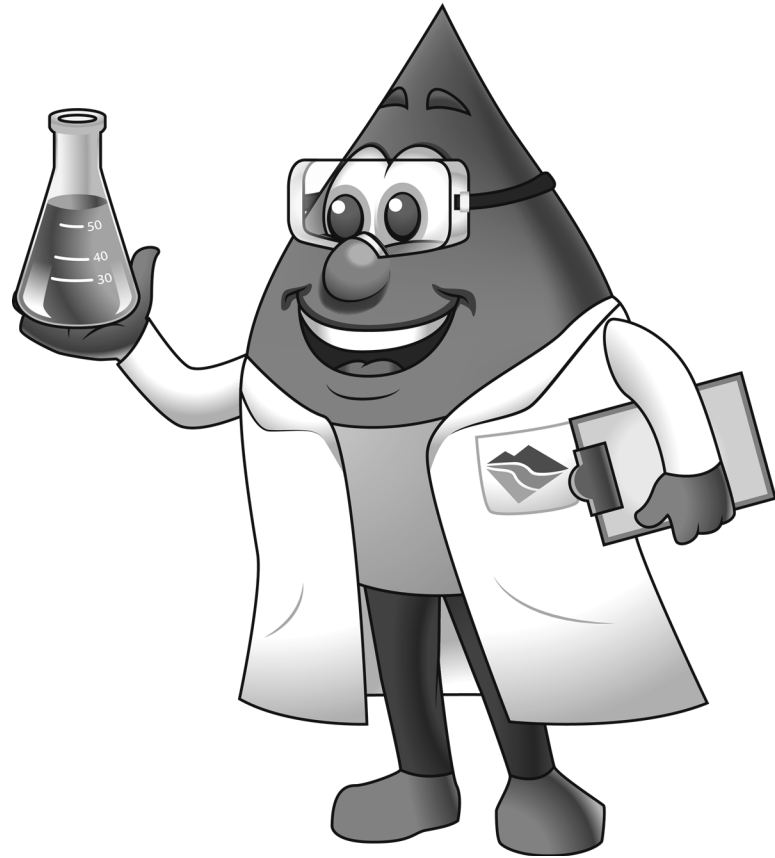
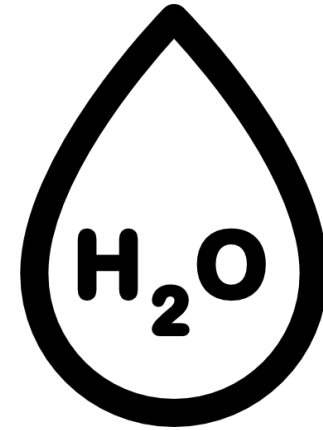


# Keep Exploring!



# THE WONDERS OF WATER



Name: \_\_\_\_\_

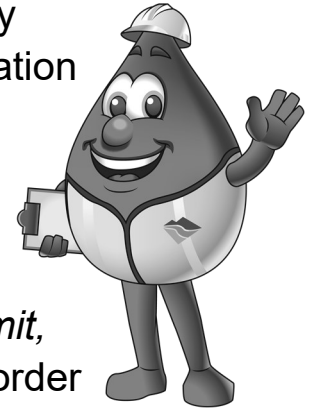
To explore other curriculum and activities developed by  
Central Utah Water Conservancy District head to:  
<https://cuwcd.com/education.html>

 Central Utah Water STEM Club Passport

# Who is Central Utah Water?



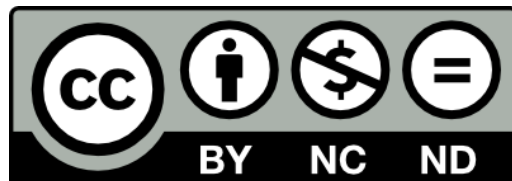
Central Utah Water Conservancy District is a government organization with the mission to move water across county boundaries. We have 8 counties located within the District (*Duchesne, Juab, Salt Lake, Sanpete, Summit, Uintah, Utah, and Wasatch*). In order to meet our mission of moving water, Central Utah Water stores water in 9 reservoirs, maintains over 180 miles of large diameter pipelines, and runs 3 regional drinking water treatment plants.



In addition to our primary responsibility to move water, Central Utah Water is the second largest producer of hydropower in the State of Utah, works to protect endangered species, supports community based water conservation projects, and is a regional leader in water education.

To learn more about Central Utah Water and our work in the community go to [CUWCD.com](http://CUWCD.com)

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Central Utah Water Conservancy District  
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## Further Adventures



Just because this club is done, doesn't mean you have to end the fun! H<sub>2</sub>Joe has done his research and found you a bunch of other water science and chemistry related activities and games that you can do at home.



### ACS - Outer Space Molecule Chase

<https://www.acs.org/content/acs/en/education/whatischemistry/adventures-in-chemistry/games/outer-space-molecule-chase.html>



### Bozeman Science - Water, A Polar Molecule

<https://www.bozemanscience.com/water-a-polar-molecule>



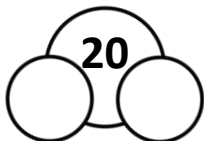
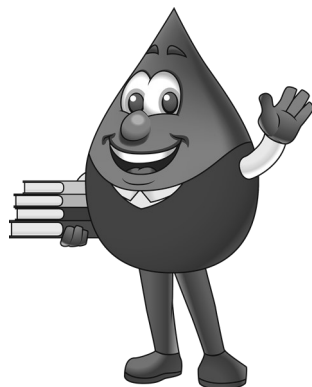
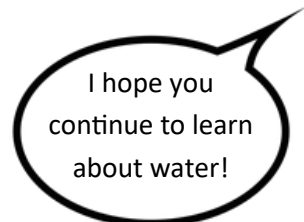
### National Geographic - Weathering and Erosion

<https://www.nationalgeographic.org/interactive/walters-travels-weathering-and-erosion/>



### NASA - Water Cycle WebQuest

<https://gpm.nasa.gov/education/interactive/water-cycle-webquest>



Welcome to the Wonders of Water STEM Club! Together we will be tackling 4 unique activities, each one exploring a different property of water. If you work as a team to defeat all 4 challenges a special surprise will greet you at the end of the club. So put on your 'science goggles' and let's dive into water chemistry!



### Activity 1 - The Universal Solvent



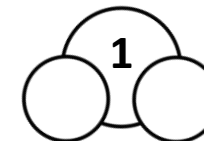
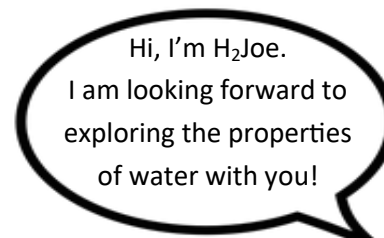
### Activity 2 - Defier of Gravity

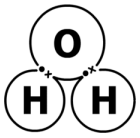


### Activity 3 - Master of Many States



### Activity 4 - Sculptor of Landscapes





# The Universal Solvent

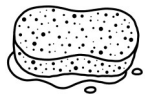
Water is known as the Universal Solvent, because it has the ability to dissolve more substances than any other chemical. Water gains this special chemical property from its molecular shape and charge. A water molecule is made of two positively charged hydrogen atoms and one negatively charged oxygen atom.

## For The Solvent Activities I Need...

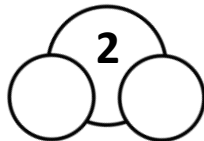
- 4 - Clear Cups
- Cold Water
- Spoon
- Hot Water
- Food Coloring
- Solvent/Solute/Solution Cards
- 1 Cup Table Salt

### FUN FACT

Water is an amazing solvent, but it isn't the only one you can find in your home. Some other common chemical solvents are...Rubbing Alcohol (*Ethanol*),



Vinegar (*Acetic Acid*), and  
Fingernail Polish Remover (*Acetone*)



# Exploring Water



Solve the Cryptogram below to unlock a passport related secret message.

$\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$   
 14   12   17   10   9,

$\overline{\quad}$     $\overline{\quad}$    5   19   10   9,

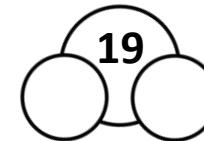
$\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$   
 26   24   14,

$\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$   
 10   18   10   14

$\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$   
 24   17   17

$\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$     $\overline{\quad}$   
 3   24   18   18   11   12!

A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
V	W	X	Y	Z					





# Exploring Water

We have learned a lot of water terms in this club.  
Try to find 20 of them in the wordsearch below!



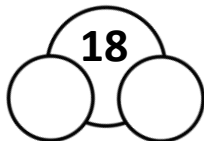
G N M V Y Q A M S T N E V L S  
 T E O O I T G Y H T V Q S O K  
 S E O I L P I R C E W U L T Z  
 Y Y H M S E D S N G K I S A G  
 R F P W O O C I N U D L X R Y  
 A R H H T R R U G E G I G Y V  
 L N R C O A P R L N D B E K F  
 L Y D D M N D H O E J R T A Q  
 I L I Q U I D I O C G I U R O  
 P S I P R M T T V L L U L S W  
 A O Z O K U V T A S O M O T N  
 C L A O L X E C A V C G S P F  
 P V R O Q H I T Y Y B J I A A  
 C E S T Q A U D H W J Y Y S Y  
 G N A Q L R N O I S O R E G T  
 L T O G A H E E Z J F J W Q D  
 T H V T J W Y Y W C B M U X P  
 Q P I H S A L P S N I A R E Z  
 Z O A L L U V I A L C C B E J  
 N B F G B R P O V M B W E N S



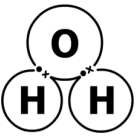
ALLUVIAL  
 CAPILLARY  
 CORROSION  
 DENSITY  
 DOCTOR  
 EQUILIBRIUM  
 EROSION

GAS  
 GEOMORPHOLOGIST  
 GLACIAL  
 KARST  
 LIQUID  
 MARINE  
 MOLECULE

RAINSPLASH  
 SATURATION  
 SOLID  
 SOLUTE  
 SOLUTION  
 SOLVENT  
 SYPHON



# The Universal Solvent



Water likes when chemicals are evenly mixed. When a chemical is added to a glass of water, molecular movement will gradually move chemical from areas where it is highly concentrated (lots of chemical) to areas where there is a low concentration (small amounts of chemical). This process is called diffusion and when all the chemical is equally mixed it is called equilibrium.

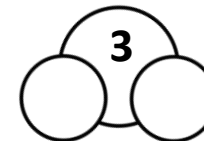
**What happened when you created a solution?**

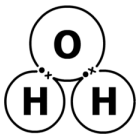
**How long did it take the solution to reach equilibrium?**

**What happened when you stirred your solution?**

**How long did it take the stirred solution to reach equilibrium?**

**What other actions could you take to help a solution reach equilibrium?**





# The Universal Solvent

Water is a powerful solvent...but even the most powerful solvent has its limits. When a solvent cannot dissolve any more solute, then the solution has reached saturation. Together we will measure how much solute (salt) a solvent (water) can dissolve before becoming a saturated solution.

## Hot Water

Number of teaspoons of salt added

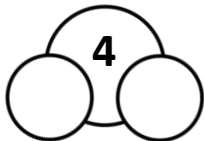
Observations

## Cold Water

Number of teaspoons of salt added

Observations

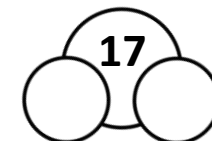
Using what you learned in this experiment, what earth environments do you think you would find saltiest natural water body?



# Sculpture of Landscapes



Now that you know how water forms different shapes on the landscape, it is your turn to be a geomorphologist. Take a look outside and sketch a water formed geologic feature you see.

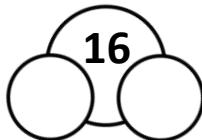


# Sculptor of Landscapes

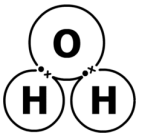
Once water has landed on the earth's surface, there are all sorts of types of erosion it can cause. In order to study all of these geologic processes, geologists grouped them based on shared traits and gave them special scientific names.

Draw a line between the scientific name and the landscape it represents.

Alluvial	
Corrosion	
Freeze Thaw	
Marine	
Glacial	
Karst	



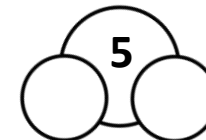
# The Universal Solvent



While water is earth's most common solvent, we interact with a lot of different solvents in day to day life. In this activity we will combine solvents and solutes to create different solutions.

Draw a line that connects the solvent and solute to the solution they create.

Solvent	Solute	Solution
Copper	Carbon Dioxide	Brass
Hydrogen	Oxygen	Bronze
Mercury	Silver	Dissolved Oxygen
Neon	Sucrose	Heliox
Nitrogen	Tin	Neonox
Water	Zinc	Nitrox
		Silver Amalgam
		Soda Water
		Sugar Water





## Defier of Gravity

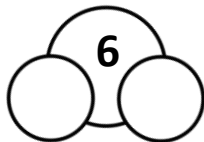
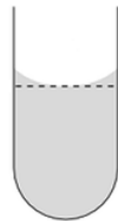
While water chemistry is amazing...the physics of water can be just as cool. From surface tension to capillary action, the bipolar water molecule has an ability to move uphill defying gravity by sticking onto surfaces or even other water molecules.

### For The Gravity Activities I Need...

- Coin
- Water
- Eye Dropper
- Tape
- Plate
- Straws
- Food Coloring
- 2 Cups
- Coffee Filter

### Fun Fact

You don't have to run an experiment to see water defy gravity! Next time you drink a glass of water take a close look at where the water meets the cup. The water's surface tension causes it to stick to the glass. This phenomenon is called a meniscus.



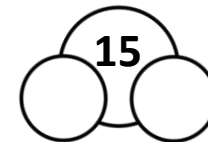
## Sculptor of Landscapes



In most places around the world, erosion starts with a single raindrop. These drops of water may be small, but they can smash into the ground at over 25 meters per second (that is about 56 miles per hour). This phenomenon is called rainsplash erosion.

### Draw Or Describe Your Rainsplash Experiment Observations Below:

	Dry	Leaf Litter	Wet
1 Inch			
1 Foot			
Maximum Height			







# Sculptor of Landscapes

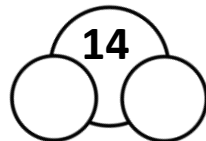
Throughout this passport we have been exploring the remarkable characteristics of water. In this activity, we will learn how water has used those characteristics and forces to impact our planet and carve out landscapes.

## For The Erosion Activities I Need...

- Pie Tin
- Eye Dropper
- Water
- Leaves

### Fun Fact

Water has sculpted some of earth's most incredible vistas... but it is a process that takes time. Geologists estimate that it took water at least 6 million years (and possibly as long as 17 million years) to carve the Grand Canyon.



# Defier of Gravity



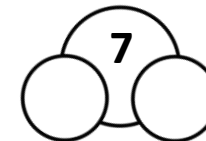
Have you ever seen a water strider walking across a puddle? That insect is able to pull off the feat because water loves to stick to itself in a process called surface tension. In this experiment we will try to push surface tension to it's limits.

Trace and label the coin you will be using for this experiment.

Using the eye dropper try to drop water on the coin as high up as you can do accurately. How many drops of water can you put on the coin before it flows off?

Now using your eye dropper, try to add water as close as you can to the coin. How many drops of water can you put on the coin before it flows off?

Where you able to put more water on the coin when you added it close to the coin or high up?

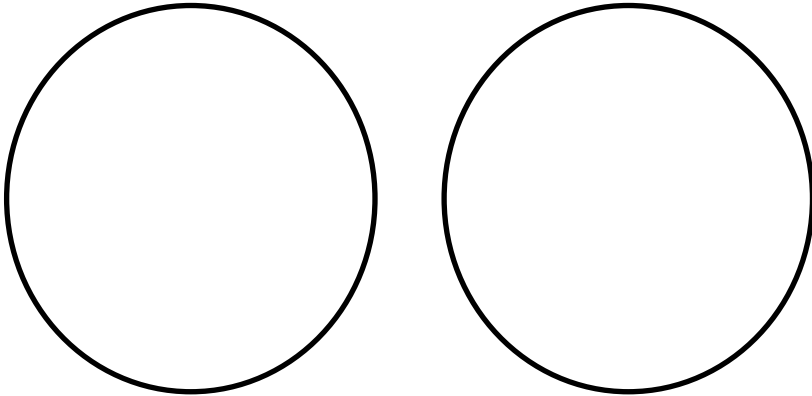




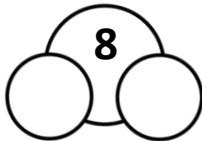
## Defier of Gravity

Humans and insects are not the only living things that have learned to master water's ability to defy gravity. Plants use water's hydrogen bonds to move it from its roots to upper branches and leaves. The process the plant uses to pull water upward is called capillary action.

Draw The Pattern Produce By Capillary Action Below:



Describe Your Capillary Action Observations Below:

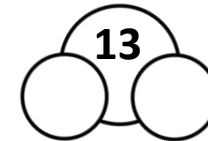
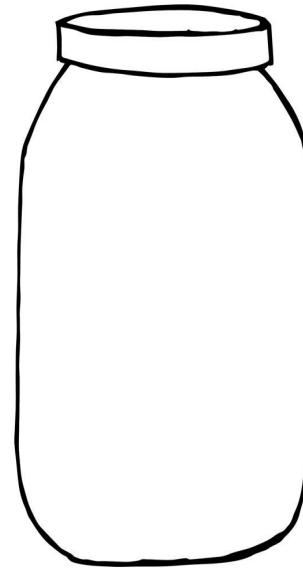


## Master of Many States



When water molecules get enough energy, they transition from a liquid to a gas. This gaseous form is called water vapor and can be formed when water under goes boiling, evaporates, transpiration, or sublimation. Once water is a gas the molecules will spread out to fill the space it is in.

Draw Your Observations: Write Your Observations:

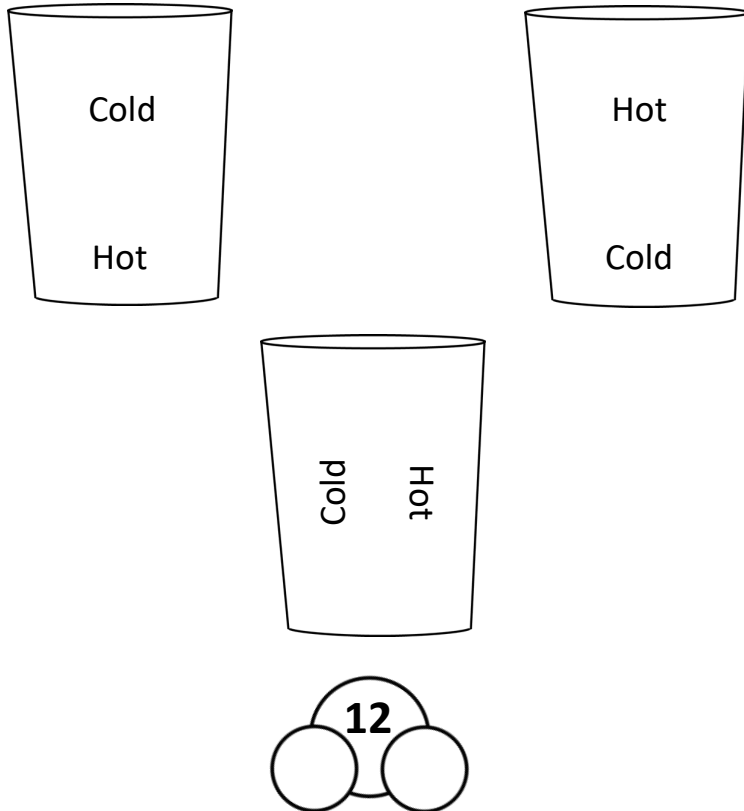




## Master of Many States

When water gains more energy its water molecules start to move too fast to stay in a crystalized solid form and becomes a liquid instead. Pure water wants to be in a liquid between the 0°C (32°F) and 100°C (212°F). While a liquid, the number of water molecules that can fit in a given space changes based the water's temperature.

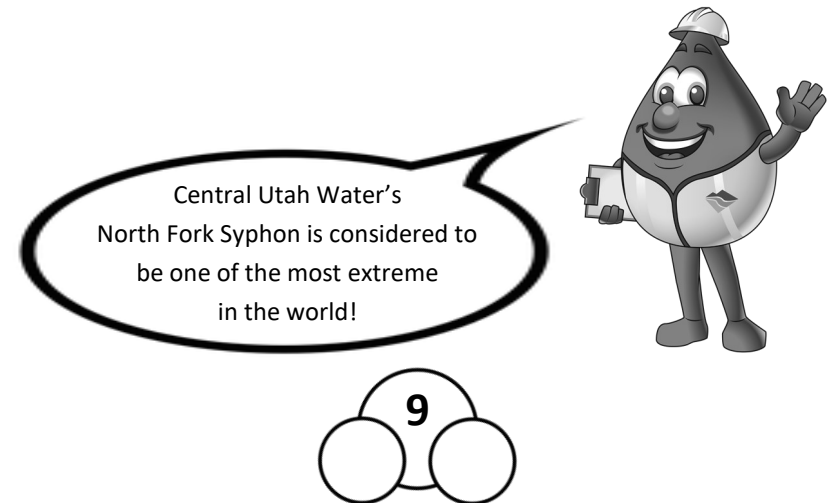
**Draw Your Water Density Observations:**



## Defier of Gravity

Surface tension and capillary action are amazing, but they are relatively weak forces. Luckily, engineers have another force their sleeves...suction. Harnessing the power of suction, water engineers can move large amount of water over entire mountain ranges without needing a pump using a tool called a syphon.

**Draw Your Syphon Model Below:**





# Master of Many States

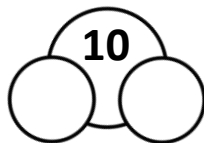
Solid, liquid, and gas. They are the three primary states of matter. While water can be found in one of these states throughout the solar system, Earth is the only planet where we see all three forms at the surface.

## For The States of Matter Activities I Need...

- Plate
- Ice
- Sugar
- Salt
- 3 Cups
- 2 Food Coloring
- Cold Water
- Hot Water
- Jar
- Sponge

### Fun Fact

While water is the most common molecule that has a solid form less dense than its liquid one, there are a few other examples. The most important is silicon, which is an key component of rocks. The fact that solid silicon floats on liquid silicon allows the earth's crust to float on the mantle.



# Master of Many States

The state of matter that water is found in is driven by amount of energy the molecules have. Because it is really hard to measure how fast an individual molecule is moving, we use temperature to measure change. Pure water wants to form ice, its solid form, at 0°C (32°F). But water can only become solid when it can successfully form an ice crystal. If another molecule interferes with crystal formation, water's freezing point can be changed.

## Draw Your Experiment Observations Below:

	Salt	Sugar	Control
Time 1			
Time 2			
Time 3			

