

11.1 Water Treatment: Background Information

Water pollution comes in many forms. It may be as simple as sand or mud suspended in water, or as complex as radioactive isotopes or viruses. It includes chemicals such as nitrates, phosphates, pesticides, and salts. It includes organic wastes such as feces and garbage disposal effluent. Some sources of pollution, such as mud slides or minerals from the earth, are natural. Others are caused by human activities.

People need clean water to be healthy, to grow crops, and for many industrial purposes. Plants and animals need unpolluted water, too. To reduce the possibility of polluting the water with household or industrial waste, most communities have **sewage** treatment plants. Individual homes may have **septic tank** systems. Many industrial plants have their own water treatment facilities.

Most water-treatment processes start with a simple filtration process. A series of screens is used to filter out large items such as sticks, stones, and rags. The water is then held in a **settling tank** for a period of time to allow suspended solids to sink to the bottom. The settled solids are called **sludge**.

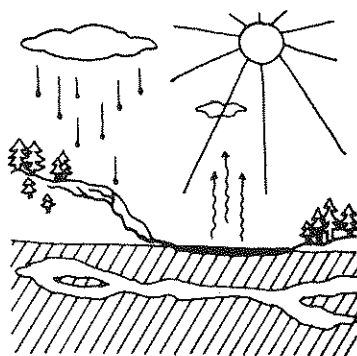
After the sludge has settled out, the water is usually treated with chlorine to kill bacteria, and then it is discharged into a river, lake, or the ocean. This mechanical separation coupled with the addition of chlorine to kill bacteria (**chlorination**) is called **primary sewage treatment**.

A similar process is used in household septic tanks. In septic-tank systems, the water flows to a tank in which the solids settle to the bottom and the greases and oils float to the top. The water is carried through pipes to perforated pipes in a drain field where it flows out over and through gravel. The gravel and microorganisms living in the soil remove many contaminants from the water.

Many communities have a more advanced sewage treatment system called **secondary sewage treatment**. In secondary treatment, the water from the settling tank is aerated by one of several ways. This aeration encourages the growth of bacteria and other microorganisms that remove many organic chemicals and suspended solids from the water. After additional time in a settling tank or pond, the water is chlorinated and released.

Even secondary treatment does not remove all pollutants. Many salts, pesticides, phosphates, and other pollutants remain in secondarily treated water. To remove the remaining chemicals is an expensive proposition, but a few communities have invested in tertiary treatment facilities. **Tertiary water treatment** involves different processes, many of them chemical, to remove different pollutants. Many tertiary treatment plants claim that the water they release is **potable**, or safe to drink.

Without clean water, our communities and industries cannot survive. As more people compete for the finite amount of water on Earth, it becomes increasingly important for us to take care of our water systems. It is important for us to understand how we can protect and improve our water supplies.



11.2 Water Treatment: Instructions

In this activity, you will design and test the effectiveness of various methods of filtering water, which is the first step in primary sewage treatment. Your teacher will supply you with some "polluted" water. You will make visual observations of the water that has passed through your filter (the filtrate), and then you will evaporate the water to see whether there were dissolved or suspended materials that you did not see.

Follow your teacher's instructions for building your filter or filters. Sketch your filter system(s) in the space provided below, labeling each part.

Then follow these steps to test your sample(s):

1. Find the mass of a 250 ml beaker as precisely as possible. Record the mass on the table below.
2. Obtain 250 ml of the "polluted" water. Record its appearance.
3. Pour the water carefully through your filter, collecting the filtrate in the massed 250 ml beaker, which should be placed under the filter.
4. Observe and record the appearance of the filtered water.
5. Follow your teacher's instructions to evaporate the filtered water (filtrate).
6. Find the mass of the beaker and residue remaining after all of the water has evaporated.
7. Find the mass of the residue by subtracting the mass of the beaker alone (step 1) from the mass of the beaker plus residue (step 6).

FILTER SYSTEM DESIGN(S)

System A

System B

DATA

	System A	System B
a. mass of clean beaker		
b. appearance of polluted water		
c. appearance of filtered water		
d. mass of residue		

11.3 Water Treatment: Questions

1. Briefly describe primary, secondary, and tertiary sewage treatment systems.

2. With regard to water pollution, discuss the Law of Conservation of Matter.

3. What are some ways that you as an individual can help reduce water pollution produced at your home?

4. Industries are important producers of water pollutants. How can individuals influence industries to reduce water pollution?
