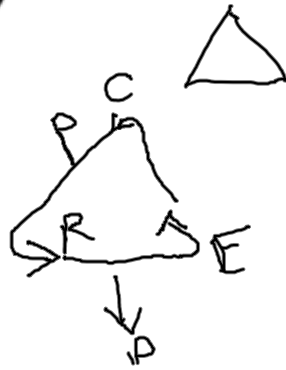


Earth Hydrosphere

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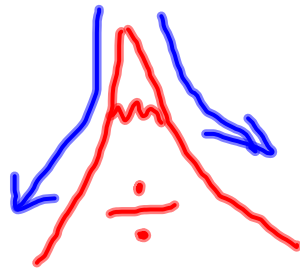
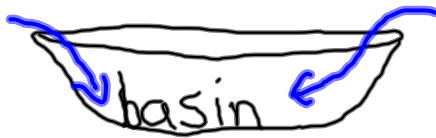
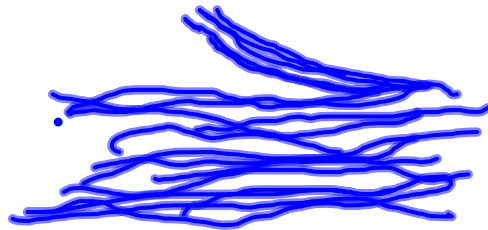
The water cycle (hydrologic cycle) is driven by energy from the sun, which causes evaporation.



I. The Active River <http://ga.water.usgs.gov/edu/watercycle.html>

- A. **The Water Cycle** is the continuous movement of water from the ocean to the atmosphere to the land (and back to the ocean) and has 3 basic parts:
- Evaporation is the process of water changing from a liquid to a gas (water vapor)
 - transpiration is the evaporation of water from plant leaves and stems (approx. 10% of all evaporating water)
 - sublimation happens when a solid changes directly into a gas (snow or ice into water vapor).
 - Condensation is the process of water vapor changing back into a liquid.
 - Precipitation is water falling back to Earth from the atmosphere in rain, snow, sleet, or hail.
 - Additional steps in the water cycle are:*
 - Runoff is precipitation that flows over land into rivers and streams, eventually to lakes and oceans.
 - Percolation is the downward movement of water through soil pores and other spaces due to gravity.

B. River Systems, Erosion, and Stages of Rivers



1. River System terminology:

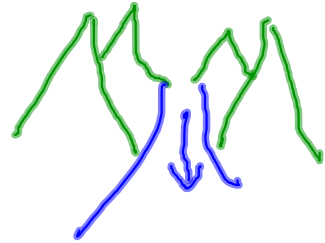
- A tributary is a smaller stream that flows into a larger stream, river, or lake.
- An area of land that is drained by a water system is a watershed or *drainage basin*.
- The boundary between drainage areas with streams that flow in opposite directions is a divide.
- A channel is the path that a stream or river follows.

2. **Erosion** the process by which wind, water, ice and gravity transport soil and sediment from one location to another

- The amount of energy that a river has for erosion depends on:
 - the river's gradient, or change in elevation
 - how much water it carries in a given amount of time, or discharge.

- The materials carried by a stream or river is called load.

b. The materials carried by a stream or river is called load.



A **flood plain** is an area along a river that forms from sediments deposited when a river overflows its banks

3. A **river's stage** indicates its general features, not the river's actual age.

a. **Youthful rivers** have a steep gradient and erode channels that are deeper rather than wider. They often have many rapids and waterfalls, and few tributaries.

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b. **mature rivers** erode channels that are wider than deeper; they have few falls or rapids and are fed by many tributaries.

c. A river with a low gradient and little erosive energy is an **old river**.

i. Instead of widening and deepening its banks, the river deposits rock and soil in and along its channel.

ii. Old rivers have wide, flat flood plains or low valleys, and many bends.

d. rejuvenated rivers happen where land is raised by tectonic activity (movement of the Earth's crust) and features "step-like" formations called terraces.

C. **Stream and River Deposits** (Section 2)

1. deposition is the process in which load (material) is dropped.

2. A fan-shaped mass of material at a river's mouth is a delta.

11. Our water resources (Section 3 and 4)

A. Underground Water – vocabulary



1. The upper surface of underground water, which forms the boundary between the zone of aeration and the zone of saturation is called the water table.

2. A rock or sediment layer that stores groundwater and allows the flow of groundwater is called an aquifer.

3. Soil types with more pore space allow water to flow through more quickly; this ability to let fluids pass through its open spaces is called permeability.

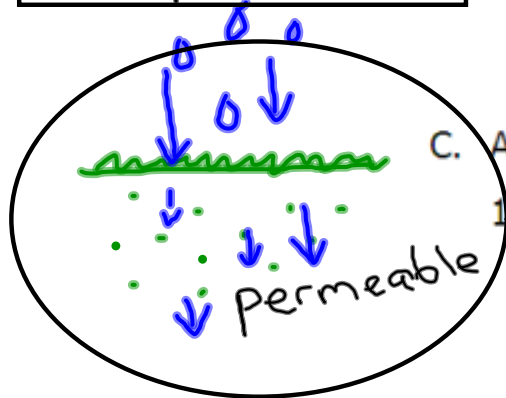
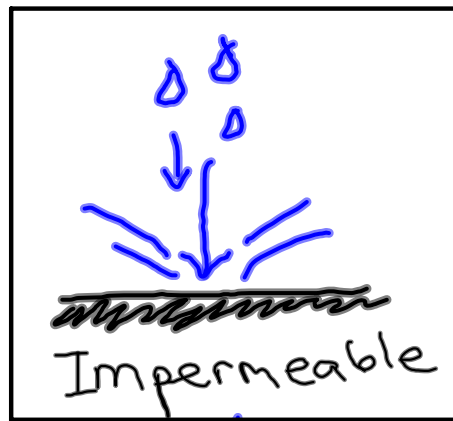
4. The percentage of open spaces in the total volume of rock or sediment is porosity.

More pore space in the soil means the water will be absorbed more quickly, causing less runoff

B. Groundwater is located within the rocks *below* the Earth's surface. After precipitation occurs, water continues to move slowly downward through pores, or spaces in the rocks and soil. This downward movement is called percolation (** see water cycle).

A rock or sediment layer that stores groundwater and allows the flow of groundwater is an **AQUIFER**

Seasons, soil permeability, water well use, and impermeable rock affect the water table.



movement is called percolation (** see water cycle).

1. Water percolates down through the soil until it reaches a rock that stops the flow of water, which is called an impermeable layer; when the downward movement stops, it begins to fill all of the pores in the soil above with water (zone of saturation).
2. Areas of soil that are **not** soaked (or saturated) with water are drier...the pores in the rocks and soil are filled mostly with air. This upper zone is called the zone of aeration.

C. Aquifers

1. Permeable earth and rock conditions, such as sandstone, limestone, or layers of sand or gravel make the best aquifers.
 - a. The largest aquifer in the United States is the Ogallala, which lies beneath parts of 8 states.
 - b. An area in which water travels downward to become part of an aquifer is a recharge zone.

The Zone of Aeration has more air than water in the pore space between soil particles

The Zone of Saturation is completely soaked with water - all pore spaces are filled with water

artesian springs (also called artesian wells) flow because pressure pushes water through a hole in the cap rock

2. Types of Aquifers:

- a. *Confined aquifers* form between two layers of impermeable rock—the top layer is called a cap rock. If the confined aquifer is between sloping layers of impermeable rock, it may form an **artesian spring**, or spring whose water flows from a crack in the cap rock over the aquifer
- b. *Unconfined aquifers* have no cap rock. The top of an unconfined aquifer is the water table.

3. In order to be useful, a **well** must be drilled deep below the top of the water table.

If there are too many wells in the same area and/or if water is removed too rapidly the water table will drop.

- 4. Sometimes underground *caverns* form when limestone is dissolved by carbonic acid (a weak acid formed when water combines with CO₂).
 - a. Stalactites are “icicles of rock” that hang down.
 - b. Stalagmites project **up** from the floor of a cavern.

WATER TABLES may drop if there is a drought or if too much water is taken from the groundwater

- c. If the water table falls below the level of a cave, and the cave's roof is not strong enough to support itself, a sink
hole may form, leaving a circular depression.

III. Using Water Wisely

**Most fresh water
on earth is
FROZEN**

**Living cells
contain
cytoplasm,
which is 80
percent water**

**97% of all water on
the Earth is salt
water and cannot be
used for drinking
unless the salt is
removed.**

- A. Water: the most valuable liquid in the world.
1. The human body is made up of approximately 67 percent of water.
 - a. Although we could live for weeks without food, we would last only days without water.
 - b. Water is necessary for cellular activity; the cytoplasm of a cell is 80 percent water.
 2. Only 3 percent of Earth's water is drinkable (or fresh water), and 75% of all freshwater on the earth is frozen.
- B. Dangers to Our Water Supply
1. Point - source pollution is pollution that comes from a specific site.

C. **Properties of Water** and Water Quality

1. Health of a water system depends on the quality of the water.
 - a. Just as we breath oxygen as a gas in the air, **fish and organisms that live in water need dissolved oxygen (or DO)**, which can be affected by pollution and temperature changes.
 - b. **High levels of nitrates, which are compounds of nitrogen and oxygen can be harmful to organisms.**
 - c. Alkalinity, or the ability to neutralize acid, is important to a healthy water system.
2. **Waste-water treatment plants**, also called sewage treatment plants are facilities that clean the waste materials found in water that comes from sewers or drains
 - a. In *primary treatment*, dirty water is passed through a large screen to remove solid objects.

- b. In secondary treatment the water is sent to an aeration tank where bacteria feed on the wastes.
 - c. Often a chemical such as chlorine is used to disinfect water.
 - d. Septic tanks are also used to separate solid wastes from liquids; bacteria breaks down the solid waste.
3. **We must protect our water by making smart decisions about water use, recycling, and careful chemical use and disposal.**