Wai: The Story and Science of Water

Water is one of the most familiar things in our lives. We drink it. We wash with it. We cook with it. We see it in rain, streams, clouds, ice, mist, and the ocean. Water can be calm, powerful, invisible, frozen, flowing, or falling from the sky. It can carve valleys, crack rock, feed forests, fill aquifers, carry nutrients through living bodies, and return again and again through the water cycle.

In science, water is known as **H_2O**. That means each water molecule is made of two hydrogen atoms and one oxygen atom. This small molecule has unusual properties that make life on Earth possible.

But water is not only important as a chemical substance. In Hawai‘i, freshwater is called **wai**. Ocean water is called **kai**. This difference matters. Wai and kai are both forms of water, but they are not the same. Freshwater feeds people, kalo, forests, streams, and aquifers. Kai surrounds the islands, feeds ocean life, carries canoes, provides food, and connects Hawai‘i to the wider Pacific.

To understand water fully, we need to look at it in more than one way. We need to understand its science, its movement through Earth, its role in living things, and its place in Hawaiian thought. Water is chemistry. Water is weather. Water is ocean. Water is forest. Water is life. Water is also kuleana, a responsibility.

How Water Appeared on Earth

Earth formed about 4.5 billion years ago. In its earliest time, Earth was very different from the planet we know today. It was hot, violent, and still forming. Space rocks struck its surface. Volcanoes released gases. The young planet was still cooling and changing.

Scientists are still studying exactly how Earth got its water. There is no single simple answer that all scientists agree on. The best explanation today is that Earth’s water may have come from more than one source.

One idea is that some water arrived from space. Long ago, icy comets, water-rich asteroids, and other early solar system materials may have struck Earth. These objects carried ice, minerals, hydrogen, oxygen, and other ingredients. When they crashed into early Earth, they may have helped deliver water or the materials needed to form water.

Another idea is that some of Earth’s water may have come from the materials that formed Earth itself. Early rocks and minerals may have contained hydrogen and oxygen. As Earth heated and changed, volcanoes released water vapor and other gases into the atmosphere. Later, as the planet cooled, water vapor could condense and fall as rain.

So Earth’s water probably has a deep and complicated history. Some may have come from space. Some may have come from Earth’s own original materials. What matters for us is that Earth’s water is ancient. The water in a stream, cloud, aquifer, plant, animal, or ocean today may include molecules that have been moving through Earth’s systems for millions or even billions of years.

Earth still receives tiny amounts of material from space, including dust and small meteor particles. But this does not give us a useful new supply of water. For practical purposes, the water we depend on is the water Earth already has. It moves, changes form, and recycles, but we do not receive large amounts of new water from outer space.

That means freshwater must be cared for. We are not getting a new ocean, a new aquifer, or a new supply of clean stream water delivered from space. We live with the water Earth already carries.

Atoms, Elements, and Molecules

To understand water, we first need to understand atoms.

An **atom** is one of the basic building blocks of matter. Everything around us is made of atoms: air, rocks, plants, animals, clouds, soil, salt, and water. Atoms are extremely small. We cannot see individual atoms with our eyes, but they make up everything we touch, see, breathe, and eat.

Atoms are made of smaller parts. The three main parts are **protons**, **neutrons**, and **electrons**.

Protons have a positive electrical charge. Neutrons have no charge. Electrons have a negative electrical charge.

The number of protons in an atom decides what element it is. For example, every hydrogen atom has one proton. Every oxygen atom has eight protons. Every sodium atom has eleven protons. If the number of protons changes, the element changes.

Electrons are different. If an atom gains or loses electrons, it does not become a different element. It becomes a charged version of the same element. That charged atom is called an **ion**.

For example, sodium has eleven protons. A neutral sodium atom also has eleven electrons, so its positive and negative charges balance. But if sodium loses one electron, it still has eleven protons. It is still sodium. It now has more positive charge than negative charge, so it becomes a positive sodium ion, written as $\mathbf{Na^+}$.

Chlorine can gain one electron. When it does, it becomes a negative chloride ion, written as $\mathbf{Cl^-}$.

Sodium ions and chloride ions are important because they form common salt, called sodium chloride. When salt dissolves in water, it separates into sodium ions and chloride ions. These charged particles spread throughout the water.

A **molecule** forms when atoms are joined together. A water molecule forms when two hydrogen atoms are joined to one oxygen atom. That is why water is written as $\mathbf{H_2O}$. The “H” stands for hydrogen, the “O” stands for oxygen, and the small “2” means there are two hydrogen atoms.

Why Water Is a Polar Molecule

Water is not just any molecule. It is a **polar molecule**.

A polar molecule has an uneven electrical charge. This does not mean that the whole water molecule is positive or negative. A water molecule is neutral overall. But the charge is not spread evenly inside it.

In a water molecule, oxygen pulls the shared electrons more strongly than hydrogen does. Electrons are negative. Because the electrons spend more time near the oxygen atom, the oxygen side of the molecule becomes slightly negative. The hydrogen sides become slightly positive.

A simple way to picture this is to imagine two people holding the same rope. One person is stronger and pulls the rope closer. Both people are still holding the rope, but the rope is unevenly shared. In water, oxygen is the stronger puller.

Because one side of a water molecule is slightly negative and the other side is slightly positive, water molecules attract each other. The slightly positive hydrogen side of one water molecule is attracted to the slightly negative oxygen side of another water molecule.

This attraction is called a **hydrogen bond**.

Hydrogen bonds are not as strong as the bonds holding the hydrogen and oxygen atoms together inside a single water molecule. But they are strong enough to give water many of its special properties. Hydrogen bonding helps explain why water forms droplets, why water sticks to some surfaces, why water has surface tension, why water dissolves many substances, and why ice floats.

The tiny structure of the water molecule helps explain the large behavior of water on Earth.

The Three States of Water

Water can exist as a **solid**, a **liquid**, or a **gas**.

When water is a solid, we call it **ice**. In ice, water molecules are held in fixed positions. They still vibrate, but they do not move freely past one another. The molecules form an open pattern with space between them.

When water is a liquid, the molecules are still close together, but they can move around and slide past one another. Liquid water can flow because its molecules are not locked into one fixed shape. This is the water we drink and see in streams, rivers, rain, and the ocean.

When water is a gas, we call it **water vapor**. Water vapor is invisible. In this state, water molecules have enough energy to spread far apart and move freely through the air.

Water changes state when energy is added or removed. When ice gains heat energy, its molecules move more, and the ice melts into liquid water. When liquid water gains enough energy, some molecules escape

into the air as water vapor. That process is called **evaporation**. When water vapor cools and loses energy, it can turn back into liquid water. That process is called **condensation**. When liquid water loses enough energy, it freezes into ice.

The state of water depends on how much energy the water molecules have and how they are arranged.

Why Ice Floats

Most substances become denser when they freeze. Their molecules slow down and pack closer together.

Water is unusual because it expands when it freezes.

When water freezes, hydrogen bonds arrange the molecules into an open crystal structure. This open structure takes up more space than the same amount of liquid water. Because the molecules are farther apart in ice, ice is less dense than liquid water.

Density means how much matter is packed into a certain amount of space. If something is less dense than water, it floats. If it is more dense than water, it sinks. Ice floats because it is less dense than liquid water.

This matters for life. If ice sank, lakes and ponds in cold places could freeze from the bottom upward. Many fish and other freshwater organisms would have a harder time surviving. Instead, ice floats on top and helps insulate the liquid water below.

The same expansion of freezing water can also break things. If water gets into cracks in rock, roads, or pipes and then freezes, it expands. That expansion can widen cracks and cause damage.

Water’s freezing behavior is unusual, but it is also one reason life can survive in cold environments.

How Water Evaporates

Evaporation happens when liquid water becomes water vapor.

In a cup, puddle, stream, pond, or ocean, water molecules are always moving. Some move slowly. Some move faster. At the surface of the water, some molecules may gain enough energy to break away from the liquid and escape into the air. When they escape, they become water vapor.

Evaporation happens faster when water is warm because heat gives molecules more energy. It also happens faster when air is moving because wind carries water vapor away from the surface. When vapor is carried away, more water molecules can escape. Evaporation also happens faster when more surface area is exposed. A shallow puddle dries faster than the same amount of water in a narrow cup because more of the water is touching the air.

This is why wet clothes dry faster in the sun and wind. The sun adds heat energy. The wind carries water vapor away.

Evaporation is one of the main ways water moves from Earth's surface into the atmosphere. Oceans, lakes, streams, soil, and wet leaves all release water vapor into the air.

How Clouds Form

Water vapor is invisible. A cloud is not made of invisible vapor. A cloud is made of tiny liquid water droplets or tiny ice crystals floating in the air.

Clouds form when warm, moist air rises. As air rises, it usually cools. Cool air cannot hold as much water vapor as warm air. When the air cools enough, some of the water vapor changes back into liquid droplets or ice crystals. This change is condensation.

Water vapor usually needs a tiny surface to condense on. In the atmosphere, these tiny surfaces can be dust, sea salt, smoke, or other small particles. These are called **condensation nuclei**. Water gathers around them and forms tiny droplets.

At first, cloud droplets are very small. They are light enough to stay suspended in the air. As they bump into each other, some join together and grow larger. When droplets become too large and heavy to remain floating in the cloud, they fall as rain. In colder conditions, water may fall as snow, sleet, or hail.

Rain is not made in one step. It begins with invisible water vapor. Then the vapor cools and condenses. Tiny droplets form. Those droplets grow. When they become heavy enough, they fall as precipitation.

The Water Cycle

The **water cycle** is the movement of water through Earth's systems.

The sun heats the ocean, lakes, streams, soil, and plants. Some water evaporates and becomes water vapor. Plants also release water vapor through tiny openings in their leaves. That process is called **transpiration**. Together, evaporation and transpiration move water from Earth's surface into the air.

As moist air rises and cools, water vapor condenses into clouds. When cloud droplets grow large enough, water falls back to Earth as precipitation. In Hawai'i, this usually means rain, though at high elevations it can sometimes include snow or ice.

After rain falls, different things can happen. Some water flows over the land as **runoff**. Runoff can enter streams and rivers and eventually reach the ocean. Some water soaks into the soil. Some is taken up by plants. Some moves deeper underground through rock and soil until it reaches aquifers.

An **aquifer** is an underground layer of rock or sediment that stores and moves water. In Hawai'i, freshwater often moves through porous volcanic rock. This underground freshwater can later emerge as springs, feed streams, or be pumped from wells for people to use.

The water cycle does not really have a beginning or end. Water moves from ocean to cloud, from cloud to forest, from forest to soil, from soil to aquifer, from aquifer to stream, from stream to ocean, and then back to the sky again.

The same water can move through many places over time. A water molecule may be part of ocean water, then a cloud, then rain, then a stream, then a plant, then water vapor, then rain again. Water is always moving, changing form, and connecting different parts of Earth.

Ocean Water and Fresh Stream Water

Ocean water and fresh stream water are both made mostly of H_2O molecules. The water molecules themselves are the same. The difference is what is dissolved in the water.

Ocean water contains a large amount of dissolved salts and minerals. The most common salt in seawater is sodium chloride. When sodium chloride dissolves, it separates into sodium ions and chloride ions. These ions spread through the water and give seawater its salty taste.

Ocean water also contains other dissolved ions, including magnesium, calcium, potassium, and sulfate. These dissolved materials make ocean water denser than freshwater.

Fresh stream water has much less dissolved salt. It may contain minerals from rocks, organic matter from plants, tiny particles of soil, and living organisms, but it is much less salty than ocean water. That is why it is called freshwater.

Ocean water becomes salty over long periods of time. Rain falls on land and slowly dissolves minerals from rocks and soil. Streams and rivers carry some of those dissolved minerals to the ocean. When ocean water evaporates, the water molecules leave and rise into the air, but the salt stays behind. Over long periods of time, salts build up in the ocean.

Fresh stream water is different because it has not gone through that same long process of salt concentration. It may come from rain, springs, groundwater, or mountain runoff. It moves through the land and eventually toward the ocean.

In Hawaiian, this difference is important. **Wai** is freshwater. **Kai** is sea water or ocean water. Wai is the water needed for drinking, farming, cooking, washing, and daily life on land. Kai is the ocean water used for fishing, voyaging, gathering, cleansing, and connection across islands. Both are life-giving, but they are not the same.

Water as the Universal Solvent

Water is often called the **universal solvent**. A solvent is a liquid that can dissolve other substances. Water does not dissolve everything, but it dissolves more substances than most liquids.

Water is good at dissolving many substances because it is polar. The slightly positive hydrogen sides of water molecules can attract negative ions or negative parts of other molecules. The slightly negative oxygen side can attract positive ions or positive parts of other molecules.

Salt is a good example. Salt is made of sodium ions and chloride ions. Sodium ions are positive. Chloride ions are negative. When salt is placed in water, water molecules surround the ions. The oxygen side of water is attracted to sodium ions. The hydrogen sides of water are attracted to chloride ions. The water molecules pull the ions apart and spread them through the liquid. That is dissolving.

This ability makes water important for life.

In our bodies, water carries dissolved nutrients, minerals, gases, and waste materials. Blood is mostly water, so it can carry oxygen, sugars, salts, and other materials to the cells. Once those materials reach the cells, water also helps them move into the places where they are needed. Without water, nutrients could not move easily through the body.

Water does something similar in plants. When rainwater soaks into the ground, it dissolves minerals and nutrients in the soil. Plant roots take in this water along with the dissolved nutrients. The water then moves upward through tiny tubes inside the plant called **xylem**. It travels from the roots to the stem, branches, leaves, flowers, and fruit.

This upward movement happens partly because water molecules stick to each other and to the walls of the plant's tiny tubes. As water evaporates from the leaves, more water is pulled upward from below. This process helps carry dissolved nutrients from the soil into the whole plant.

In this way, water is not only something the plant drinks. Water is also the carrier that brings minerals and food-making materials into the plant's living tissues.

But water does not dissolve everything. Oil and grease do not mix well with water because they are nonpolar. They do not have charged ends that water can easily attract. That is why oily substances separate from water.

Why Water Can Clean

Water cleans because several of its properties work together.

First, water can dissolve many substances. Salt, sugar, and many kinds of dirt can dissolve or loosen in water. When water flows, it carries those substances away.

Second, water molecules stick to many surfaces. Because water is polar, it can cling to small particles and surfaces. This helps loosen dirt.

Third, water flows into small spaces. It can move into cracks, cloth fibers, skin, and surfaces where dirt may be trapped.

But water alone is not always enough. Grease and oil do not dissolve well in water. That is why soap is useful. Soap molecules have one end that mixes with water and another end that mixes with oil or grease. Soap helps break grease into tiny droplets that water can carry away.

So water is a powerful cleaner, but it works best when the substance being cleaned can dissolve in water or be lifted and carried away by water. For greasy things, soap helps water do the job.

Wai in Hawaiian Cultural Context

In Hawaiian thought, **wai** is not just a chemical substance. Wai is freshwater, but it is also life. Without wai, people cannot live. Kalo cannot grow. Streams cannot flow. Forests cannot thrive. Communities cannot survive.

The Hawaiian word **waiwai** means wealth or value. This connection shows how important freshwater was and still is. Wealth was not only money or property. True wealth was tied to the things that sustained life: water, land, food, family, and proper relationships.

Freshwater was not treated as something to waste. It was understood as something to respect, protect, and share. People depended on flowing streams for farming, especially for growing kalo in loʻi. Water moved through the ahupuaʻa from the uplands toward the sea. What happened upstream affected everyone downstream.

This is an important lesson. If people damage the forest, the water is affected. If soil washes into streams, the reef can be affected. If streams are diverted or dried, farming, fishponds, nearshore life, and families can be affected. Water connects everything.

The idea of **kuleana** is important here. Kuleana means responsibility, privilege, and duty. If people receive the gift of water, they also have a duty to care for the sources of that water. That includes forests, streams, wetlands, aquifers, and the ocean.

The word **kānāwai** is often explained as connected to the equal sharing of water. This reminds us that water is not only a physical need. It is also connected to fairness, order, responsibility, and community life.

Kūmokuhāliʻi: The Complex Forest and the Cycle of Water

The document **Kūmokuhāliʻi: A Comprehensive Tool for Hawaiian Understanding of the Complex Forest** was prepared by the Edith Kanakaʻole Foundation for Kamehameha Schools. It gives a Hawaiian way of understanding the native forest as part of a larger living system.

In this view, the forest is not just a collection of trees. Kūmokuhāliʻi describes the forest as a living covering of the land that rises upward into the atmospheric space above the tallest trees. The forest belongs to the land, but it also reaches into the sky. It touches the atmosphere, draws down moisture, and participates in the movement of water.

This is an important idea for students. In modern science, we often separate topics into different categories: land, air, plants, animals, weather, clouds, and water. Kūmokuhāliʻi teaches that these things are not truly separate. The forest lives through its relationship with the sky, the earth, water, wind, sunlight, plants, animals, and people.

The document uses the Hawaiian framework of **Papahulihonua**, **Papahulilani**, and **Papahānaumoku**.

Papahulihonua refers to earthly elements, including land, soil, stone, and fresh water.

Papahulilani refers to the atmosphere and the sky world, including clouds, wind, rain, sun, moon, and stars.

Papahānaumoku refers to living forms, including plants, animals, and people.

Kūmokuhāliʻi belongs to all three. The forest grows from the earth. It rises into the atmosphere. It is made of living beings. Because of this, the forest becomes a meeting place between earth, sky, water, and life.

The document also makes clear that the foundation of the forest is **wai** and **lā** — water and sunlight. Trees, ferns, mosses, vines, insects, birds, and people all depend on water and sunlight. Without them, the forest cannot continue.

At the same time, the forest does not merely use water. The forest also helps gather, move, hold, and return water. Leaves, branches, bark, moss, roots, and soil slow rainfall. The forest can send water vapor into the air through evaporation and transpiration. It can also absorb water vapor and droplets from the atmosphere. Water then moves into the ground, where it may be stored and later travel toward springs, streams, aquifers, shorelines, and the ocean.

This relationship is a cycle. Water feeds the forest. The forest helps protect and continue the movement of water.

For middle school students, the idea can be stated simply:

The forest needs water, and water needs the forest.

Laka, Lono, Kū, and Kāne as Environmental Processes

The Kūmokuhāliʻi document also explains that Hawaiian inoa akua, or names of akua, can be understood as a way of naming natural energies and environmental functions. This is not the same as treating the forest as only a physical object. It is a way of seeing the forest as a living system of forces and relationships.

For this water study, four important names are **Laka**, **Lono**, **Kū**, and **Kāne**.

Laka is connected with evaporation, transpiration, and the quiet rising of mist. Water rises from trees, ponds, people, soil, forest, and ocean. This water moves upward into the atmosphere. In science class, we may call this evaporation and transpiration. In the Kūmokuhāliʻi framework, Laka helps us understand the upward movement of water.

Lono is connected with wind, sound, weather, and horizontal movement through the air. Winds gather, carry, and deposit water molecules, clouds, mist, seeds, organisms, and weather systems. In science class, we may talk about air currents moving moisture. In the Kūmokuhāliʻi framework, Lono helps us understand water being carried through the atmosphere.

Kū is connected with vertical growth, standing, rising, forest structure, and the vegetation that covers the land. Kūmokuhāliʻi itself can be understood as the vertical living cover of the land — the forest rising upward. The forest reaches into the sky, draws down moisture, and provides the structure through which water can be gathered, slowed, and stored.

Kāne is connected with sunlight, heat, air movement, water, and life. In science class, we say that the sun drives evaporation and powers much of the water cycle. In the Kūmokuhāliʻi framework, Kāne helps us understand the life-giving energy of sunlight and water.

These names help students see that Hawaiian knowledge is not random or decorative. It is a careful way of observing and naming environmental processes. It recognizes that water does not move alone. It moves with heat, wind, plants, clouds, land, and living things.

Modern science may say:

The sun heats water. Water evaporates. Plants transpire. Wind carries water vapor. Clouds form. Rain falls. Forests slow and absorb water. Water enters the ground and returns to streams and ocean.

The Kūmokuhāliʻi framework helps students see those same relationships through Hawaiian categories of knowledge:

Kāne, Laka, Lono, Kū, Papahulilani, Papahulihonua, Papahānaumoku, wai, lā, forest, cloud, wind, earth, and life.

Both ways of knowing point to one central truth:

Water moves through relationship.

The Forest as a Water Gatherer

A healthy native forest helps water enter the land.

When rain falls on bare ground, it can hit hard. It can loosen soil, create mud, and run quickly downhill. This fast-moving runoff can carry soil into streams and eventually into the ocean. Too much runoff can damage stream life, reefs, and nearshore waters.

A healthy forest changes this process. Leaves catch the rain. Branches slow it down. Moss, ferns, roots, and leaf litter hold moisture. Soil protected by plants can absorb more water. Instead of rushing away, more water can soak into the ground.

Some of this water is used by plants. Some returns to the air through evaporation and transpiration. Some moves underground and helps recharge aquifers. Some later returns to springs, streams, wetlands, or the shoreline.

This is why forests matter to water. A forest is not only a place where water falls. It is a living structure that helps gather, slow, store, release, and protect water.

In Hawai‘i, this is especially important because the islands depend on rainfall, forested watersheds, and aquifers. There is no large continent behind Hawai‘i sending endless rivers of freshwater. Island water must be gathered, held, and protected within the islands themselves.

This is one reason the Hawaiian view of forest and water is so important. If the forest is damaged, the water system is damaged. If the water system is damaged, plants, animals, people, farms, streams, fishponds, reefs, and future generations are affected.

Water Is Ancient, but Freshwater Is Limited

One of the most important things to understand is that water is recycled, not newly made for us each day.

The water falling as rain today may once have been part of the ocean. Before that, it may have been inside a cloud, a plant, a stream, an animal, or a glacier. Water molecules move through many forms and places over time.

This does not mean usable freshwater is unlimited. Most of Earth’s water is salt water in the ocean. Much of Earth’s freshwater is frozen in ice or stored underground. Only a small portion is easily available in streams, lakes, shallow groundwater, rainfall, and soil moisture.

On an island, freshwater is especially limited. Hawai‘i depends on rain, forests, watersheds, and aquifers. If forests are damaged, if aquifers are overused, or if streams are polluted, the amount of clean freshwater available to people and ecosystems can be reduced.

So even though Earth has a lot of water, clean freshwater must be cared for carefully.

Bringing the Science and the Hawaiian View Together

Science helps us understand how water behaves. It explains that water is made of molecules. It explains polarity, hydrogen bonding, evaporation, condensation, freezing, melting, dissolving, clouds, rain, runoff, infiltration, aquifers, and the movement of nutrients through living things.

Hawaiian knowledge helps us understand how people should live with water. It teaches that wai is life-giving, that water connects land and sea, and that people have kuleana to protect the sources of water.

The Kūmokuhāliʻi framework adds another important lesson. It teaches that the forest, sky, earth, and living things are not separate pieces. The forest grows from the land, reaches into the atmosphere, gathers water, releases water vapor, supports life, and helps maintain the cycle of water between earth, sky, and forest.

These ways of understanding water can stand beside each other. Science can explain the physical and molecular properties of water. Hawaiian knowledge can remind us that water moves through relationship and must be treated with respect.

Water is H_2O. It is also wai. It is chemistry, weather, ocean, stream, cloud, forest, aquifer, food, body, and life. It is ancient, but it is also present in every breath of mist, every drop of rain, every stream, every cup, and every living thing.

To understand water is to understand connection.

What rises from the ocean returns as rain. What falls on the forest enters the ground. What enters the ground fills the aquifer. What fills the aquifer feeds people, streams, farms, forests, and reefs. What reaches the sea begins the journey again.

Water moves through the whole living system of Earth. Because life depends on it, water must be treated with care.

Student Review Questions

1. What does H_2O mean?
2. What is the difference between an atom, an ion, and a molecule?
3. Why does an atom not become a different element when it gains or loses an electron?
4. Why is water called a polar molecule?
5. How do water molecules behave differently as ice, liquid water, and water vapor?
6. Why does ice float on liquid water?
7. Why does water expand when it freezes?
8. How does evaporation happen?
9. How do clouds form?
10. How does rain form inside a cloud?
11. What are the major parts of the water cycle?
12. What is the difference between wai and kai?

13. Why is ocean water salty?
14. Why is water called the universal solvent?
15. How does water carry nutrients in the human body?
16. How does water carry nutrients from soil into plants?
17. Why are native Hawaiian forests important for freshwater?
18. What are Papahulihonua, Papahulilani, and Papahānaumoku?
19. How does Kūmokuhāliʻi help us understand the relationship between forest, water, sky, and life?
20. What does it mean to say that water is both science and kuleana?

Key Vocabulary

Aquifer — an underground layer of rock or sediment that stores and moves water.

Atom — a tiny building block of matter.

Condensation — the change from water vapor into liquid water.

Condensation nuclei — tiny particles in the air that water vapor can condense around to form cloud droplets.

Density — how much matter is packed into a certain amount of space.

Electron — a negatively charged particle in an atom.

Evaporation — the change from liquid water into water vapor.

Freshwater — water with very little dissolved salt.

Hydrogen bond — an attraction between the slightly positive hydrogen side of one water molecule and the slightly negative oxygen side of another water molecule.

Infiltration — the movement of water into soil or rock.

Ion — an atom or molecule with an electrical charge because it has gained or lost electrons.

Kai — ocean water or salt water.

Kuleana — responsibility, privilege, and duty.

Kūmokuhāliʻi — a Hawaiian framework for understanding the complex native forest as a living relationship between land, atmosphere, water, plants, animals, and people.

Molecule — two or more atoms joined together.

Neutron — a particle in an atom with no electrical charge.

Papahānaumoku — a Hawaiian category of knowledge relating to living forms, including plants, animals, and people.

Papahulihonua — a Hawaiian category of knowledge relating to earthly elements, including land, soil, stone, and fresh water.

Papahulilani — a Hawaiian category of knowledge relating to the atmosphere, including sun, moon, stars, clouds, wind, and rain.

Polar molecule — a molecule with an uneven electrical charge.

Precipitation — water that falls from the sky, such as rain, snow, sleet, or hail.

Proton — a positively charged particle in an atom.

Runoff — water that flows over the land surface.

Solvent — a liquid that dissolves other substances.

Transpiration — the release of water vapor from plants.

Universal solvent — a common description of water because it dissolves many substances, though not everything.

Wai — freshwater.

Waiwai — wealth, value, or abundance.

Water cycle — the movement of water through Earth's atmosphere, land, ocean, living things, and underground systems.

Xylem — tiny tubes in plants that carry water and dissolved nutrients upward from the roots.

Source Note for Teachers

This reading brings together middle school earth science, chemistry, biology, and Hawaiian cultural knowledge. The Hawaiian cultural section is informed by **Kūmokuhāli'i: A Comprehensive Tool for Hawaiian Understanding of the Complex Forest**, prepared by the Edith Kanaka'ole Foundation for Kamehameha Schools, June 15, 2011. The science sections are based on standard middle school earth science and chemistry concepts, including water's molecular structure, polarity, hydrogen bonding, phase changes, evaporation, condensation, precipitation, water cycling, solubility, and the role of water in living systems.