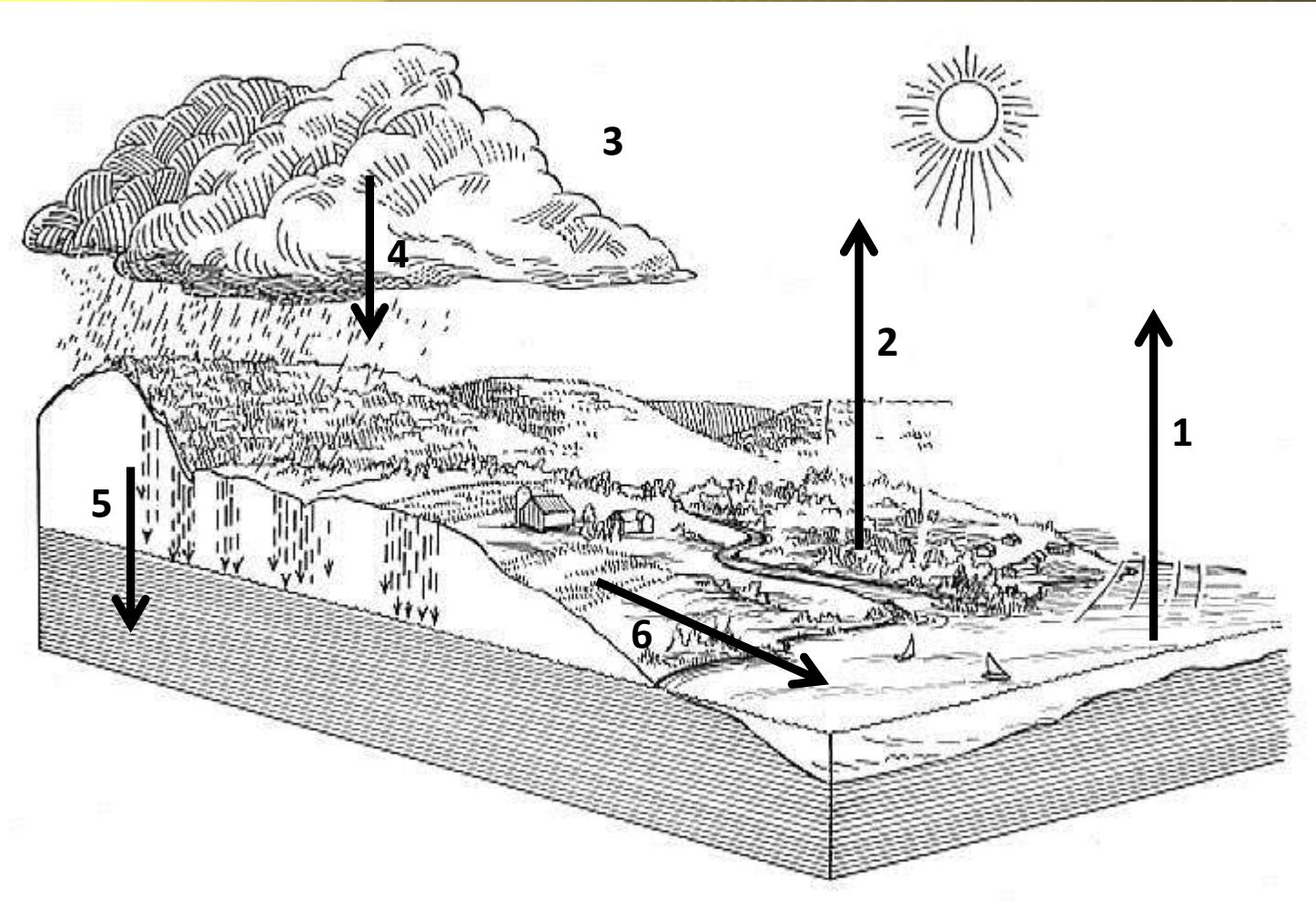


The Hydrologic Cycle

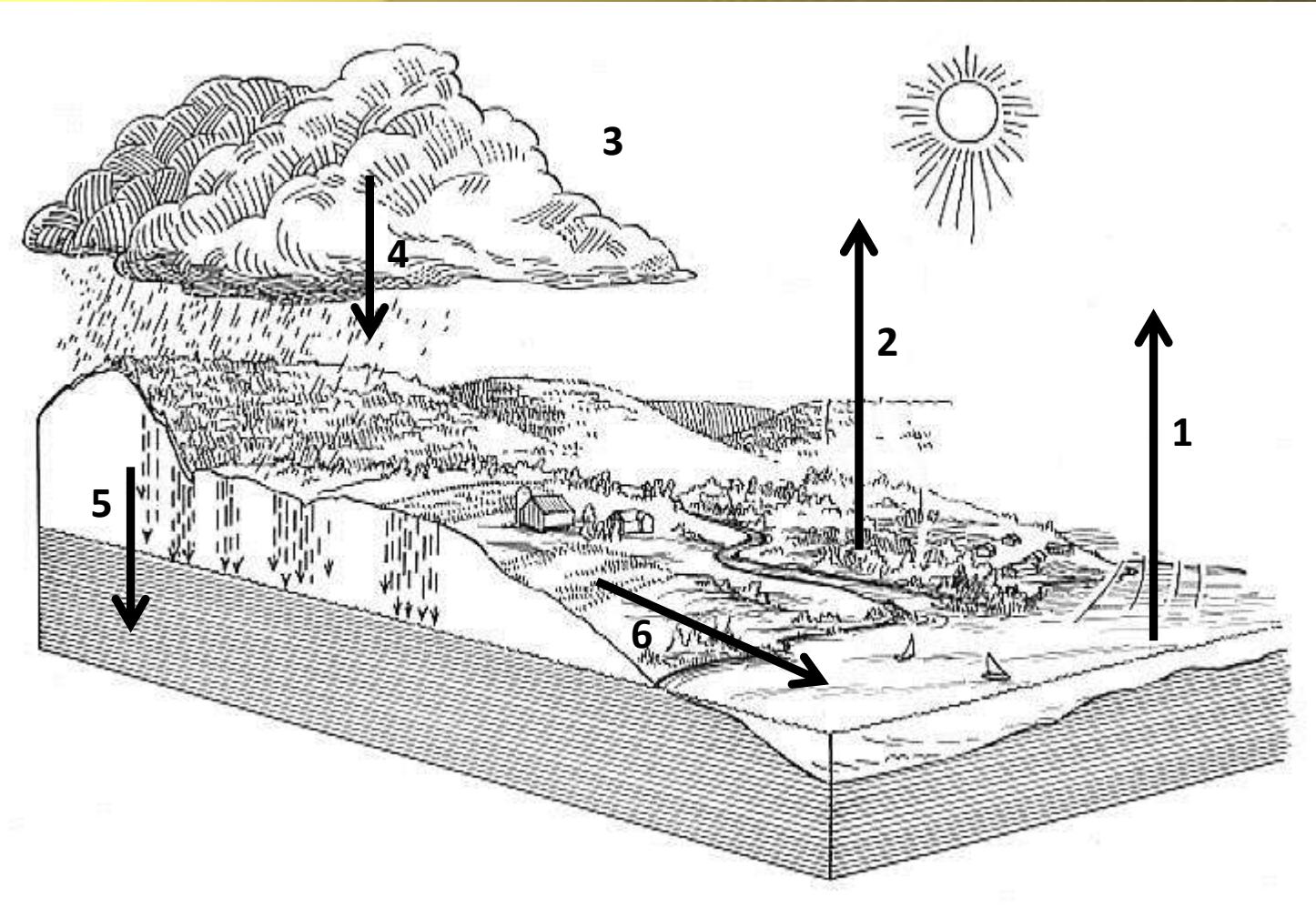




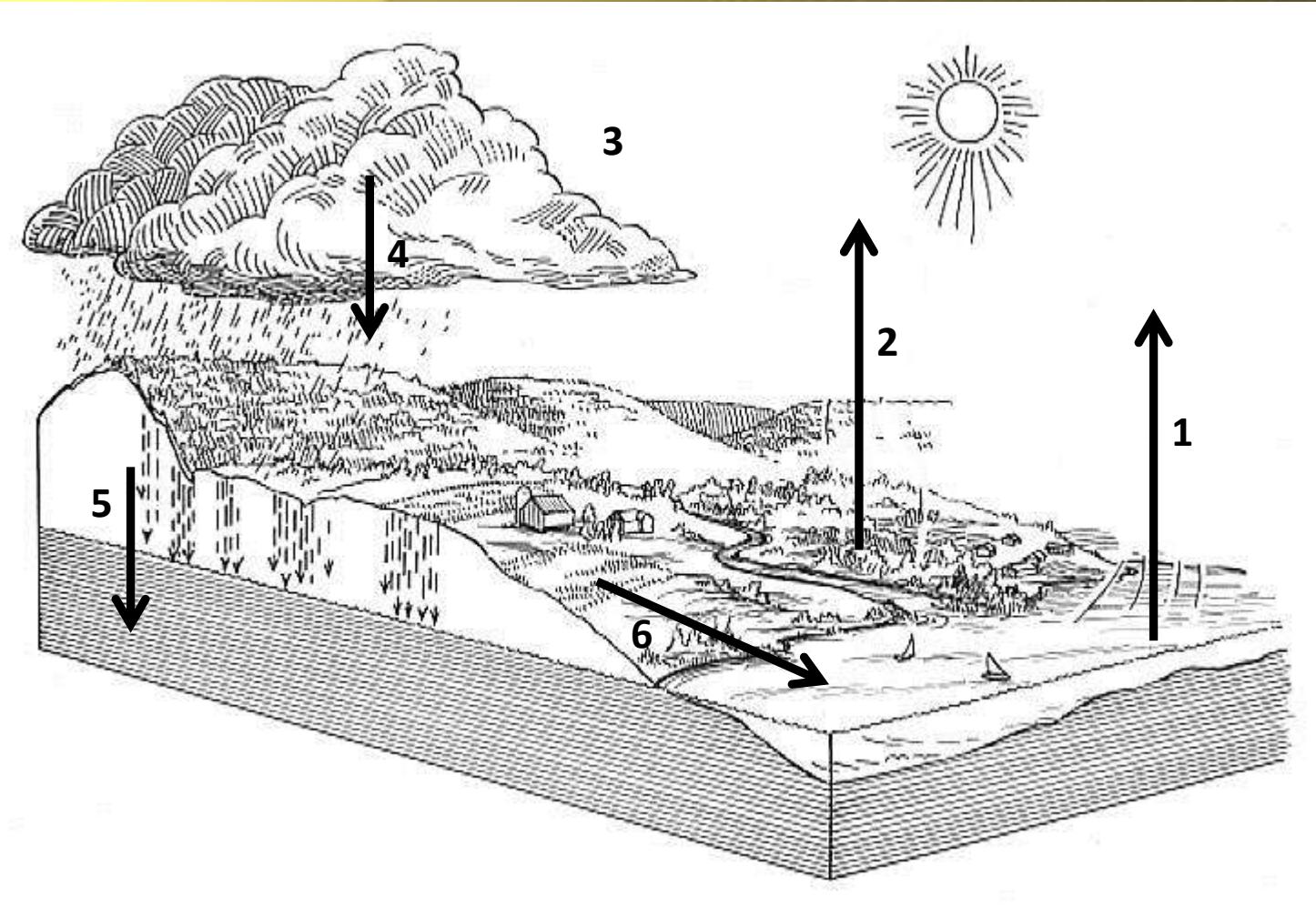
1. **Evaporation** – when liquid water turns into a gas. When this happens, water absorbs (sucks up) heat energy.



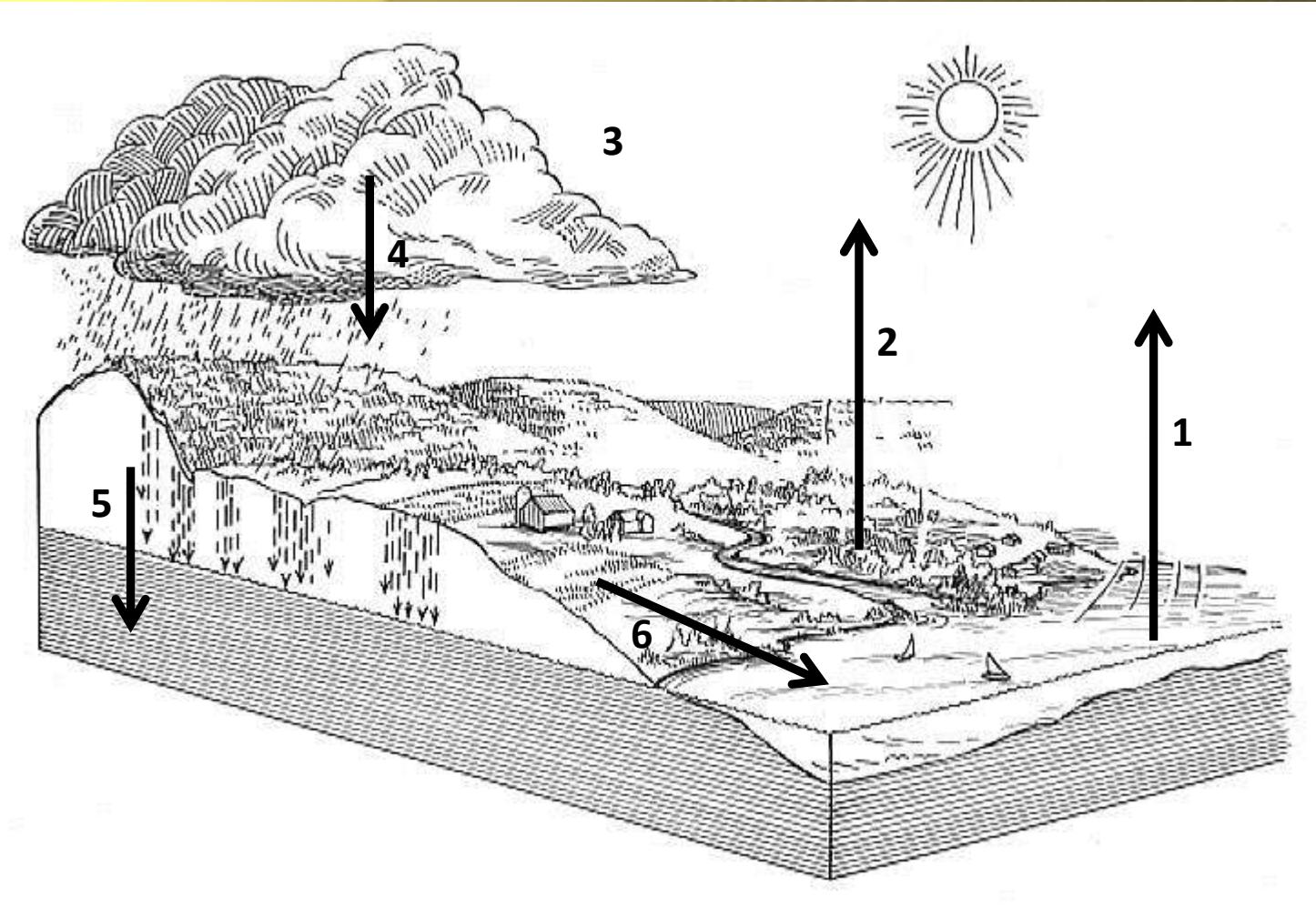
2. Transpiration – when water is evaporated through plants. This happens in the stomata of a plant.



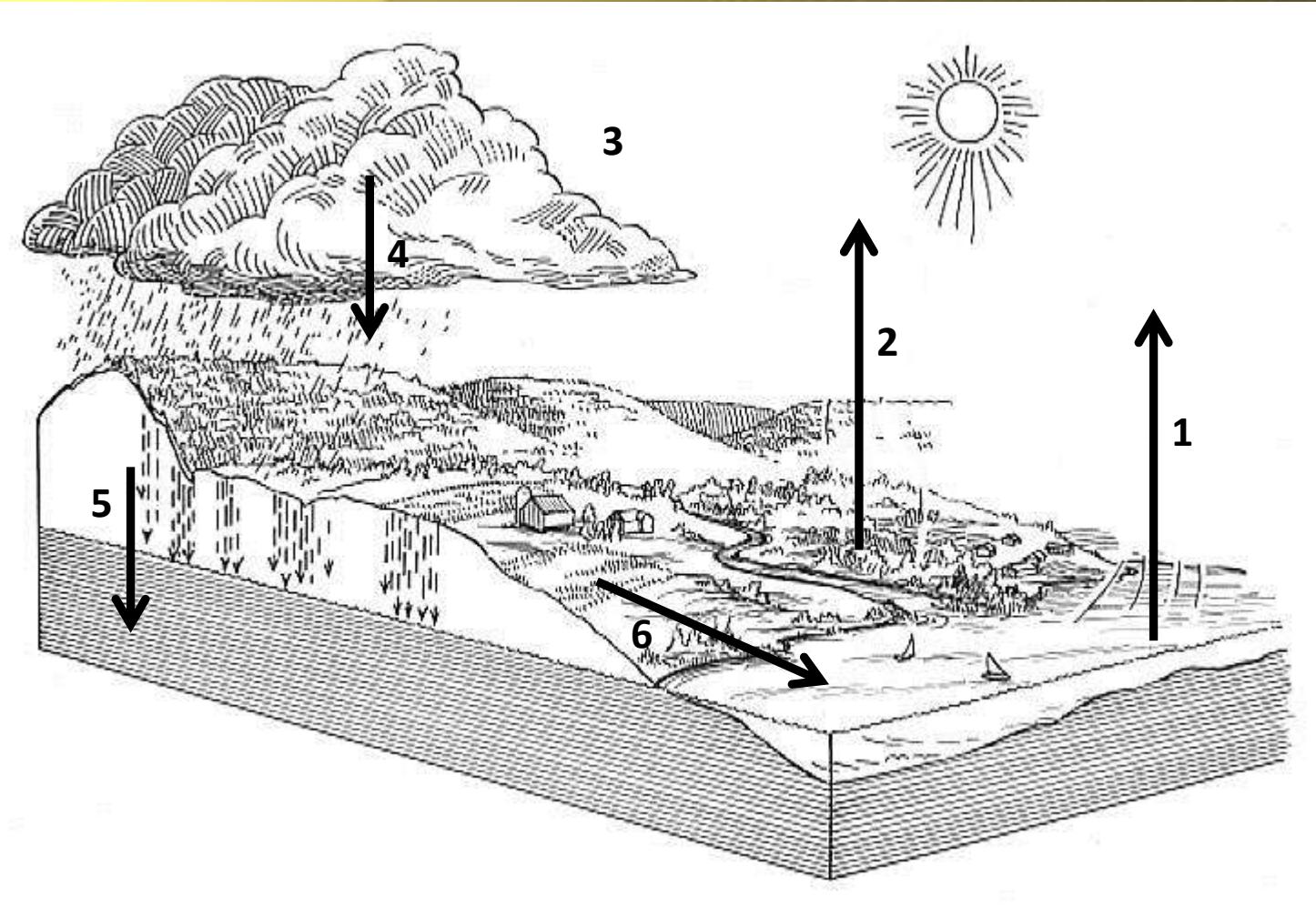
3. Condensation – when water changes from a gas to a liquid. When this happens, water releases heat energy. This also makes clouds.



4. Precipitation – when liquid or solid water falls back to the earth.



5. Infiltration – when water seeps through the soil into the groundwater.



6. Runoff – when water from the surface runs back into the ocean, lakes and rivers.

Evaporation

You get more evaporation when...

the temperature outside is warmer.



There's more evaporation in the summer than the winter.



Two things happen when water evaporates:

1. It absorbs heat energy.

Whatever water is on when it evaporates gets cooler.

Why does sweating cool you off?

As the water evaporates off of your skin, it absorbs heat energy from your body.

Fans don't really make the air cooler. They just increase how fast water evaporates off of your skin.



Super humid or muggy days only feel really hot because the air is so full of water that it cannot hold any more. So, your sweat doesn't evaporate.



Two things happen when water evaporates:

- 2. The water drops anything dissolved in it.**

How does evaporation clean water?

Because water cannot hold anything when it evaporates, it drops all of the things dissolved in it.

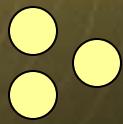
This is how the Hydrologic Cycle cleans the water.



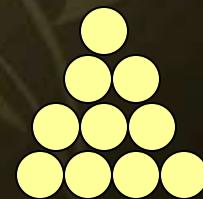
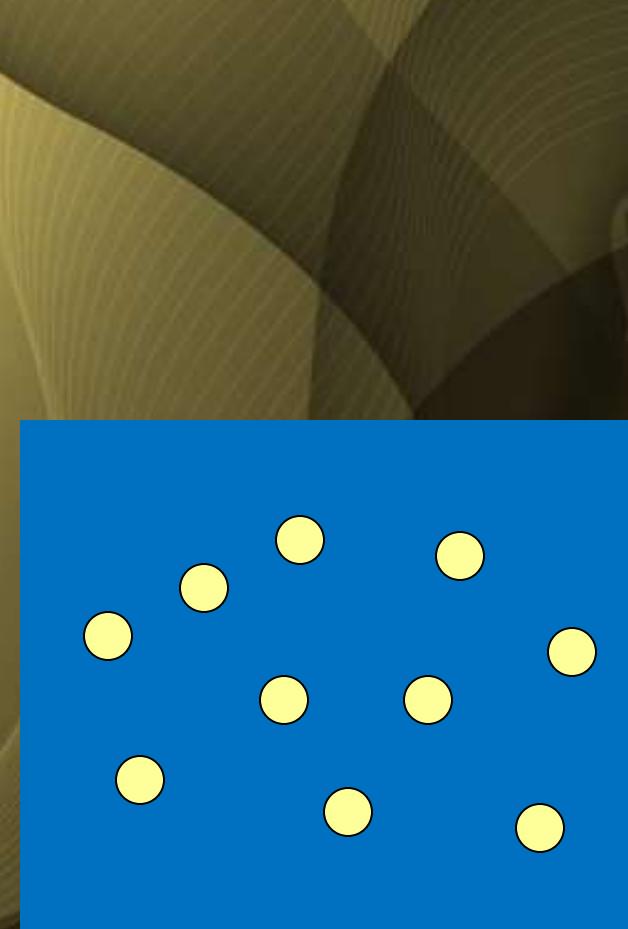
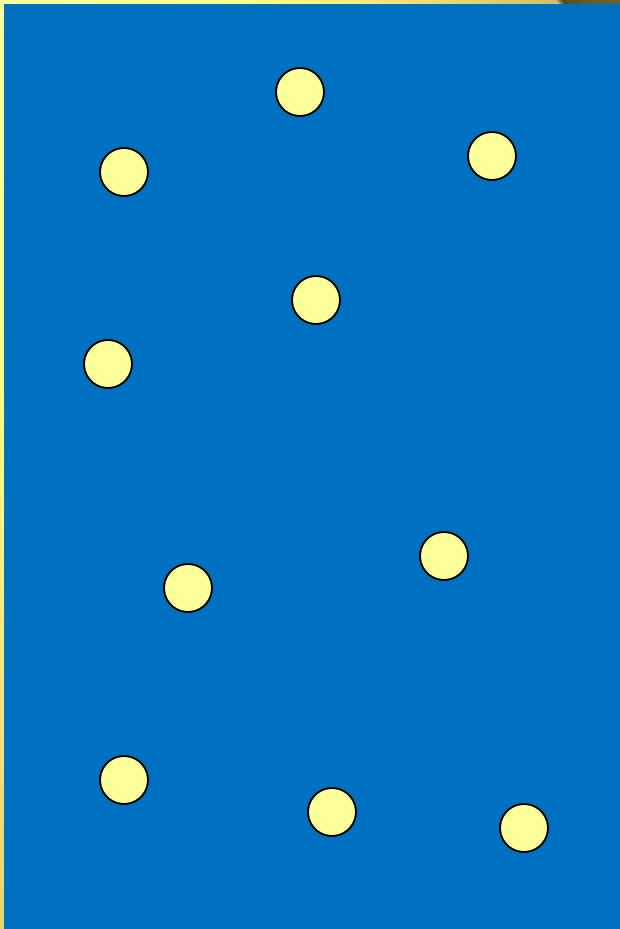


Sewage treatment plants.

water = 

dissolved solids = 

Eventually, all of the water will evaporate, leaving the sun evaporates some of the water but the dissolved solids stay behind. This makes them more concentrated.



Normally, precipitation adds more water and balances evaporation out. This means that, for most bodies of water, the concentration of dissolved solids stays about the same. However if evaporation is greater than precipitation for a long time, this happens...



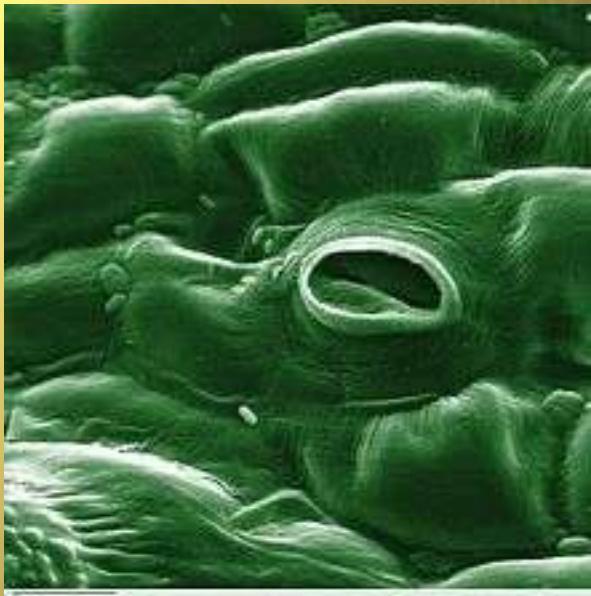
The Dead Sea

Transpiration



Stomata -

A hole in a plant's leaf where water is evaporated from.



Credit: Ming kei College, Hong Kong

Condensation

condensation

When water condenses:

It releases heat energy, making
the air around it warmer.

Why do areas near water have more stable temperatures?

During the day, evaporation absorbs heat energy. At night, condensation releases heat energy.



The Bahamas have an average temperature range of 84°F in the summer and 75°F in the winter.



Death Valley has an average temperature range of 99.5°F in the summer and 47°F in the winter.

**Condensation forms clouds.
What forms when condensation
happens near the surface?**

It makes fog.



Precipitation

Precipitation can be in two states of matter:

Rain (liquid) or snow (solid).

Sleet is a combination of both.



**Even though the Hydrologic Cycle
cleans the water, it's still possible
for the precipitation to get
polluted.**

Acid rain -

Precipitation that becomes polluted and forms a mild acid.

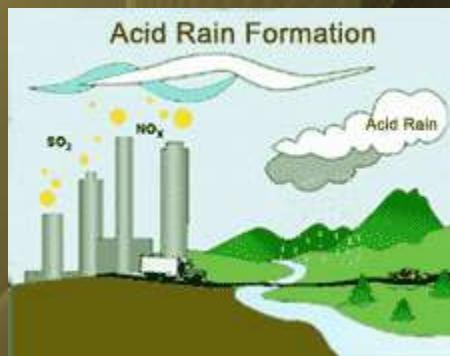


Major cause of acid rain -

When pollution gets into the air
and is absorbed by rain as it falls
to earth.

How do these gasses get into the air?

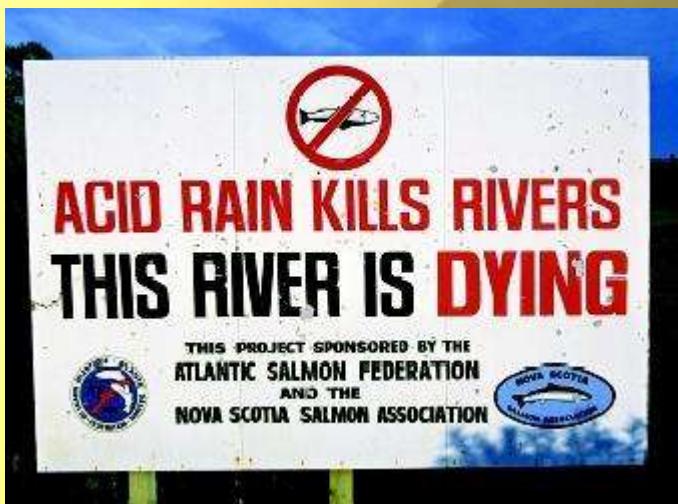
Mostly from burning fossil fuels.
Some occurs naturally from
volcanoes and lightning strikes.





Negative effects of acid rain -

It harms plants and water animals. It decays buildings, statues and other things made from limestone and marble.



Acid Rain Effects on Sculptures



1908

1969

C. Ophardt, c. 2003

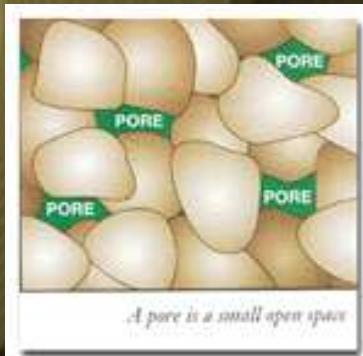
Infiltration

**Two things affect the movement
of water in the ground:**

porosity and permeability

Porosity -

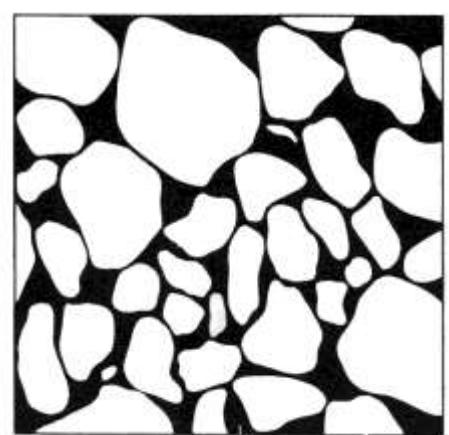
The amount of space between the particles of a material. Or, how many holes it has.



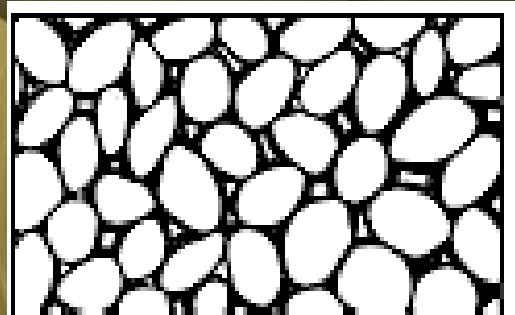
The higher the porosity ...

the more water it can hold.

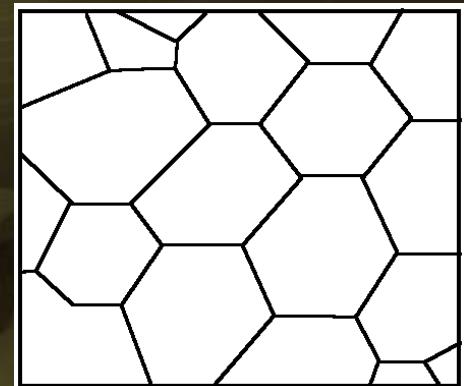
**Gravel has a
high porosity.**



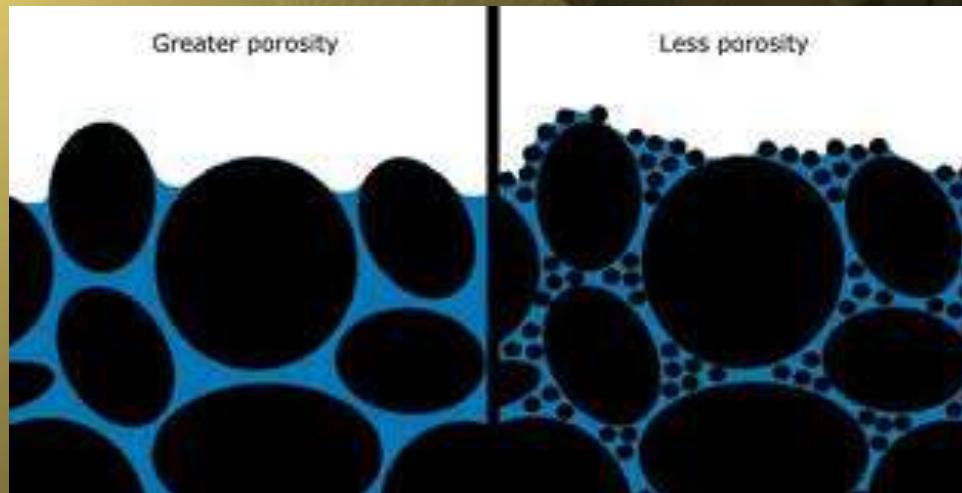
**Sand has a
medium
porosity.**



**Granite has a
low porosity.**

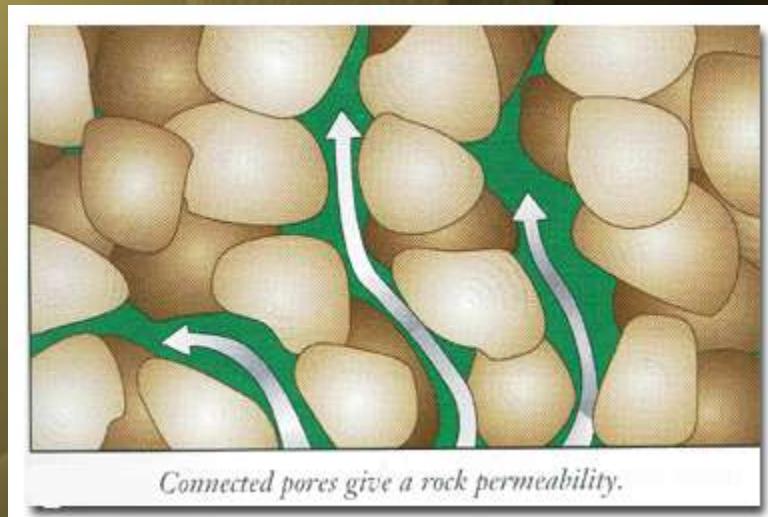


Sometimes small material like sand can fill in the gaps of larger materials like gravel. This reduces the porosity.



Permeability -

How easily water can flow through a material.



The higher the permeability ...

the faster water goes through it.

A material might have lots of holes, but if the holes are not connected, it won't be very permeable.



Styrofoam



Pumice



Visualize It!

- 11 Label Draw an arrow, ↑ (high) or ↓ (low), to indicate the porosity and permeability of each rock sample. One is already completed as an example.

↓ porosity,
↓ permeability



B

_____ porosity,
_____ permeability



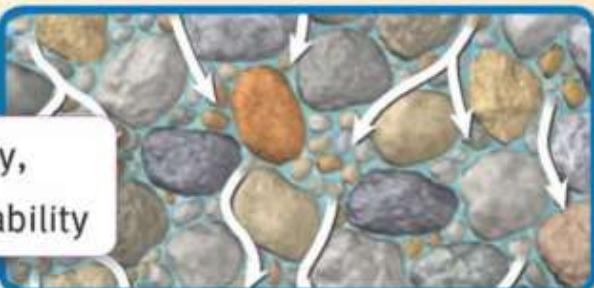
A

_____ porosity,
_____ permeability

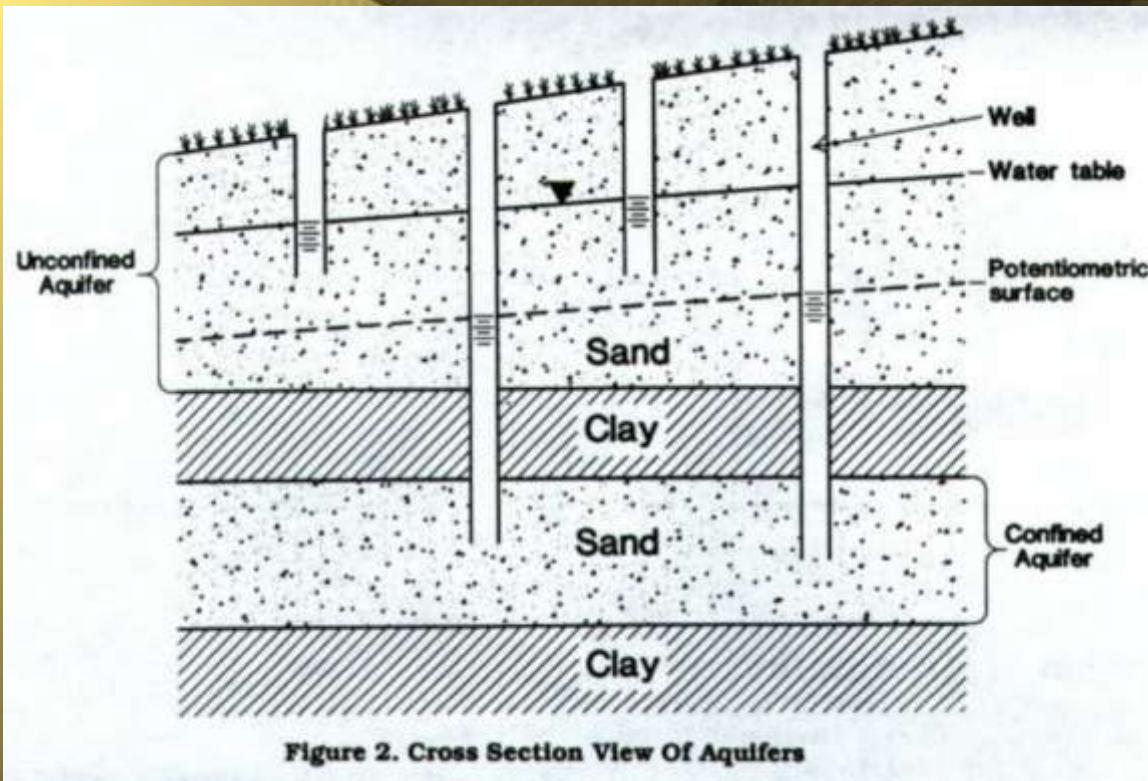


C

_____ porosity,
_____ permeability



An aquifer is an area of underground water. Guess the permeability of the materials. Which has the higher permeability? Lower?



Go through each and decide if it would be able to hold groundwater.

Low porosity, low permeability

Low porosity, high permeability

High porosity, high permeability

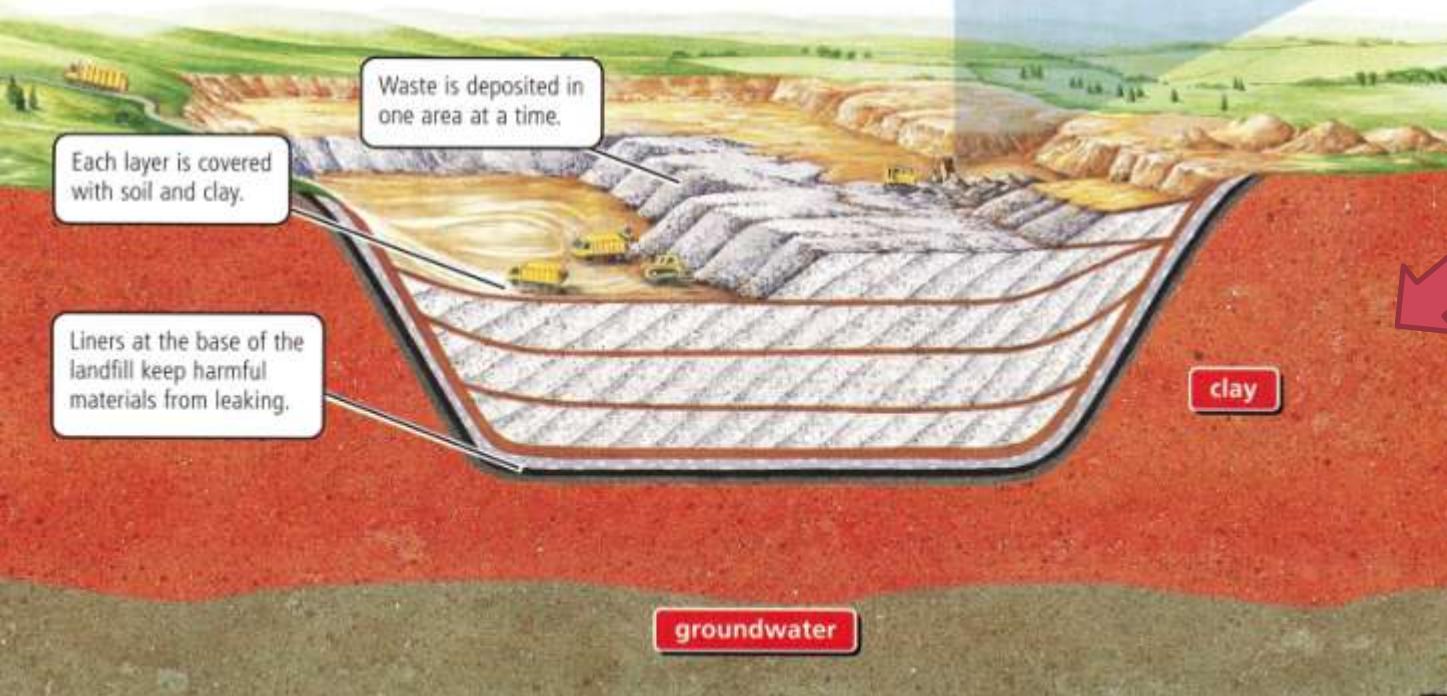
High porosity, low permeability

**Groundwater can become
polluted when:**

**Pollution seeps into the ground.
Rainwater carries it deeper into
the ground. (Infiltration)**

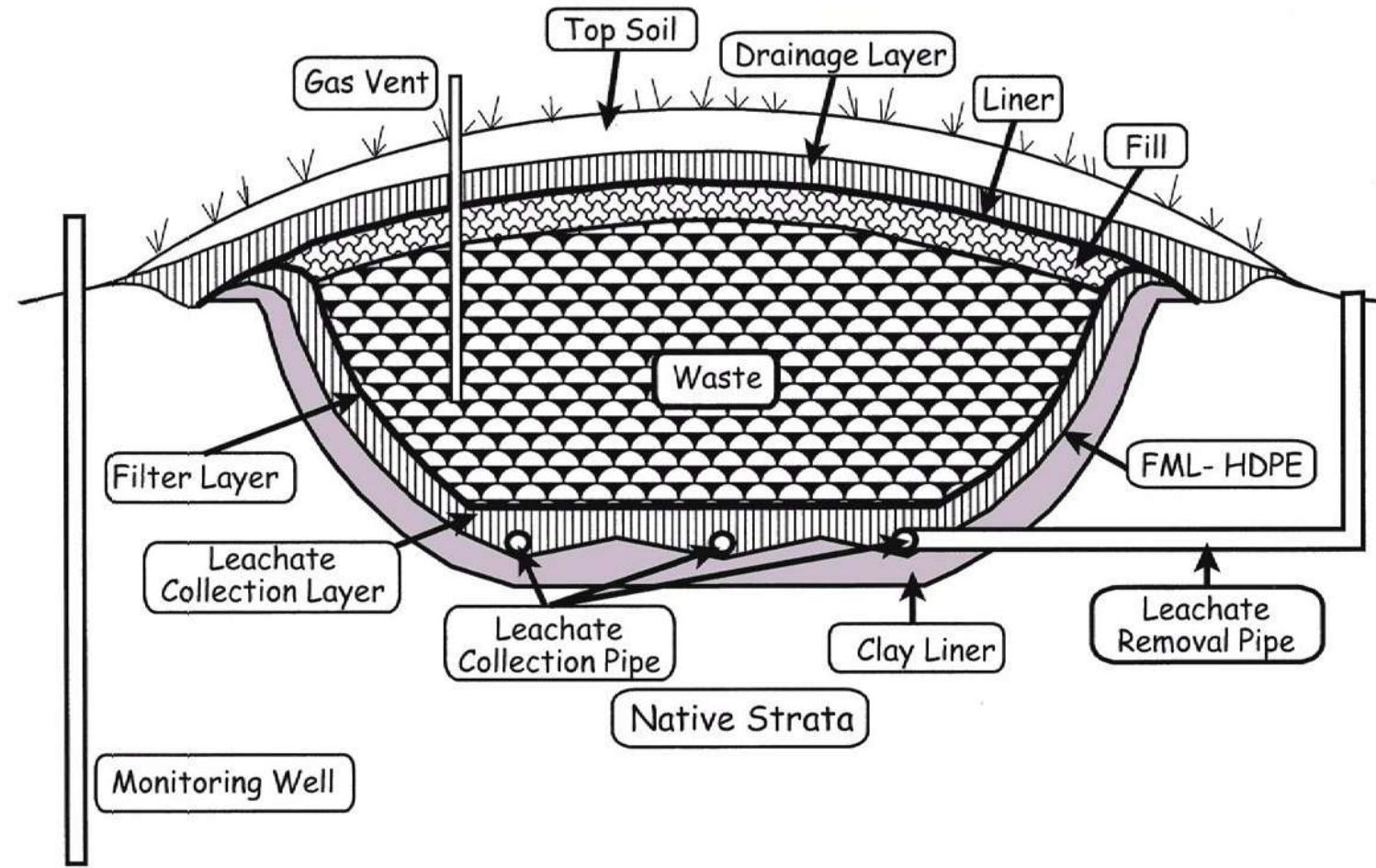


Constructing a Landfill



Clay has a low permeability.

Note the liner at the bottom. Why cover each layer of soil with clay?



Discuss the permeability of both the drainage layer and clay liner.

Runoff



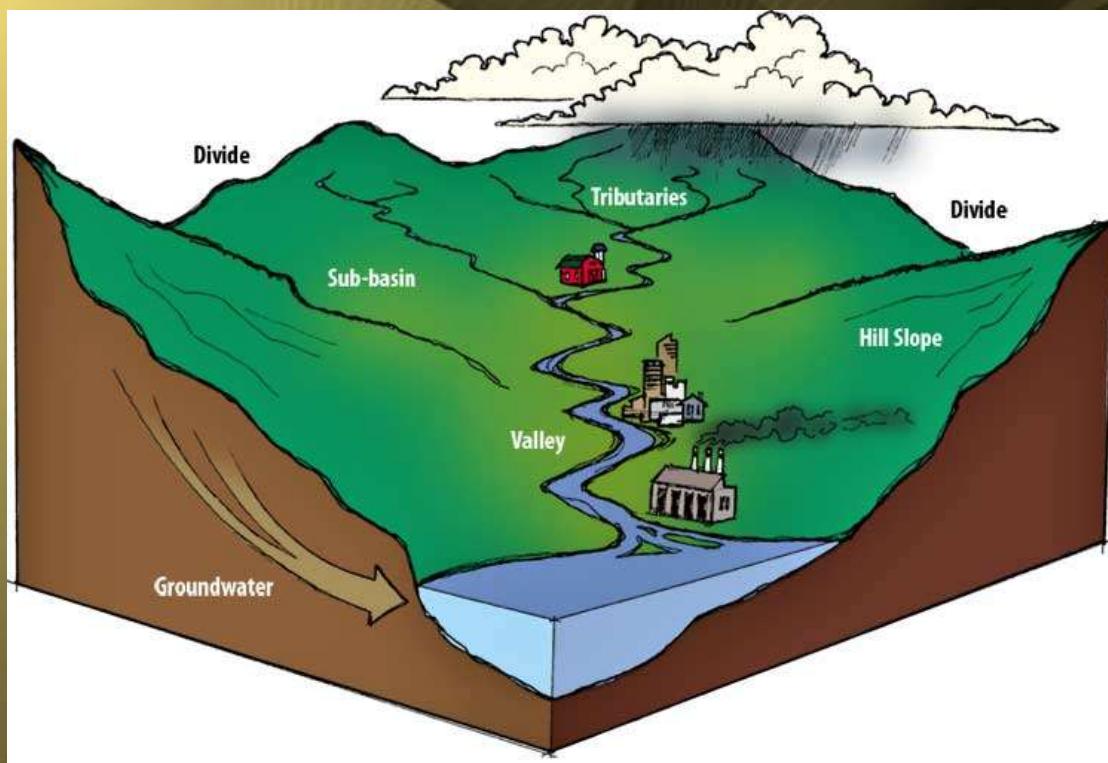
How can runoff cause pollution in the water?

When the pollution or fertilizer is picked up by runoff and dumped into the water.



Watershed -

An area of land that all drains to the same location.



You can identify the drainage patterns of watersheds by looking at aerial photographs.

