



Discovery Lesson

TEACHER ENRICHMENT RESOURCE PACKET

Water and the Water Cycle Exhibition

Water covers nearly three fourths of the Earth's surface. Explore the physics of floating and sinking, the biology of aquatic life forms, and the geology of streams and oceans. Discover the fascinating features of our nearby waterways and how the choices we make can affect us locally and globally. Learning objectives:

- Learn about the water cycle,
- Explore special adaptations of aquatic animals,
- Investigate karst landscapes and erosion.

Think it.
Try it.
Explorit.

contents

Learning Objectives	1
Background Information & Classroom Activities	2-4
Vocabulary	5
Supplemental Resources	6
Science Standards	7

Background Information "Our World in Water"



Thank you for choosing Explorit Science Center's *Discovery Lesson* program to supplement your ongoing science curriculum. Whether you use the program to kick off a new unit, wrap up a nearly completed unit, or purely to excite and interest your students in the wonderful world of science, advance preparation and follow up with your students are critical to achieving the greatest educational benefit from this unique science experience.

Explorit provides two resources to help prepare you and your students for the *Discovery Lesson*. First, simple logistics of the program are detailed in the confirmation letter. Second, this Teacher Enrichment Resource Packet outlines appropriate science content and processes to help you:

- successfully prepare your students prior to visiting Explorit;
- participate fully in the *Discovery Lesson* yourself; and
- follow-up with your students back in the classroom.

Nearly three fourths of the earth's surface is covered in **water**. Water exists all around us; falling from the sky, deep within the earth, crashing as waves against shorelines, and in us. There are three forms that water exists in: solid, liquid and gas. Water in its solid form is **ice**, and water in gas form is **steam**. A water molecule is made of two hydrogen atoms and one oxygen atom. Hydrogen and oxygen are abundant in space, therefore, water is also found in the Universe in solid and vapor forms.

The study of the movement of water on earth is called **hydrology**. The **hydrologic cycle**, also the **water cycle**, describes the movement of water through the atmosphere and earth. There is no start or end to the water cycle, and water can change between all three forms depending on stage of the water cycle. The water cycle is driven by the sun, which provides the heat and energy to change the form of water. Sun's energy heats up water in oceans, lakes and rivers causing **evaporation**, the changing of water from liquid to vapor.

The water vapor in the atmosphere begins to cool and, if cooled enough, will **condense** into clouds. **Condensation** is the transformation of water vapor into liquid water, producing clouds, fog, and morning dew.

All known life forms depend on water. Consequently, life is only found where there is water. Water is essential for chemical reactions within life forms, and is necessary for metabolic processes. The fact that Earth is the only planet with substantial liquid water is believed to be an important factor for why life exists on this planet and not others.

Humans get most of their water by drinking it. About 20% of our water intake comes from the foods we eat. Humans lose water through sweat, urine, and **respiration**. Many factors affect **hydration**, including humidity, temperature, activity level, metabolic rate, and others. It is important to drink water and maintain hydration; **dehydration** can be life threatening.



JELLYFISH ARE MADE
OF 94-98%
WATER!

The human body is approximately 60% water, and is found in our blood, lubricating our joints, and in our breath, just to name a few.

Plants also require water for survival. **Photosynthesis** is how plants make their own food. Using the sun's energy, carbon dioxide, and water, plants create a sugar to provide energy for growth. Like humans, plants also lose some water into the atmosphere. Plants release water vapor through their leaves using a process called **transpiration**.

Aquatic animals have developed special adaptations that enable them to live in water. One example is gills on a fish, allowing it to extract oxygen from the water. Another, very impressive, example are **swim bladders** in fish. These are internal, gas filled sacs that allow a fish to ascend, descend, and stay at constant depths without exerting much energy. The fish, using its swim bladder, can control **buoyancy**, the upward force on an object in liquid.

Gas enters the bladder through a gas gland, which is fed by oxygen-rich blood, causing the fish to become more buoyant, and begin to ascend. In order for a fish to descend it releases gas from the bladder back into its bloodstream.

Water is also an important factor in landscape shaping through **erosion**. Over time, moving water has power to reshape the land. Rivers carve their way through the earth, rushing down mountains and meandering through valleys. Wave action also sculpts shorelines and cliffs.

Most of the surface of the earth is covered in water. However, 97% of the water on earth is in the oceans, making it inconsumable to humans. 2.4% of the water is frozen in glaciers and ice caps, rendering it unavailable. Only 0.6% of the water on earth is available for human use! As it is a limited resource, and required for life, it is crucial to make conservative choices when it comes to water use.

Classroom Activity #1

ACTIVITY #1 CARTESIAN DIVERS

Background: Sinking and floating depend on three main factors: salinity, temperature, and density. This activity will investigate sinking and floating depending on density. The density of an object equals mass divided by volume ($D = m/v$).

Materials: soy sauce or ketchup packets, paperclips, 1 or 2 liter bottles with caps, water.

1. Put a paperclip at one end of packet. Put packet into an empty bottle.



Classroom Activity #2

2. Fill bottle with water until completely full, and screw on cap tightly.
3. Squeeze the bottle. What happens? What happened to the air bubble in the packet?

What is happening? As the bottle is squeezed, pressure increases inside the bottle. The increased pressure causes the volume of air in the packet to decrease. As volume decreases and mass stays constant, the density of the packet increases (Remember, $D = m/v$). When the density of the packet becomes greater than the density of the water, the packet will sink.

Follow up: If experiment is not working well, try different packets. The amount of air in the packets will vary, and can affect the experiment.

ACTIVITY #2 CHEMICAL EROSION

Background: Some rocks, most notably limestone but also various mineral salts, are water-soluble—they dissolve in water. This activity looks at the way that water affects the landscape and how it changes overtime.

Materials: Brown sugar or sugar cubes, pitcher of water or squirt bottle, baking sheet or pan, modeling clay.

1. Build a landscape out of brown sugar or sugar cubes.
2. Pour water across the landscape and observe the changes. How did the water affect the landscape?
3. Build a second landscape and cover part of it with modeling clay. Pour water again and compare the region where clay is covering the sugar with the region where there is sugar at the surface.
4. Now poke some holes through the clay to allow the water to seep through. What is happening beneath the clay?

Follow up: Karst landscapes like those of southern China have been shaped by chemical erosion. Subterranean caverns are often created by limestone erosion. Florida, Ireland, and England have extensive karst landscapes. What would happen if you built a house on top of a layer of water-soluble rock? What if there was a layer of water-soluble rock 100 feet below your house?

THE AVERAGE AMERICAN
USES 100 GALLONS OF
WATER A DAY!



Vocabulary

This list includes words that may be used during the *Discovery Lesson*. Specific vocabulary used depends on students' grade level and prior knowledge.

Buoyancy– the ability to float in water

Condensation – water that collects in droplets on a cold surface when humid air is in contact with it

Dehydration – the condition in which the loss of bodily fluids, mostly water, exceeds intake

Erosion – the wearing away or breaking down of the Earth's surface by wind, water, or other natural forces

Evaporation – the process of a liquid transforming into a gas through increased heat or pressure

Humidity – a measurement of the amount of water vapor in the atmosphere or a gas

Hydration – the condition in which a living being has enough body fluids to carry out normal life functions

Hydrologic Cycle – describes the movement of water through the atmosphere and Earth

Hydrology – the study of the movement of water on Earth

Ice – water in its solid state

Photosynthesis – the process by which plants use water, carbon dioxide, and the sun's energy to make their own food

Respiration – the production of energy through the exchange of oxygen and carbon dioxide

Steam – water in its gaseous form

Swim Bladder – internal, gas filled sacs that allow a fish to ascend, descend, and stay at constant depths without exerting much energy

Transpiration– the process by which moisture is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere

Only 1% of the water on Earth is considered potable!



Supplemental Resources

BOOKS

Albert, Richard E. **Alejandro's Gift**. Chronicle Books, 1994.

A heartwarming tale of the central importance of water for all life in every ecosystem.

The Blue Planet: Seas of Life, Ocean World. Scholastic Inc., 2001.

Fascinating exploration of the world's oceans as habitats and ecosystems. Lots of wonderful pictures. An accompaniment to the Discovery Channel program The Blue Planet.

Jennings, Terry. **The Young Scientist Investigates: Water**. Childrens Press, 1982.

Thorough and child-friendly explanations of the physical properties of water and its many uses in our world. Includes hands-on activities using everyday materials that students can try themselves.

Moore, Jo Ellen and Joy Evans. **Water**. Evan-Moore Educational Publishers, 1986.

Activity workbook on water's three states of matter: solid, liquid, gas with a variety of activities and experiments that can be done individually or as a class.

Peters, Lisa Westberg. **Water's Way**. Scholastic Inc., 1991.

One boy's exploration of water in its three states through the course of a day. Reinforces the ubiquity of water and its many roles in our lives.

Project Wet Curriculum and Activity Guide 2.0. Project Wet Foundation, 2011.

Exhaustive curriculum for hands-on water activities for all grade levels covering water's physical and chemical properties; its use and management as a natural resource; its role in human, animal and plant biology; and its social and cultural values.

WEB SITES

<http://water.usgs.gov/edu/>

Exhaustive, multilingual site with tons of background information and classroom resources.

<http://water.usgs.gov/edu/propertyou.html>

Fun facts and charts about the human body's use of water.

Science Standards

NGSS STANDARDS

Physical Science (K-PS3-1, 1-PS4-2, 2-PS1-2, 2-PS1-4, 4-PS4-1, 5-PS1-4)

Life Science (K-LS1-1, 2-LS2-1, 2-LS4-1, 3-LS3-2, 3-LS4-1, 3-LS4-3, 3-LS4-4, 4-LS1-1)

Earth Science (K-ESS2-1, K-ESS3-1, K-ESS3-3, 2-ESS1-1, 2-ESS2-1, 2-ESS2-2, 2-ESS2-3, 3-ESS3-1, 4-ESS2-1, 4-ESS2-2, 4-ESS3-2, 5-ESS2-1, 5-ESS2-2, 5-ESS3-1)

Engineering and Technology Applications in Science (K-2-ETS1-1, 3-5-ETS1-1, 3-5-ETS1-2)

Explorit Programs for Schools and Groups

At Explorit's Site

Discovery Lessons

Visit our current museum exhibition

Inquiry Labs

Try a series of team challenges

Nature Safaris

Spring visits to Explorit's outdoor spaces at Mace Ranch Park

Explorit in Your Classroom

Classroom Adventures

Explorit educators visit your classroom for hour-long presentations

For the Whole School

Health in Your World

Learn about keeping your body and the world healthy and safe

Science in Your World

The ultimate family science night

Reservations required.

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