GETTING STARTED

TRY THIS ACTIVITY: SIMULATED WATER TREATMENT

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Observations of the activity are listed in **Table 1.**

Table 1 Observations of Water Treatment

Glass	1	2	3
Contents	water, alum, ammonia	water, alum, soil, ammonia	water, soil
Observations	• white precipitate forms when ammonia is added • precipitate falls and settles on the bottom of glass • water above precipitate is clear and colourless	• white precipitate forms when ammonia is added • soil particles and the precipitate fall and settle on the bottom of glass • water above precipitate/soil mixture is clear and colourless • some soil particles float on the surface of water	• soil particles slowly settle on the bottom of glass • water above settled soil particles still contains small suspended soil particles • some soil particles are floating on the surface of the water

(a) All three glasses contain a layer of particles that settled on the bottom. The settled particles in glass 1 are all white. Glass 2 contains a layer of settled particles consisting of a mixture of white precipitate and soil. The soil particles are very small. Although glasses 2 and 3 contain settled particles, the water in glass 3 still contains suspended soil particles.

(b) The gelatinous precipitate is allowed time to settle instead of being filtered because it appears to remove fine suspended soil particles from the water. By allowing the precipitate time to settle, the clarified water can be easily poured off (decanted).

(c) Based on observations, the water sample treated with alum and ammonia appears safe to drink because the water appears clear. Microorganisms and chemical contaminants found in soil would still be present in water, however, as well as dissolved alum and ammonia. Thus, unless the water was treated further, it would not be safe to drink.

REFLECT ON YOUR LEARNING

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1. Student answers will vary. Substances that can dissolve in water include ionic compounds (salts), polar molecular compounds such as alcohols, and gases. Examples of substances that can dissolve in water include sucrose, glucose, sodium chloride, potassium chloride, oxygen gas, carbon dioxide gas, methanol, ethanol, sodium hydroxide, and hydrochloric acid.
2. Nonpolar substances do not dissolve in water. Water is composed of polar molecules that are capable of forming hydrogen bonds (or dipole interactions) with other polar molecules to dissolve them. Nonpolar molecules cannot form hydrogen bonds with water molecules, and disrupt the hydrogen bonding between water molecules. Three examples of substances that do not dissolve in water are vegetable oil, petroleum products (oil), and animal fats.
3. (a) Acids are water-soluble substances that turn blue litmus red in solution. Acidic solutions also neutralize bases, taste sour, have a pH less than 7, and conduct electricity in solution.
   (b) In solution, acids ionize to produce hydrogen ions, $H^+_{(aq)}$. These hydrogen ions are responsible for the properties of acids.
4. (a) Bases turn red litmus paper blue in solution, neutralize acids, taste bitter, feel slippery, have a pH greater than 7, and are electrolytes in solution.
   (b) A base dissociates in water to form hydroxide ions, $OH^-_{(aq)}$. Hydroxide ions are responsible for the properties of bases.
5. A strong acid completely ionizes in solution to produce hydrogen ions. Thus, strong acids are good conductors of electricity. Comparatively, a weak acid partially ionizes in water (less than 50%) and, thus, is a poor conductor of electricity.

6. Although many gases are invisible, their properties can be measured, such as the volume, temperature, density, and pressure exerted by a gas. The properties of gases can also be observed through chemical reactions. By observing the products of a chemical reaction, you can determine the nature of the reactant gases.
7. A hot-air balloon rises because, as the air is heated inside, the gas particles move more quickly and the volume of the gas increases. As the volume increases, the density of the gas becomes less than the air surrounding the balloon. A gas of lower density will rise through a more dense gas until the densities of the two gases are equal. Therefore, the balloon will continue to rise until the density of the air in the balloon equals the density of the atmospheric air.
8. The quality of air in the atmosphere is affected by the amounts of pollutants present. These pollutants include nitrogen oxides, sulfur dioxide, carbon dioxide, volatile organic compounds, ground-level ozone, heavy metals, and other toxins.

4.1 WATER: ESSENTIAL FOR LIFE

TRY THIS ACTIVITY: HOW MUCH WATER IS ESSENTIAL?

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1. Student answers may vary. **Tables 2** and **3** present an example of water used in a home of two people.

Table 2 Water-Use Journal for Family Member 1

Water use	Number of times in one day	Total for three days	Average amount of water used	Actual amount of water used (L)
Bathroom				
flushing toilet	4	12	× 18 L	216
showering (10 min)	1	3	× 100 L	300
bathing in tub	0	0	× 60 L	0
brushing teeth*	0	0	× 10 L	0
shaving	1	3	× 20 L	60
washing hands	5	15	× 8 L	120
Kitchen				
cooking	2	6	× 20 L	120
washing dishes by hand	1	3	× 35 L	105
using dishwasher	0	0	× 40 L	0
Laundry				
using washing machine	1	3	× 225 L	675
Outside				
washing car*	0	0	× 400 L	0
watering lawn	0	0	× 35 L/min	0
			Total water used	1596 L

* while water is running