American Museum of Natural History

WATER : H_2O = Life

EDUCATOR'S GUIDE

amnh.org/education/water

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ESSENTIAL Questions

This exhibition explores where water occurs on Earth, how it's used, and how we can become better stewards of our water planet. You can use the essential questions below to connect the exhibition's educational themes to your curriculum.

Why is water essential to all life?

Life started in water, and the properties of water drove the course of its evolution. About two-thirds of the human body is water. Every living organism needs water to survive. Space probes look for signs of water on other planetary bodies to determine whether they are, or might have been, home to life as we know it.

- **Water is crucial to all ecosystems.** Along with temperature, the presence or absence of water determines what lives where on Earth and in what quantities. Species have adapted exquisitely to an amazing variety of freshwater and marine habitats. The ocean is home to the largest known diversity of life on the planet. Ingenuity enables our species to live in environments that range from very wet to very dry.

How does water shape the planet and regulate its climate?

Water covers more than two-thirds of the Earth's surface, an abundance that is unique in our solar system. It continuously changes from one form to another as it moves through the crust, oceans, and atmosphere in a vast process known as the "water cycle." The oceans store heat in great quantities. By storing and transporting heat, as ocean currents and atmospheric vapor, water is an extremely important modifier and driver of climatic patterns.

- **Earth system processes are made possible by the unique physical and chemical properties of water.** The water molecule (H_2O) is very stable, is an excellent solvent, and requires a lot of energy to change temperature and states. These properties are the basis of the fundamental connection between life and liquid water. Water exists in three states on Earth: liquid (clouds, rivers, and aquifers), gas (water vapor), and solid (ice, snow, glaciers, and icebergs). Unlike most substances, water is less dense in its solid form than in its liquid form.

Tropical cyclones like Katrina, above, are fueled by heat released when moist air rises and the water vapor it contains condenses.

How is water distributed across the planet?

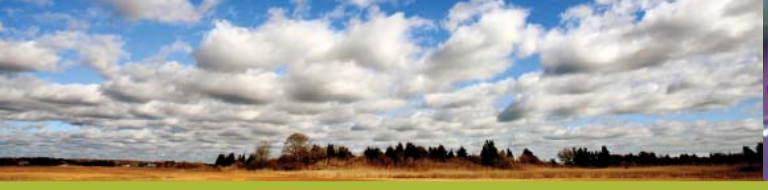
Earth's water is a finite resource. The availability of water on land varies due to weather patterns, evaporation rates, and other factors. Most water is contained in the oceans. Less than 3% of all water on Earth is fresh, and less than one-third of that is liquid.

Drip irrigation systems like this one use tubes or pipes on or under the soil to deliver water. This low-pressure method is efficient and loses less water to evaporation than other forms of crop irrigation.

- **Water fuels the growth of human settlements.** Access to water has shaped the distribution and spread of homes, farms, and cities across millennia. People live along coastlines, rivers, and lakes because water is useful for food, sanitation, transportation, power, and many industrial processes. Where fresh water is not readily available, people have used many technologies to collect and carry it. Its value and beauty make water a potent symbol in many cultures.
- **Freshwater and marine systems are fragile and susceptible to human misuse.** Rivers, lakes, and groundwater can be depleted or polluted, making them unavailable or unsuitable for life. Oceans are under threat from chemical pollution, overfishing, sedimentation, habitat destruction, and other factors. All species, including humans, live "downstream"—all living things use water already used by others. Billions of people live without safe water and sanitation, and global thirst is growing along with the world's population.

How can we be better stewards of our water planet?

We need to use water more efficiently, conserve where possible, protect water quality, and make informed decisions to balance competing demands among species. While the world's aquatic systems have a limited capacity to absorb waste, they can be resilient. Actions we take today can revitalize and sustain this precious resource.



USEFUL TERMS & CONCEPTS

"the commons": any resource—like the oceans and the water we drink—that is shared by a group of people and should be preserved for future generations

conservation: the sustainable use of natural resources

desalination: removing salt, especially from seawater

ecosystem services: benefits obtained from intact ecosystems, such as water purification, waste breakdown, and oxygen production

grey water: wastewater from showers, sinks, and washing machines (not toilets)

groundwater: fresh water that is stored under Earth's surface in aquifers, layers of sand, gravel, or porous rock; groundwater supplies springs and wells

pesticides: any substance intended to kill unwanted organisms, especially insects. They can remain in the food web and water supply, with unintended consequences.

reclaimed water: sometimes called recycled water, this is former wastewater that has been treated and purified for reuse rather than discharged into a sewer or drain.

surface water: fresh water found on Earth's surface, such as rivers, lakes, and reservoirs

sustainable: meeting current needs without losing the ability to meet future needs

virtual water: the volume of water required to produce a commodity or service

wastewater: water, including sewage, that has been used in homes, industries, or businesses and cannot be reused unless it is treated

water cycle: the continuous movement of water between the atmosphere, the land, and the sea

water ethic: the concept that humans must protect the quality and availability of water for all the species that depend on it, now and in the future

water footprint: the total volume of fresh water used to produce the foods and services consumed by an individual or community

water stress: the combination of high human population and low water supply

waterborne disease: a disease caused by microorganisms (such as protozoa, viruses, bacteria, and intestinal parasites), and which is directly transmitted by drinking contaminated water

watershed: all the land drained by a single river system. Large watersheds like the Mississippi River basin contain thousands of smaller watersheds.

wetland: shallow, often intermittently wet habitat, such as a swamp or marsh. Wetlands help filter water, absorb the force of storms and tides, and provide habitat for countless species.

COME PREPARED

Plan Your Visit

- Find information on field trips, reservations, lunchrooms, and more at **amnh.org/education/plan**.
- Look inside this guide and the grade-specific inserts it contains for activities and discussion questions to use before, during, and after your visit.
- Visit **amnh.org/education/water** for an in-depth description of the exhibition, activities, book and web lists, and more.

Making the Most of Your Visit

Teaching in the Exhibition
Designed for an educator leading a small group of students, this section of the guide provides an overview of each area of the exhibition and points out highlights. It also suggests guiding questions to spark an inquiry process in which students ask questions, make observations, and propose explanations.

Self-Guided Exploration
You may wish to have your students explore the exhibition independently using one of the strategies below. The evidence and questions they gather can serve as springboards for follow-up discussions and further research.

- **Museum worksheets:** The inserts provide black-and-white reproducibles that you can distribute.
- **Make your own worksheets:** You can adapt the information and questions in the Teaching in the Exhibition section.
- **Map of the exhibition:** You may wish to distribute copies of the *Water: H_2O = Life* map to the class in advance of your visit. Ask students to choose an area of the exhibit that they find particularly interesting, and to write several questions about it. During your visit, have students look for information across the whole exhibition that helps answer these questions, as well as record new questions that come up.

Your visit to the *Water: H_2O = Life* exhibition can be correlated to the National Science Education Standards listed below. Grade-specific NYC Scope & Sequence units are listed on the inserts. Visit **amnh.org/education/water** for a full listing of relevant NYS Science Core Curriculum Standards, NYC Scope & Sequence, National Curriculum Standards for Social Studies, and NYC Mathematics Standards.

National Science Education Standards

All grades A: Science as Inquiry, Abilities necessary to do scientific inquiry; A2: Understanding about scientific inquiry; E: Science and Technology, Identify a problem and propose a solution, communicate problems, design, and solution
K–4 C1: The characteristics of organisms; C2: Life cycles of organisms; C3: Organisms and environments; D1: Properties of earth materials; E1: Abilities of technological design; E2: Understanding about science and technology; F1: Characteristics and changes in populations; F2: Types of resources; F3: Changes in environments; F4: Science and technology in local challenges
5–8 B1: Properties and changes of properties in matter; C1: Structure and function in living systems; C3: Regulation and behavior; C4: Populations and ecosystems; C5: Diversity and adaptations of organisms; D: Earth and Space Science, Structure of the Earth System; F: Population, Resources and Environments
9–12 C1: Interdependence of organisms; C3: Behavior of organisms; F1: personal and community health; F2: Population growth; F3: Natural resources; F4: Environmental quality; F5: Natural and human-induced hazards; F6: Science and technology in local, national, and global challenges; G1: Science as a human endeavor; G2: Nature of scientific knowledge

Teaching IN THE EXHIBITION

The *Water: H_2O = Life* exhibition is designed to engage all learning styles through hands-on and digital interactives, videos, wall panels, models, specimens, and live animals. This guide divides the exhibition into eight numbered areas, which correspond to the map and to the text below. Each area is supported by an overview, highlights to explore, and guiding questions.

1. Life in Water

All life needs water. This area showcases some unexpected groupings of animals and plants—such as the **wood frog**, **orchid**, **tardigrade**, **kangaroo rat**, **albatross**, **diatom**, and **mud-skipper**—that gather, store, and use water in unique ways.

Exploration:

- **Models and specimens:** Students can compare and contrast the way different plants and animals have adapted to extreme environments such as the driest deserts, the hottest water, and the saltiest seas.

Guiding Questions:

- What would you have to do to be able to live in an environment where all the water was hot or salty?
- Many plants and animals can't live in the extreme conditions depicted here. What physical features enable some organisms to survive where others can't?

Some species never drink! Kangaroo rats get all the water they need from the food they eat.

2. Blue Planet

Water shapes our planet. This area focuses on the extraordinary H_2O molecule, water's dynamic role in Earth processes, and where fresh water is abundant or scarce around the world.

Exploration:

- **Touchable water cycle sculpture:** Students can use their senses to explore water as a liquid, a vapor, and a solid, and can then describe their experience.
- **Science on a Sphere:** Students can watch visualizations on this globe suspended in midair, and consider how water is distributed around the world. Ask students to find their homes on the globe and compare their local water availability to that of other places.

Guiding Questions:

- What are the unique characteristics of water?
- Where is fresh water found?
- What human activities are possible because of the physical properties of water?

3. Water Works

Humans put water to work. This area discusses where fresh water is found, how we collect it, who uses how much, and how it contributes to almost everything we produce and consume.

Exploration:

- **How We Use the World's Water interactive:** With the help of these wall-sized graphs, students can analyze how water is used around the world, who uses more of it, and why.
- **Virtual Water quiz show:** Students can play the game for surprising information about how we use water—and how much! Ask students to list two facts that surprise them.
- **Stories of dams around the world & Removing a Dam interactive:** Students can look at these wall panels and lift the lever on the interactive. Ask them to consider the problems that dams solve and create.
- **Getting Groundwater interactive:** Students can turn the crank to pump water from the well and explore water delivery from an aquifer.

Guiding Questions:

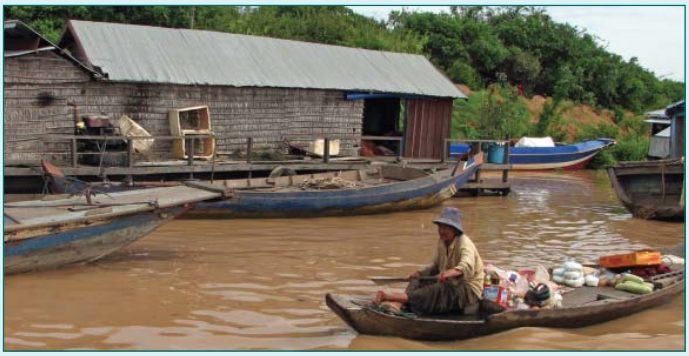
- What do humans use water for?
- How do we put water to work?
- How does technology help us use water more efficiently?
- Why are some technologies less efficient than others?

4. Water Everywhere

Some places or seasons are extremely wet, others very dry. This area explores some of the wettest and iciest places in the world, how species (including humans) have adapted to these extremes, and how climate change is affecting them.

Exploration:

- **Tonle Sap & Arctic ice cap displays:** These models of Cambodia's freshwater fishery and the North Pole give students the opportunity to explore how species adapt to



During Cambodia's monsoon season, the Mekong River runs backwards and Tonle Sap Lake expands. Houses on floats move with the lake's edge.



these environments, why they might be at risk, and the behaviors that are the cause. Ask students to come up with five questions about the animals and plants.

Guiding Questions:
- In what ways does life depend on water?
- How do Arctic species cope with rising temperatures?
- What are some of the many roles that water plays in cultural beliefs?

5. Not a Drop

Half of the world's fresh water can be found in only six countries. Over a billion people do not have access to safe drinking water. This area offers stories from some of the driest locations in the world and examples of technologies that collect and carry water.

Exploration:
- **Stories of water scarcity:** Stories about places such as northern India enable students to explore how gender and age affect access to water. Other panels show technologies that address water shortages in places that include Western Australia, Chile's Atacama Desert, and South Africa. Ask a few student volunteers to talk about times when water really mattered to them. Ask how their stories are different from—or similar to—stories in the exhibition.

Guiding Questions:
- How does access to water influence the way people live?
- How do people use technology to increase access to water?
- How does access to water affect women and children around the world?

The marshlands of Mesopotamia, which cleaned the waters of the Tigris and the Euphrates, were drained during the 1991 Gulf War. They have responded well to reflooding by the native Ma'dan people.

6. Healthy Water

Clean water and good health go hand in hand. This area explores where our drinking water comes from, what's involved in making it safe, and why clean water is so important.

Exploration:
- **Wetlands diorama & bottled water technology:** Students can observe these displays in order to compare natural and industrial ways to purify water.
- **Your Water On Tap interactive:** Students can explore drinking water sources, delivery methods, and wastewater treatment. Ask where the water goes when they flush a toilet.
- **Porous Rocks interactive:** Students can drip water through four rocks of varying porosity to explore how water finds its way underground.

Guiding Questions:
- What makes water clean or dirty?
- Where does our drinking water come from? Where does our dirty water go?
- How can we protect and conserve our drinking water?
- How is water stored and how does it move underground?

7. Restoring Ecosystems

More than any other resource, water exemplifies the ecological principle that all living things are connected. This area demonstrates how aquatic ecosystems are both fragile and resilient.

Exploration:
- **Mesopotamia, Mississippi Delta, & Mono Lake displays:** Students can examine stories from different places to see how local ecosystems have been severely damaged and what programs are now in place to restore them. Ask students to list which parts of the ecosystem are at particular risk, and why.

Guiding Questions:
- How have societies used water throughout history?
- How does water use in one area affect other regions?
- How do tidal wetlands protect us? How can we protect tidal wetlands?

8. Local Story

We are stewards of our water planet. This area features stories of New York residents who are taking action to protect the region's water.

Exploration:
- **What Can We Do? interactives:** Students can use these multimedia stations to discover how much water they use in daily activities. Have students suggest ways in which they could use less water. Ask students to consider making a specific change that would protect and conserve water in their daily lives.

Guiding Questions:
- What are some surprising ways to be more responsible about water use?
- What could you do to reduce water pollution around your home or school?

BACK IN THE Classroom

ACTIVITIES

Animal Story (K-8): Have students create a poster, story, or cartoon strip about an animal from the exhibition. Younger students can draw the animal's home and describe how it uses water. They can also include other living things that share the ecosystem. Older students can describe a day in the life of that animal based on its physical traits and its relationship to water. Request further research if needed.

Write a Letter (K-12): Have students write a letter to their families or local policy makers about what they learned in the exhibit and how they think their families or communities could conserve water.

Water Conservation in School (K-12): Ask students to survey how their school uses water and brainstorm conservation strategies (e.g. fixing leaks, using water fountains instead of bottled water). Encourage them to present the report to your principal.

Watersheds (3-12): Ask students to research their local watershed and water supply on the Environment Protection Agency website (**epa.gov/owow/watershed**). Sample questions: What is a watershed? What is "good" water? How is your water supply tested, cleaned, and treated? How can you protect local resources?

Global Water Issues (5-12): Have students describe and categorize water problems and solutions from around the world. Then quote Einstein: "We can't solve problems by using the same kind of thinking we used when we created them." Brainstorm new solutions. For inspiration, visit Cooper-Hewitt Museum's "Designing for the Other 90%" website (**other90.cooperhewitt.org**) and explore the Water section. As an extension, students can design and build their own water-related inventions.

Bottled Water (5-12): Brainstorm brands of bottled water with students and compile a list on the board. Then conduct a blind taste test that includes tap water and at least three brands of bottled water. Divide the class into teams, assign one brand to each, and ask teams to research how theirs is produced and marketed. Have students include the benefits and disadvantages of using plastic bottles. Ask them to compare the cost to that of orange juice and gasoline.

DISCUSS THE EXHIBITION

Build on what your students learned at the Museum with these conversation starters.

- What did you learn about water that surprised you?
- How do your actions affect how much water you use? What future choices could you make to protect this valuable resource?
- How would your life change if you didn't have access to water? What would you be willing to give up?
- Who owns water? Who competes for it? Is water a public or private resource?
- Is clean water a human right?
- How can we balance human use of natural resources while still preserving them?

ONLINE RESOURCES

- **Water for Educators:** amnh.org/education/water
  You'll find an in-depth description of the exhibition, activities, book and web lists, and more.
- **Water OLogy:** amnh.org/ology/water
  Younger students can explore interactives such as "Living on Ice" and find fun Stuff-to-Do activities.
- **Science Bulletins:** amnh.org/sciencebulletins
  Students can examine current research about water through videos and interactives.
- **Your Water On Tap:** amnh.org/education/waterontap
  Students can explore how drinking water is delivered and treated, and how wastewater and stormwater is processed.

Who Owns Water? (5-12): Divide the class into two teams, one representing corporations (for which water is a commodity to be bought and sold) and the other the people (for whom water is an inalienable individual and collective right). Have each team research its side of the issue. Ask them to debate "Who Owns Water?"

Credits

Water: H_2O = Life is organized by the American Museum of Natural History, New York (www.amnh.org), and Science Museum of Minnesota (www.smm.org) in collaboration with Great Lakes Science Center, Cleveland; The Field Museum, Chicago; Instituto Sangari, São Paulo, Brazil; National Museum of Australia, Canberra; Royal Ontario Museum, Toronto, Canada; San Diego Natural History Museum; and Singapore Science Centre with PUB Singapore.

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WATER: H_2O = Life

Grades K–4

BEFORE YOU VISIT

These discussion questions and activities are designed to spark your students' interest in the exhibition and to prepare them for the concepts they'll encounter. You may wish to review the material prepared for other grade levels as well, and adapt them for your class.

Discussion

To start your students thinking about what they'll encounter in the exhibition, ask one one or more of the following questions:

- What are some activities, such as sports and games, that are possible because of water?
- How do you use water? Where do you use it?
- What would your day be like if you lived in a house without running water?
- Who or what uses water on our planet?
- Where on Earth do we find water? What about fresh water?
- Where does water go when it evaporates? What role does the Sun play in this process? Where does rainwater come from? How do clouds form?
- Would you drink water out of a puddle? Why or why not?
- Where do you find dirty water in your home? Clean water?
- Why is it important not to waste water?

Activities

Fresh Water vs. Salt Water

Objective: To demonstrate that fresh water is a limited resource

Procedure:

1. Using a world globe or map, discuss the differences between fresh water and salt water, where each is found, and their uses.
2. Fill a one-gallon container with water. Have students imagine that this container represents all of Earth's water. Ask how much of it would be fresh water.
3. Pour about a half-cup of water into a glass. Explain that this water represents all the fresh water on Earth. About two-thirds of it is locked in icecaps and glaciers, and less than one-third of it (about 2.5 tablespoons) is liquid fresh water available for use. Point out that what remains in the container represents the 97% of the world's water, which is found in the oceans.

Water Cycle

Objective: To review the three phases of water

Procedure:

1. Review the water cycle with students. Hand out ice cubes and cups of water and ask students to make observations of how they differ. Then, to demonstrate the third phase, heat the ice cubes in a pot or electric kettle until the water boils and steam can be observed.
2. Ask students to list where they encounter these different phases of water, both inside and outdoors.

You can visit the **US Geological Survey** website at **ga.water.usgs.gov/edu/watercycle.html** to download a colorful water cycle diagram in over 50 languages.

NEW YORK CITY SCOPE & SEQUENCE

Your visit to the ***Water: H_2O = Life*** exhibition can support the teaching of the following units.

Kindergarten
- **Unit 1:** Exploring Properties
- **Unit 4:** Trees Through the Seasons
- **Unit 3:** Animals

Grade 1
- **Unit 1:** Properties of Matter

Grade 2
- **Unit 2:** Earth Materials
- **Unit 3:** Plant Diversity

Grade 3
- **Unit 1:** Matter
- **Unit 4:** Plant and Animal Adaptations

Grade 4
- **Unit 1:** Animals and Plants and Their Environment
- **Unit 3:** Properties of Water: What Makes Water So Special?
- **Unit 4:** Interactions of Air, Water, and Land

Visit **amnh.org/education/water** for a full listing of relevant:
- National Science Education Standards
- New York State Science Core Curriculum Standards
- New York City Scope & Sequence
- National Curriculum Standards for Social Studies
- New York City Mathematics Standards

WATER: H_2O = Life Student Worksheet

1. Explore Animals

Pick two animals from the exhibition and draw them. (They can be live animals, specimens, or models.)

Animal: _____

Describe where it lives: _____

_____

How does it use water? What adaptations help it survive?

_____

_____

Animal: _____

Describe where it lives: _____

_____

How does it use water? What adaptations help it survive?

_____

_____

2. Explore the Water Cycle

Go to the **Blue Planet** area of the exhibit. Then find the **water cycle sculpture**. This model shows three forms of water. Use your senses to describe water as a solid, a liquid, and a vapor.

Solid: _____ **Liquid:** _____ **Vapor:** _____

_____ _____ _____

_____ _____ _____

What activities in our lives are possible because of water, in solid, liquid, and vapor form?

Solid: _____ **Liquid:** _____ **Vapor:** _____

_____ _____ _____

_____ _____ _____

3. For Further Exploration

As you walk through the exhibition, think of things about water that make you curious. On the back of this sheet, write down five or more questions you have about water.

WATER: H_2O = Life

Grades 5–8

BEFORE YOU VISIT

These discussion questions and activities are designed to spark your students' interest in the exhibition and to prepare them for the concepts they'll encounter. You may wish to review the material prepared for other grade levels as well, and adapt them for your class.

Discussion

To start your students thinking about what they'll encounter in the exhibition, ask one one or more of the following questions:

- What are some activities, such as sports and games, that are possible because of water?
- How have you used water this week? What would your day be like if you lived in a home without running water?
- In what ways does life depend on water? What are some of the things that would happen if the water supply diminished?
- How do industry and agriculture depend on water?
- Where on Earth is water found? What about fresh water?
- How does water move? How does it change? How does it affect the land?
- Where does the water that we use at school and at home come from? Where does it go after we're done with it?
- Is clean water a human right? Who owns our water?
- Why is it important not to waste water?

Activities

What Does Water Weigh?

Objective: To experience the weight of water and consider its importance in daily life

Procedure:

1. Fill several gallon-sized milk containers with water and pass them around the room. Make sure the tops are sealed tightly.
2. Ask students to guess how much a gallon of water weighs. Then reveal the answer: a gallon of water weighs approximately 8.34 pounds.
3. Brainstorm a list of ways we use water each day with your students.
4. Tell students that in some parts of the world, water needs to be carried home from sources that are often several miles away. People, typically women and girls, may make multiple trips in order to provide enough water for entire families.
5. The average amount of water a New York City resident uses in the home every day is about 60 to 70 gallons. Ask students how their own habits might change if they had to carry home the gallons of water they use every day.

How Much Water Do We Use?

Objective: To visualize daily water consumption

Procedure:

1. Have a student brush, or pretend to brush, his or her teeth for two minutes, first with the water running and then with the tap or keg turned off between rinses.
2. Collect, measure, and compare the water used during the two experiments.

You and your students can visit the **H_2O Conserve** website at **H2Oconserve.org** to calculate your water use and learn how to conserve this valuable resource.

NEW YORK CITY SCOPE & SEQUENCE

Your visit to the ***Water: H_2O = Life*** exhibition can support the teaching of the following units.

Grade 5
- **Unit 3:** Food and Nutrition
- **Unit 4:** Exploring Ecosystems

Grade 6
- **Unit 2:** Weather
- **Unit 4:** Interdependence

Grade 7
- **Unit 1:** Geology
- **Unit 2:** Interactions Between Matter and Energy

Grade 8
- **Unit 2:** Humans and Their Environment: Needs and Tradeoffs
- **Unit 3:** Earth, Sun, Moon System

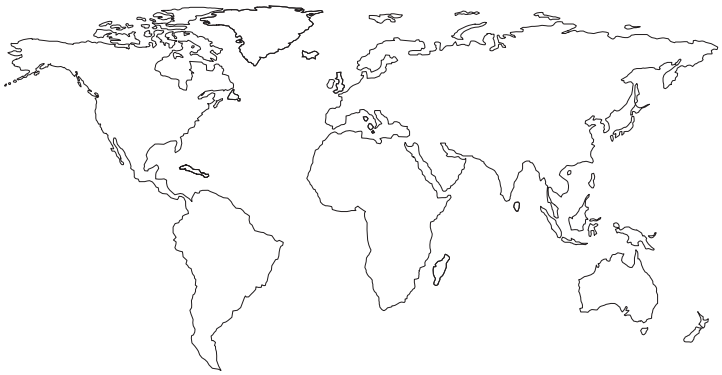
Visit **amnh.org/education/water** for a full listing of relevant:

- National Science Education Standards
- New York State Science Core Curriculum Standards
- New York City Scope & Sequence
- National Curriculum Standards for Social Studies
- New York City Mathematics Standards

WATER: H_2O = Life Student Worksheet

1. Explore Animals and Adaptations

Pick three animals from the entire exhibition. (They can be live animals, specimens, or models.) Mark where they live on the map. For each animal, describe [A] its habitat, [B] the physical characteristics that help it adapt to its environment, and [C] other organisms that compete for water in the same ecosystem.



Animal: _____

[A] Habitat: _____

_____

[B] Physical Characteristics: _____

_____

[C] Competing Organisms: _____

_____

Animal: _____

[A] Habitat: _____

_____

[B] Physical Characteristics: _____

_____

[C] Competing Organisms: _____

_____

Animal: _____

[A] Habitat: _____

_____

[B] Physical Characteristics: _____

_____

[C] Competing Organisms: _____

_____

2. Explore Global Water Problems & Solutions

The exhibition tells stories of how people around the world use water. Read about local stories from the **Water Works**, **Not a Drop**, and **Water Everywhere** areas of the exhibit.

Describe an example of how technology helps people use water efficiently.

_____

_____

_____

_____

Describe an example in a different part of the world where technology has had a negative effect.

_____

_____

_____

_____

3. For Further Exploration

As you walk through the exhibition, think of things about water that make you curious. On the back of this sheet, write down five or more questions you have about water.

WATER: H_2O = Life

Grades 9–12

BEFORE YOU VISIT

These discussion questions and activities are designed to spark your students' interest in the exhibition and to prepare them for the concepts they'll encounter. You may wish to review the material prepared for other grade levels as well, and adapt them for your class.

Discussion

To start your students thinking about what they'll encounter in the exhibition, ask one one or more of the following questions:

- What are some activities, such as sports and games, that are possible because of water?
- How long could you live without water?
- How does access to water affect your day-to-day existence? How would your life change if water became scarcer, or was not clean?
- Where does the water that we use at school and at home come from? Where does it go after we're done with it?
- How do humans change the quality of water?
- What do you know about water as a resource?
- How does water affect where people settle? How do these patterns of growth affect the environment?
- Is clean water a human right? Who owns water?
- Why is it important not to waste water?

Activities

Water Calculator

Objective: To visualize daily water use

Procedure:

1. Ask students to list all the ways they use water. Have the class share responses and compile them on the board.
2. Break students into teams and ask them to estimate how much water each activity requires.
3. Ask teams to visit the **US Geological Survey Water Calculator** website at **ga.water.usgs.gov/edu/sq3.html** to calculate how many gallons of water each student uses per day.
4. Ask teams to compare their individual results. Have them share ways in which they can conserve water, and recalculate their water use.

Water Footprint

Objective: To understand how much water is required to produce what we consume

Procedure:

1. Visit **waterfootprint.org** and select ten or more products from the Product Gallery. Print each product page, which includes an image and its water footprint data. Post them on the board. You may wish to cover up the data.
2. In a class discussion, point out one product image. Ask students to list all the ways in which water is involved in producing that product, and estimate how many gallons of water are used in its production. Reveal the actual total.
3. Have students pick three other products that interest them and make similar lists and estimates.
4. Have students compare their estimates with the actual data, and ask them to write a reflection about any findings that surprise them.

NEW YORK STATE SCIENCE CORE CURRICULUM STANDARDS

Your visit to the ***Water: H_2O = Life*** exhibition can be correlated to the following standards.

The Living Environment
Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.
Key Idea 1: 1.1b, 1.1c, 1.1d, 1.1e, 1.1f
Key Idea 5: 5.1a, 5.1b, 5.1c, 5.1d
Key Idea 6: 6.1a, 6.1b, 6.1c, 6.1d, 6.2b, 6.3a, 6.3c
Key Idea 7: 7.1a, 7.1b, 7.1c, 7.2a, 7.2b, 7.2c, 7.3a, 7.3b

Physical Setting/Earth Science
Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.
Key Idea 1: 1.1a, 1.1i, 1.2e, 1.2f, 1.2g
Key Idea 2: 2.1a, 2.1c, 2.1d, 2.1i, 2.1u, 2.2b, 2.2c

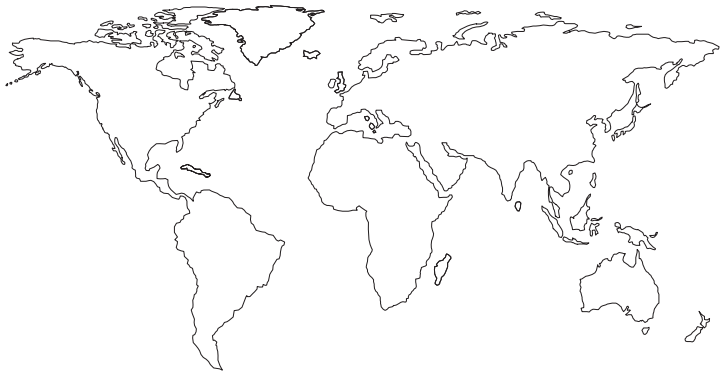
Visit **amnh.org/education/water** for a full listing of relevant:

- National Science Education Standards
- New York State Science Core Curriculum Standards
- New York City Scope & Sequence
- National Curriculum Standards for Social Studies
- New York City Mathematics Standards

WATER: H_2O = Life Student Worksheet

1. Explore Global Water Problems & Solutions

This exhibition tells stories of how people around the world use water. Read about local stories from the **Water Works**, **Not a Drop**, and **Water Everywhere** areas of the exhibit. Pick two cities or countries to investigate and mark their locations on the map.



What problems are unique to each?

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_____

_____

What role does local technology play in helping people use water efficiently?

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_____

What are some examples of the negative effects of technology?

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2. Explore Water Quality

Go to the **Healthy Water** area of the exhibition to explore our drinking water.

Where does bottled water come from? What are its effects, both beneficial and harmful, on humans and on the environment?

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_____

_____

Compare the ways in which bottled and tap water are produced, how safe they are, and how they affect the environment.

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_____

3. For Further Exploration

As you walk through the exhibition, think of things about water that make you curious. On the back of this sheet, write down five or more questions you have about water.