Name: _____ Date: _____ Env. Science Period: _____

Chapter 11: Water Student Guided Notes

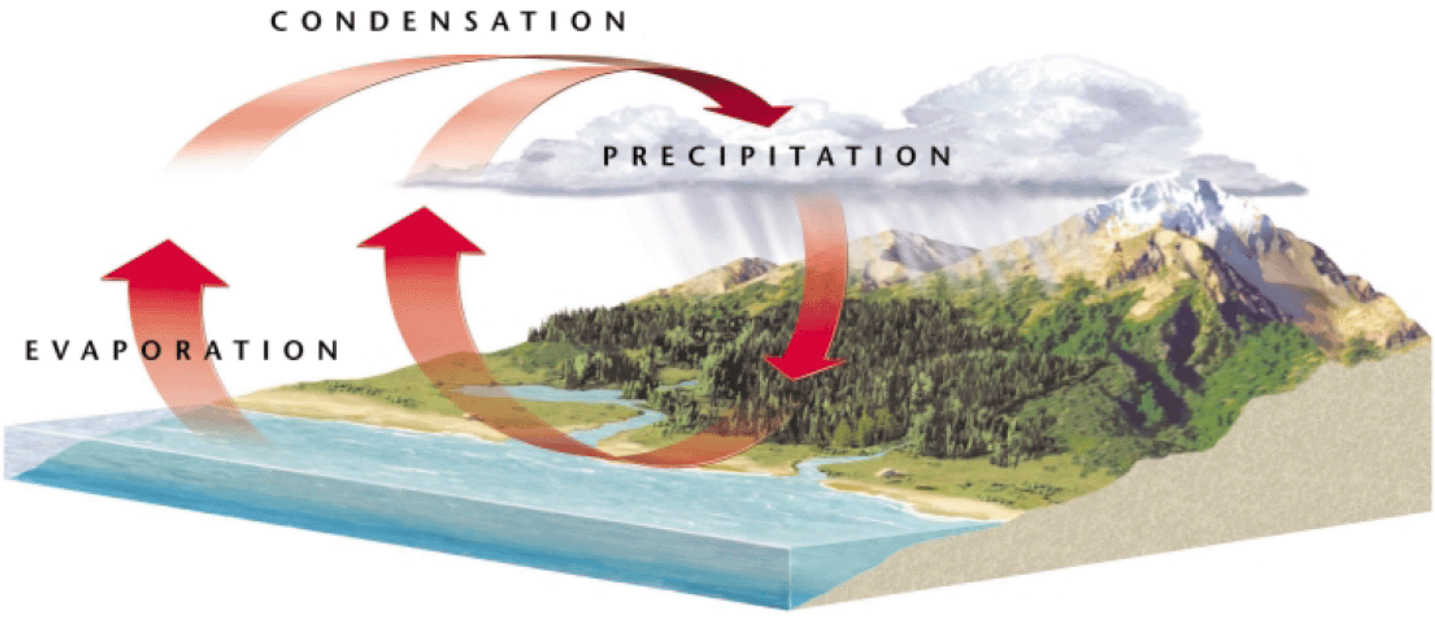
Section 1: Water Resources

Water Resources

- Water is _____ to life on Earth. Humans can live for more than a month without food, but we can live for only a few days without water.
- Two kinds of water found on Earth:
  - _____, the water that people can drink, contains little salt.
  - _____, the water in oceans, contains a higher concentration of dissolved salts.

The Water Cycle

- Water is a _____ because it is circulated in the water cycle.
- In the water cycle, water molecules travel between the Earth's _____.
  - Water _____ at the Earth's surface.
  - Water vapor rises into the air.
  - As the vapor rises, it _____ to form clouds. Eventually the water in clouds falls back to the Earth.
- The oceans are important because _____ all of the Earth's water is in the ocean.



Global Water Distribution

- Although _____ % of the Earth's surface is covered with water, nearly _____ % of Earth's water is _____ _____ in oceans and seas.
- Of the fresh water on Earth, about _____ % is _____ in glaciers and polar icecaps.
- The fresh water we use comes mainly from _____ and from a relatively narrow zone beneath the Earth's surface.

Surface Water

- _____ is all the bodies of fresh water, salt water, ice, and snow that are found above the ground.
- The distribution of surface water has played a vital role in the _____ of human societies.

River Systems

- As streams flow downhill, they combine with other streams and form _____.
- A _____ is a flowing network of rivers and streams draining a river basin.
- The _____ system is the largest river system in the world as it drains an area of land that is nearly the size of Europe.

Watersheds

- A _____ is the area of land that is drained by a water system.
- Rapidly melting snow as well as spring and summer rains can dramatically _____ the amount of water in a watershed.

Groundwater

- Most of the fresh water that is available for human use _____ be seen, as it exists underground.
- _____ is the water that is beneath the Earth's surface.
    - As water travels beneath the Earth's surface, it eventually reaches a level where the rocks and soil are saturated with water.
    - This level is known as the _____.
- The water table has _____ that match the shape of the land above. Groundwater tends to flow slowly from the peaks to the valleys.

Aquifers

- An _____ is a body of rock or sediment that stores groundwater and allows the flow of groundwater.
- They are an _____ water source for many cities.
- The water table forms the _____ of an aquifer, and most aquifers consist of materials such as _____ that have a lot of spaces where water can accumulate.
- Groundwater can also _____ rock formations, filling vast caves with water, creating underground lakes.

Porosity

- _____ is the percentage of the total volume of a rock or sediment that consists of open spaces.
- Water in an aquifer is stored in the pore spaces and flows form one pore space to another.
- The more porous a rock is, the more water it can hold.

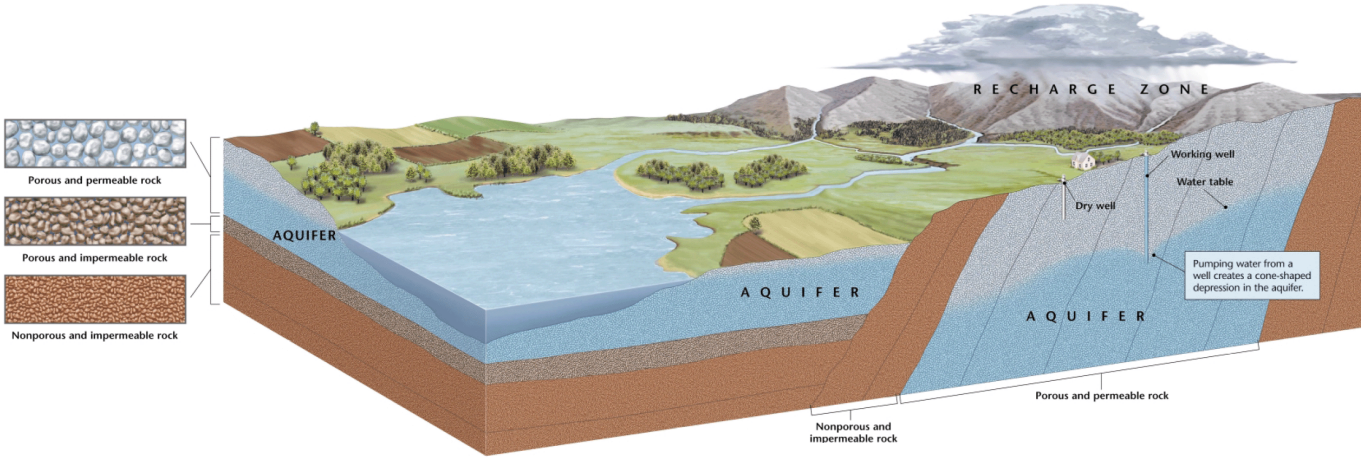
Permeability

- _____ is the ability of a rock or sediment to let fluids pass through its open spaces or pores.

- Materials such as _____ that allow the flow of water are permeable. Materials such as clay or granite that stop the flow of water are _____.
- The most productive aquifers usually form in permeable materials, such as _____, limestone, or layers of _____.

The Recharge Zone

- The _____ is an area in which water travels downward to become part of an aquifer.
- Recharge zones are environmentally sensitive areas because any pollution in the recharge zone can also enter the aquifer.



- The size of an aquifer's recharge zone is affected by the _____ of the surface above the aquifer.
- Structures such as _____ can act as impermeable layers and reduce the amount of water entering an aquifer.

Wells

- A hole that is _____ to reach groundwater is called a well.
- The height of the water table changes seasonally, so wells are drilled to _____ below the water table.

Section 2: Water Use and Management

Water Use and Management

- A shortage of clean, fresh water is one of the world's _____ environmental problems.
- According to the World Health Organization, more than _____ people lack access to a clean, reliable source of fresh water.

Global Water Use

- There are three major uses for water: _____ _____ and _____
- Most of the fresh water used worldwide is used to _____.
- Industry accounts for about _____% of the water used in the world, with the highest percent occurring in _____.
- About _____% of water is used by households.

Residential Water Use

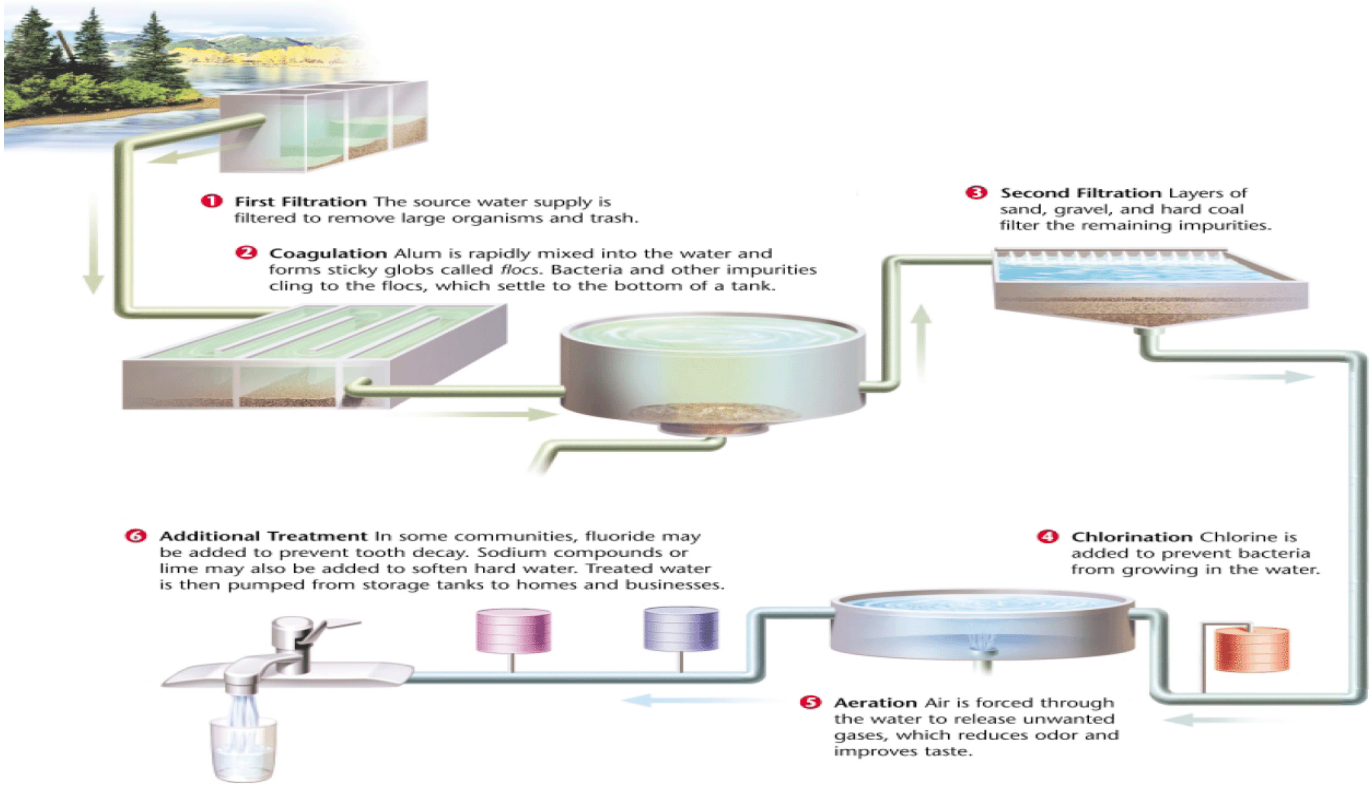
- There are striking differences in residential water use throughout the world.
  - For example, the average person in the United States uses about _____ of water a day.
  - But in India, the average person uses only _____of water every day.
- In the U.S., only about _____ of residential water use is for activities inside the home, such as drinking and cooking. The remainder of the water used residentially is used for activities outside the home such as watering lawns.

Daily Water Use in the United States (per Person)

Use	Water (L)
Lawn watering and pools	95
Toilet flushing	90
Bathing	70
Brushing teeth*	10
Cleaning (inside and outside)	20
Cooking and drinking	10
Other	5

Water Treatment

- Most water must first be made ***potable***.
  - _____ means suitable for drinking.
- Water treatment removes elements such as _____, arsenic, and _____which are poisonous to humans even in low concentrations. A _____ is a virus, microorganism, or other substance that causes disease.
- Pathogens are found in water contaminated by _____, but can be removed with water treatment.
- There are several methods of treating water to make it potable. A common method includes both physical and _____treatment.



Industrial Water Use

- Industry accounts for _____% of water used in the world.
- Water is used to manufacture goods, to dispose of wastes, and to _____.
- Most of the water that is used in industry is used to _____ power plants.
- Power-plant cooling systems usually _____ from a surface water source such as a river or a lake, carry the water through pipes in a _____, and then _____ the water back into the source.

Agricultural Water Use

- Agriculture accounts for _____% of the water used in the world. Plants require a lot of water to grow, and as much as 80 percent of the water used in agriculture _____.

Irrigation

- _____ is a method of providing plants with water from sources other than direct precipitation.
- In the U.S., _____sprinklers are the most common form of irrigation.
- However, this method is _____ because nearly half the water evaporates and never reaches the plant roots.

Water Management Projects

- People often prefer to live in areas where the natural distribution of surface water is inadequate.
- Water management projects, such as _____, are designed to meet these needs.
- Water management projects can have various goals, such as:
  - bringing in water to make a dry area _____
  - creating a _____ for drinking water,
  - _____, which then allows people to live and grow crops in desert areas.

Dams and Reservoirs

- A _____ is a structure that is built across a river to control a river's flow.
- A _____ is an artificial body of water that usually forms behind a dam.
  - Water from a reservoir can be used for _____,drinking water, _____, recreation and _____.
- Hydroelectric dams use the power of flowing water to turn a _____ that generates electrical energy.
- About _____% of the world's electrical energy is generated using this method.
- But, interrupting a river's flow can have consequences. For example, when the land behind a dam is flooded, _____, and entire ecosystems can be destroyed.
- _____ also builds up behind a dam instead of enriching the land farther down the river, and farmland below may be _____.
- Dam failure can be another problem. If a dam bursts, the people living along the river below may be _____.

Water Conservation

- _____ is one way that we can help ensure that everyone will have enough water at a reasonable price.

Water Conservation in Agriculture

- Most of the water loss in agriculture comes from _____, seepage, and _____ so technologies that reduce these problems go a long way toward conserving water.
- _____ offer a promising step toward conservation.
    - They deliver small amounts of water directly to plant roots by using _____.
    - Water is _____ to plants as needed and at a controlled rate.

Water Conservation in Industry

- In industry today, the most widely used water conservation practices involve the _____ of cooling water and wastewater.

Water Conservation at Home

- Water-saving technology, such as _____, can also help reduce household water use.
- Another way some people conserve water outside the home is by _____, or designing a landscape that requires minimal water use.

Solutions for the Future

- In some places, conservation alone is not enough to prevent water shortages, and as populations grow other sources of fresh water need to be developed.
- Two possible solutions are:
    - _____
    - _____

Desalination

- _____ is the process of removing salt from ocean water.
- Most desalination plants _____salt water and collect the fresh water that evaporates.
- Because desalination consumes a lot of energy, the process is too expensive for many nations to consider.

Transporting Water

- In some areas of the world where freshwater resources are not adequate, water can be transported from other regions.
- For example, ships regularly travel from the mainland to the Greek islands towing enormous plastic bags full of fresh water. The ships anchor in port, and fresh water is then pumped onto the islands.
- This bag solution is also being considered in the United States, where almost half of the available fresh water is in Alaska.
- Because _____% of the Earth's fresh water is frozen in icecaps, icebergs are another potential freshwater source.

Section 3: Water Pollution

Water Pollution

- _____ is the introduction _____ into water that is harmful to organisms living in the water or to those that drink or are exposed to the water.
- However, the two underlying causes of water pollution are _____.
- In developing parts of the world, water pollution is a big problem because often the only water available for drinking in these countries is polluted with _____, which can spread waterborne diseases.
- Water pollution comes from two types of sources: _____ and _____ sources.

Point-Source Pollution

- _____ is pollution that comes from a specific site.

Nonpoint-Source Pollution

- _____ is pollution that comes from many sources rather than from a single specific site.
- An example is pollution that reaches a body of water from _____ and storm _____.
- Controlling nonpoint-source pollution depends to a great extent on _____ of the effects of activities such as spraying lawn chemicals.

Wastewater

- _____ is water that contains wastes from homes or industry.
- At a wastewater treatment plant, water is _____ to make the water clean enough to return to a river or lake.

Treating Wastewater

- Most of the wastewater from homes contains _____ that can be broken down by living organisms.

Sewage Sludge

- One of the products of wastewater treatment is _____, the solid material that remains after treatment.
- Sludge can be an _____ to cities as the volume of sludge that has to be disposed of every year is enormous.
- If the toxicity of sludge can be reduced to safe levels, it can be used as a _____.

Artificial Eutrophication

- Most nutrients in water come from _____, such as leaves and animal waste that is broken down into mineral nutrients by decomposers such as bacteria and fungi.
- Nutrients are an essential part of any aquatic ecosystem, but when lakes and slow-moving streams contain an abundance of nutrients, they are _____.
- Eutrophication is a _____ process.

- When organic matter builds up in a body of water, it will begin to decay and _____.
- The process of decomposition uses up _____, and as oxygen levels decrease, the types of organisms that live in the water change over time.
- The natural process of eutrophication is accelerated when inorganic plant nutrients, such as _____, enter the water from sewage and fertilizer runoff.
- _____ is a process that increases the amount of nutrients in a body of water through human activities, such as waste disposal and land drainage.
- The major causes of eutrophication are _____ and phosphates in some laundry detergents.
- _____ is a plant nutrient that can cause the excessive growth of algae.
- In bodies of water polluted by phosphorus, algae can form large floating mats, called _____.

Thermal Pollution

- _____ is a temperature _____ in a body of water that is caused by human _____ and that has harmful effects on water quality and on the ability of that body of water to support life.
- Thermal pollution can occur when _____ and other industries use water in their cooling systems and then discharge the warm water into a lake or river.
- Thermal pollution can cause _____ if the discharged water is too warm for the fish to survive.
- As oxygen levels _____, aquatic organisms may _____ and die.

Groundwater Pollution

- Pollutants usually enter groundwater when polluted surface water _____ down from the Earth's surface.
- _____, herbicides, _____ and petroleum products are common groundwater pollutants.
- _____ are another major source of groundwater pollution because as they age, they may develop leaks that allow pollutants to seep in to the groundwater.

Cleaning Up Groundwater Pollution

- Groundwater pollution is one of the most challenging _____ problems in the world.
- Groundwater recharges very slowly, so the process for some aquifers to recycle water and purge contaminants can take hundreds of years.

Ocean Pollution

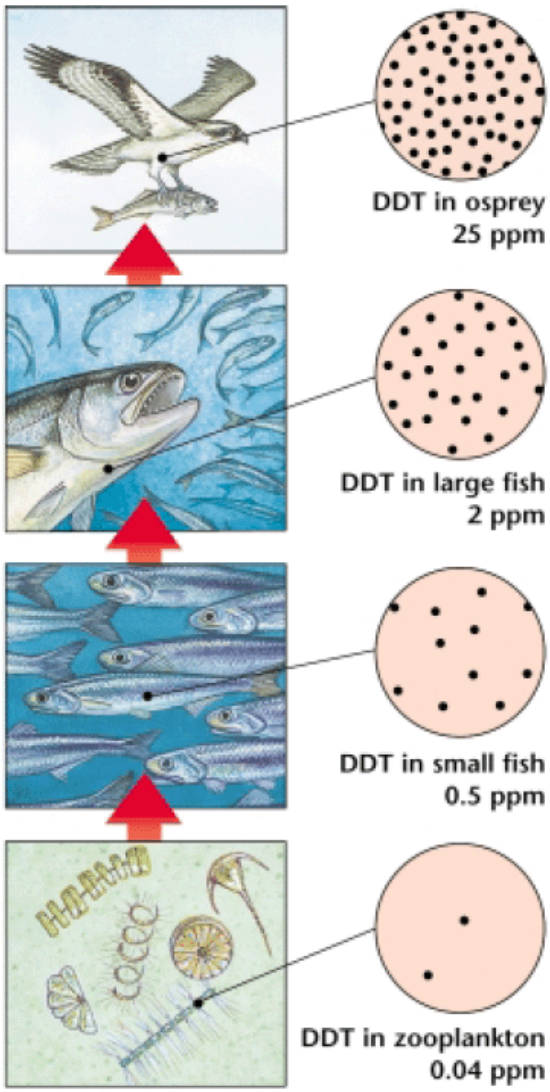
- Pollutants are often dumped directly into the ocean. For example, ships can legally dump wastewater and garbage overboard in some parts of the ocean.
- But at least _____% percent of ocean pollution, including pollutants such as oil, _____, and medical wastes comes from activities on land, near the coasts.
- Sensitive coastal ecosystems, such as coral reefs, are the most effected by pollution.

Oil Spills

- Ocean water is also polluted by accidental oil spills. Each year, about _____ of oil from tanker accidents are spilled into the ocean.
- Such oil spills have dramatic effects, but they are responsible for only about _____% of oil pollution in the oceans. Most of the oil that pollutes the oceans comes from cities and towns.

Water Pollution and Ecosystems

- Water pollution can cause immediate damage to an ecosystem, but the effects can be far reaching as some pollutants build up in the environment because they do not decompose quickly.
- _____ is the accumulation of pollutants at successive levels of the food chain.
- Biomagnification has alarming consequences for organisms at the top of the food chain, and is one reason why U.S. states _____ of fish people can eat from certain bodies of water.



Cleaning Up Water Pollution

- _____ was to designed to "restore and maintain the chemical, physical, and biological integrity of the nation's waters."
- The percentage of lakes that are fit for swimming has increased by _____, and many states have passed stricter water-quality standards.
- For example, the _____ strengthened the laws against ocean dumping.
- Also, the _____ requires all oil tankers traveling in U.S. waters to have double hulls by 2015 as an added protection against oil spills