SIOUX EMPIRE WATER FESTIVAL

WaterWiz

Q: What should we study?
A: Study ALL of the information in the Water Wiz!

Sioux Empire Water Festival Quiz Bowl Guide

Inside this issue:

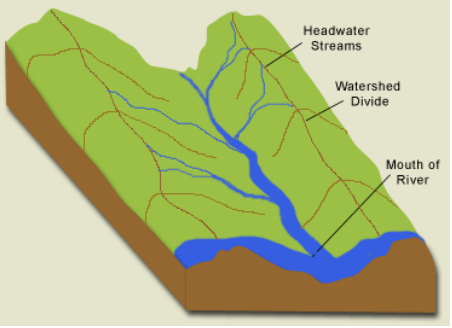
All About Rivers

Rivers play an important part of the world's environment; providing transportation, creating energy, and creating animals' habitats; but have you ever wondered how a river is created? A **river** is formed by **surface water**, standing water on the land from either rain or melted snow, finding its way from a higher altitude to a lower altitude because of gravity. In the beginning, flowing water finds its way downhill in the form of a creek. As small creeks flow further downhill, they merge to form larger streams and rivers.

The water that forms a river comes from many different sources. When it rains, it either seeps into the ground or becomes runoff. **Runoff** is the water that runs off the surface of the land when it rains or when the snow melts. It will flow downhill, into streams, ponds, rivers and lakes which eventually make it to the ocean. A **watershed** is an example of how creeks form into streams and how streams form into rivers. A watershed, or drainage basin, is an area of land, small or large, that all drains to the same point. Think of the way that water falling into a bathtub all flows towards the drain. The tub could be considered the watershed of the drain.

The Longest Rivers in the World

River	Country	Miles
Nile	Egypt	4,145
Amazon	Brazil	4,000
Chang jiang - Yangtze	China	3,964
Mississippi-Missouri (river system)	U.S.	3,740
Yenisei-Angara (river system)	Russia	3,442



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Sioux Empire Water Festival

All About Rivers, continued...

A number of small watersheds can combine to form a larger watershed. For example, the watersheds of the Big Sioux River and the James River are separate watersheds, but they are also parts of the Missouri River watershed. The watershed of the Missouri, and those of thousands of other rivers and streams combine to form the watershed of the Mississippi River. The watershed of the Mississippi is an enormous watershed, draining more than half of the country.

All the creeks and streams that flow into the Mississippi, eventually drain into the Gulf of Mexico.

Not all water runs off the land surface, though. Some of the water soaks into the ground through soil and the underlying rock layers, which is known as **infiltration**.

When infiltration occurs, some of the water returns to the surface while the rest remains below as **groundwater**. At a certain depth below the land surface, called the **water table**, the ground becomes soaked with water. If a river bank cuts into the water table, the water will seep out of the ground into the river.

Highest Dams in the Country

Dam	State	Height
Oroville Dam	California	754 feet
Hoover Dam	AZ-NV Border	726 feet
Dworshak	Idaho	718 feet
Glen Canyon	Colorado	708 feet

Many things can affect the quality of water entering a river, whether through runoff or infiltration. Anything abnormal that is added to a water system is **water pollution**. There are many sources of water pollution: from factory or industrial plants, fertilizers spread on fields, runoff of livestock wastes from farming, soil from erosion, pesticides sprayed on lawns and crops and material washed from streets into storm drains.

Rivers supply an important role in providing electricity in the form of dams. A **dam** is a man-made structure built across a river. Most dams are built to control river flow, improve navigation and regulate flooding. However, some dams are built to produce hydroelectric power. Dams make hydroelectric power by water passing through a dam and into the river below. The more water that passes through a dam, the more energy is produced. Electricity is produced by a turbine. Turbines, which are located inside the dam, contain metal coils surrounded by magnets. When the magnets spin over the coils, due to falling water, electricity is produced. Dams provide clean, pollution-free energy.

Change-O-Rama!

AQUATIC INSECTS (WATER BUGS!) GO THROUGH METAMORPHOSIS

Metamorphosis affects many aquatic insects. When aquatic insects undergo metamorphosis, they are experiencing changes during their growth stages.

Aquatic insects will either experience simple or complete metamorphosis. **Simple metamorphosis** means the insect egg develops into a nymph. As a nymph, the insect will be similar to its adult form. **Complete metamorphosis** means the eggs change into larvae. Larvae develop into pupae, which then grow into the adult form. As adults, they are soft-bodied and very pale in color. After a short time, the bodies will grow firmer and become more colorful.

Each aquatic insect is unique in what kind of metamorphosis it experiences.

The Water Cycle

This cycle has existed since water was formed on the Earth

How does the water cycle work?

Heat from the sun causes water to become a gas, or vapor. This is called evaporation. As the earth's surface warms, rising currents of air carry the water vapor upwards. The water vapor becomes cooler as it rises, and condenses into tiny drops, forming clouds. These drops join together and fall back to the earth as rain, hail or snow. The ocean's water level does not rise, even though all rivers flow into it because of the water cycle.

Rainfall may:

- Evaporate directly from water, land or vegetation
- Run off the land into streams and wetlands
- Soak a little way into the ground, be absorbed by plant roots and then return to the water vapor in the air by evapotranspiration from the leaves of plants
- Soak deeper into the ground and add to the groundwater, moving slowly along the direction of groundwater flow towards rivers, wetlands or the sea.

This cycle has existed since water was formed on earth, but human activities change the way water moves through the landscape. We cannot change the amount of the water in the water cycle. We have the same amount of water in the water cycle we had two thousand years ago.

Recipe for Disaster
Water & Electricity: DO NOT MIX!

People are good conductors of electricity, particularly when standing in water or on a damp floor. A body can act like a lightning rod and carry the current to the ground. Shocks can be fatal.

- Never use any electric appliance in the tub or shower.
- Never touch an electric cord or appliance with wet hands.
- Do not use electrical appliances in damp areas or while standing on damp floors.
- In areas where water is present, use outlets with "ground fault interrupters" or GFIs.

Source: National Ag Safety Database

Water Pollution - The Dirty Facts

WHAT IS IN WATER?

Water (H2O) is never just pure hydrogen and oxygen. Water naturally contains minerals and microorganism from the rocks, soil and air with which it comes in contact.

Human activities add many more substances to water. Some, such as bacteria, come from waste products of people and animals. Others, such as gasoline and industrial solvents, are synthetic chemicals made and used for special purposes. Still other materials, such as nitrate and salt, occur naturally. Human activities can greatly increase nitrate and salt concentrations in the environment.

WHAT IS WATER QUALITY?

It is the chemical, biological and physical characteristics of water.

HOW DOES WATER QUALITY AND QUANTITY AFFECT ME?

Water is the "indispensable nutrient" for humans, animals and plants. Nothing can live long without it. Therefore, a reliable, safe source of water is important to everyone and everything. Point and nonpoint source pollution must be carefully monitored and controlled.

WHAT IS POINT AND NONPOINT SOURCE POLLUTION?

Point source pollution is commonly defined as water pollution that can be traced to a specific source of discharge such as a pipe. Nonpoint source (NPS) pollution is more difficult to define. A simplified definition would be water pollution that does not discharge from a pipe. Examples include, but are not limited to, runoff from construction sites and agriculture, mining and urban areas. Nonpoint sources of pollution can come from any area, and most do not discharge at a specific, single location. In general, nonpoint pollutants are carried over and through the ground by rainfall, runoff and snowmelt. Remember, though, water movement alone is not pollution unless the water is carrying contaminants.

WHAT ARE CONTAMINANTS?

Contaminants are minerals or microorganisms occurring in water that may pose a risk through the use of the water. They are regulated by the US Environmental Protection Agency (EPA) when they occur in drinking water supplies and can threaten public health. Such contaminants must be detectable in drinking water using current laboratory methods.

SOME CONTAMINANTS OF CONCERN TO EPA ARE:

Bacteria – Health officials agree the most direct health threat associated with drinking water is from bacterial contamination. Bacteria from human or livestock wastes can cause serious health problems, such as dysentery, hepatitis, and typhoid fever.

Nitrates – Nitrate levels in ground water have been rising in many areas. Common sources of nitrates include septic systems, livestock wastes, and use of nitrogen fertilizer on farm fields and lawns.

Minerals – Some of the minerals found in ground water, iron and sulfur for example, can give water an unpleasant odor or color without making it unsafe. Occasionally, metals such as chromium or lead leach into water from surrounding rock in sufficient concentrations to present a health risk.

Synthetic Chemicals – Public health officials understand the health effects of bacteria, nitrate, and some minerals. But the health effects of certain synthetic chemicals are not so clear. Determining the health effects of such contaminants is difficult, since researchers are still learning how these chemicals react in the body.

Explorers on the Waterways

Before man-made roads, waterways were the main highways of travel and trade. Native Americans had been using canoes and bull boats for river transportation for years before Europeans ventured into present-day South Dakota. The earliest explorers to our area came up the rivers on flatboats, keelboats, rafts, or canoes. Many came as part of the fur trade, and they made use of the rivers to "ship" their trade goods into and furs out of the area.

In 1743, the first tangible evidence of European presence in what would become South Dakota was left along the Missouri River near present-day Fort Pierre. French-Canadian brothers Louis-Joseph and Francois de la Verendrye, fur trappers from Lake Superior, came through the area looking for a "River of the West" with passage to the Pacific Ocean. The brothers were hoping for a waterway that could easily move their trade goods across North America. They gave up their quest when they hit a "mountain range", perhaps the Black Hills, and headed back. On their return trip they buried a lead plate near the Missouri River claiming the land for France. This plate was forgotten and remained in place until a group of Fort Pierre high schoolers found it in 1913!

In 1803 after purchasing Louisiana Territory from France, President Thomas Jefferson commissioned Captain Meriwether Lewis to lead a military expedition through the land, documenting the plants, animals, and people encountered as well as the land and waterways. Captain Lewis asked Captain William Clark to help guide the party. They began their expedition in 1804 St. Louis, MO, heading north in a keel boat along the Missouri River. Lewis and Clark relied heavily on the knowledge of fur trappers and Native Americans who had been using the Missouri, Big Sioux, and other rivers for years.

Surface Tension

The molecules in water have a "pull" that they use on surrounding water molecules.This pull is in all directions on each molecule. At the surface of the water, however, there is less pull from the top because it's air rather than water. Because of this, the molecules at the surface tend to cling more strongly to those on either side.

This creates a slight film on the surface of the water that makes it a little more difficult for objects to pass through the surface of the water. This is why a water strider (water bug) is able to walk on the surface of the water.

The clinging together of the water molecule (surface tension) is also what causes drops of water to cling to the glasses in a dish washer. If these drops are allowed to remain before the dishes are dried, it will result in water spots on the glasses.

Water POWER!

Hydroelectricity is electricity produced by water. (Hydro means water.) To create power from water, some important things have to happen. A hydroelectric plant must first build a dam on a river. The water will back up in the dam, creating a lake or **reservoir**. When the water is released from the reservoir it spills into a giant **turbine**. A turbine is made up of a series of angled blades mounted to a central shaft. The force of the water causes the blades of the turbine to spin. The turbine is connected to something called a **generator**. The generator is powered by the spinning blades of the turbine. This produces energy. When the water leaves the turbine it flows out of the plant and back into a river on the other side of the dam.

Up until hydroelectric energy was invented, people burned coal to make energy, and now because of hydroelectric energy, energy costs less, is waste free and does not pollute the water or the air. The reservoirs provide ideal lakes for **water recreation**, including fishing, boating or kayaking. The Hoover Dam is one of the larger hydroelectricity plants in the United States.

Hydroelectric power has been around for centuries. The first form of hydroelectric energy was the water wheel. This water wheel was first used to turn different forms of machinery to grind food or make textiles. The first hydroelectric power plant to open was in Appleton Wisconsin in 1882, and was located on the Fox River. When hydroelectricity first started it was sent out as a direct current, which limited the distance electricity could be transmitted. Alternating current is the method of electricity transportation now.

The major countries that utilize hydroelectric power are the United States, China, Russia, Brazil, Denmark and Egypt. Because of advances in technology it is possible for countries to build plants in remote areas and transfer the energy over long distances. The largest power plant in the world is China's Three Gorges project on the Yangtze River.

South Dakota has four hydroelectric plants along the Missouri River; Oahe Dam, Big Bend Dam, Fort Randall Dam and Gavins Point Dam. Hydroelectric power is the primary source of energy in the state. Half of all the electricity needed by the state is produced by these dams.

FAST FACTS

Percent of the Earth's Water

Oceans (salt water) 97%

Ice Caps and glaciers (fresh water) 2%

Rivers, Lakes and Streams

(fresh water) 0.33%

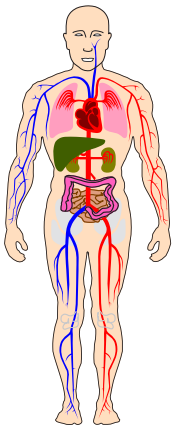
Groundwater (fresh water) 0.67%

Water Exists in Three Forms on Earth

- solid (ice, hail, snow or frost)
- liquid (in lakes, oceans, rain, dew, fog or mist)
- gas (steam or water vapor - "invisible" water in the air).

Water can change from one form to another with a change in temperature.

Water and our Bodies



Approximately 75% of our body weight is water and water makes up over 80% of our brain and 90% of our blood. Medical researchers report that there is virtually no function or reaction in the body that can take place without the presence of water.

Because our bodies are more than half water we must replace, on the average 80 to 96 ounces of water per day that is used or lost by respiration, urination, and perspiration. We can get some water by eating foods that are high in water. but most of our water will come from drinking eight to ten cups of water per day.

Let's Talk Rain

THE FIRST RAIN GAUGE:
Dates back to India over 2,000 years ago. An Indian manuscript from 400 B.C. refers to a simple bowl for measuring rainfall, and then using that to decide how many seeds to plant.

SIZE OF A RAIN DROP:
0.5 - 2.5 mm, and fall from the sky at between 13 and 30 feet per second. Ouch!

SMELLY RAIN:
Rain is often thought to have a smell. Even the experts have no explanation for this!

MOST RAIN IN LESS THAN AN HOUR:
Holt, Montana USA received 12 inches of rain in only 42 minutes, on June 22, 1947.

IT'S RAINING CATS AND DOGS!
Well there are no actual reports of cats and dogs but the following have fallen out of "rain clouds"- maggots in Mexico, minnows in Aberdare, Wales and blood-red rain in Locarno, Switzerland, and on the mountains it fell as red snow.

FREEZING RAIN:
Freezing rain occurs when rain falls onto cold surfaces and turns to ice. The worst ice storm in recent history, occurred in 1998 and caused over a billion dollars of damage in the NE of the US and eastern Canada. There were a number of deaths, and wholesale destruction of trees and power lines occurred.

WORST FLOOD DAMAGE:
Hurricane Katrina caused the worst flood damage in the United States to date.

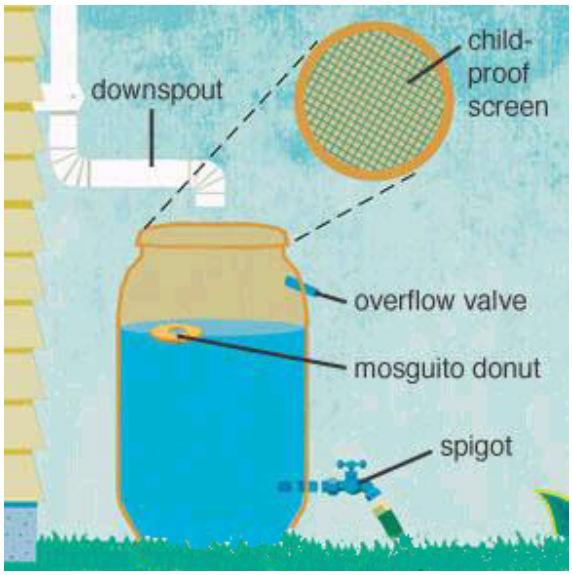
Electrical Safety and Other Smart Things to do with Water

- Don't water your yard if rain is in the forecast.
- Choose native plants in your garden – they are used to using less water.
- You must be dry to touch anything electrical.
- Stay indoors when there is lightning.
- Never use an electric mower or power tool on a wet surface.
- Keep radios, television sets and other appliances away from swimming pools or bathtubs. If something electrical falls in the water, don't try to get it out.

Old Conservation Idea Still Useful Today

While searching the Internet an interesting item brought back some old memories for me. I thought back to the days when I would visit my grandparents and we would play in the yard. At the corner of the house, under the waterspout stood the rain barrel. The thought of that barrel took me back to a time when water was hauled to the house and water quality was anything but exceptional. Early water systems in the United States had a central water supply location where water was hauled from. Through many inventions and construction improvements, such as well digging, piping and pumps, water is now transmitted directly to your house. Most of the population of the United States are now served by one of the 155,000 public water systems in existence today.

The news item that triggered all this reminiscing had to do with a program called the "Green Barrel" that a city offered to its residents at a discounted price. In this city lawn and garden watering account for 40% of the household water usage. It was estimated that each barrel could save approximately 1,300 gallons over the summer season. These new rain barrels were different than the ones used in the past. The old barrels had a screen or lid weighed down by a rock or brick. The new barrels have an inlet that directs water to a small opening and an outlet that can work with a watering can or hose. In both cases the barrels were designed to prevent evaporation and/or keeping bugs out of the water. Evaporation is an essential part of the water cycle. The sun drives evaporation of water from oceans, lakes, moisture in the soil, and other sources of water. Evaporation of water occurs when the surface of the liquid is exposed, allowing molecules to escape and form water vapor; this vapor can then rise up and form clouds.



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The water collected in the barrel can be used to water houseplants, gardens and even lawns. In the old days rain barrels could give a constant water supply during drought conditions. Drought conditions occur when there is a period of abnormally low rainfall that results in a shortage of water. Benefits of using a rain barrel include reducing water usage, cutting down on water sent to sewers, and saving money on water bills.

Quiz Bowl Bits

SURFACE WATER
When a river overflows its banks, a natural disaster known as a flood occurs. Land bordering the river which often floods is called a floodplain or riparian zone. Some rivers like the Big Sioux have many curves. These curves are called meanders. The sides of a river are known as banks.

PROPERTIES OF WATER
Water is made on only two elements, hydrogen and oxygen. Water is also known as the universal solvent. Water is the only substance on earth which is naturally found in three forms: gas, liquid and solid. Water in the form of a solid is called ice. Water in the form of a gas is called vapor.

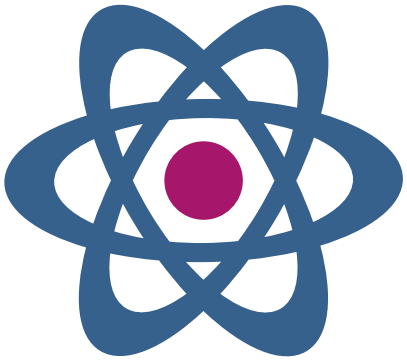
FISH
To live under water, fish have gills which remove oxygen from the water, much like your lungs remove oxygen from the air you breathe. Whales, dolphins and turtles are not fish, and must come to the surface to breathe, even though they spend most of their lives in water. There are about 100,000 ponds or stock dams in South Dakota, and 48,000 contain fish.

WATER EROSION
Any activity that disturbs the soil surface, such as farming, construction work, and building roads can leave the ground in an easily erodible state. There are many methods to use so that the least amount of erosion will occur. When new roadbeds are built, straw is applied to the bare ground before the new grasses become established. Many construction sites install silt fences that catch the soil particles before they are carried off down the slope and into a stream or creek.

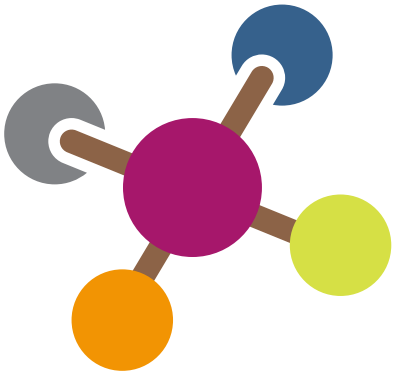
How much is one part per million?

Just as per cent means out of a hundred, so parts per million or ppm means out of a million. This unit usually describes the concentration of something in water, soil, or air. An example might help illustrate the part per million idea. If you divide a pie equally into 10 pieces, then each piece would be a part per ten; for example, one-tenth of the total pie. If, instead, you cut this pie into a million pieces, then each piece would be very small and would represent a millionth of the total pie or one part per million of the original pie. To give you an idea of how little this would be, a pinch of salt in one ton of potato chips is also one part (salt) per million parts (chips). Some other examples of this measurement would be one inch is 1 ppm (part per million) of 16 miles and 1 minute is 1 ppm of 1.9 years. Can you figure this out: one penny is 1 ppm of how many dollars? You already know that one dollar is 1 ppm of a million dollars.

We need to be able to discuss and use this term as a way of expressing very dilute concentrations of substances usually one mixed into another. But what does this



term represent? It is a measure of concentration, the amount of one material in a larger amount of another material; for example, the weight of a toxic chemical in a certain weight of water. They



are expressed as concentrations rather than total amounts so we can easily compare a variety of different environmental situations. For example, scientists can measure the concentration of a chemical in your drinking water by looking at small samples. Water treatment plants that turn water into drinkable water must be able to use ppm so that they can use the correct concentration of one chemical to clean the water of unwanted and dangerous chemicals like lead and microorganisms like coliform bacteria. By using the correct ppm in the water treatment plant your drinking water will arrive in your glass and be safe to drink.

(Answer: $10,000)

Did you know?

South Dakota's State Fish
The walleye

Average amount of water consumed in a lifetime
16,000 gallons

The sun's heat causes
Evaporation

Condensed vapor is also called
Precipitation

When falling snow combines with strong winds and often produces deep snow drifts, it is called a
Blizzard

Why is the Ocean Blue? The ocean appears blue because it reflects the blue color of the sky. On a cloudy, gray day, the ocean appears gray.

Holy Cow!
Of all farm animals, dairy cows producing milk require the greatest amount of water as compared in proportion to the sizes of their bodies. This is because the milk that cows produce is 86 to 88 percent water.

Something's Fishy
There are about 100,000 ponds or stock dams in South Dakota, and 48,000 contain fish. There are 450 public fishing lakes and 10,000 miles of rivers and streams, which are managed for fish.

Weather Wise

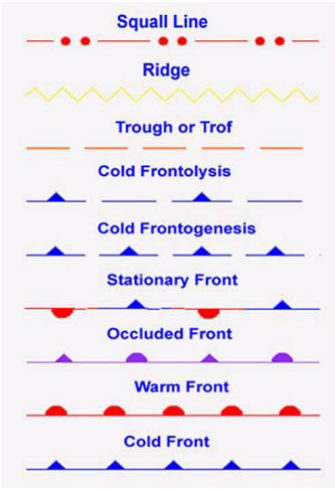
Humidity – the amount of water vapor in the air.

Relative humidity – the amount of water vapor the air is holding at a given temperature, compared to the total amount it could hold at that temperature.

Clouds – a cloud might look like fluffy cotton balls, but it is really billions of tiny drops of water that condensed.

Fog – happens when a cloud touches the Earth's surface

Rain gauge – used to measure the amount of precipitation



WEATHER MAPS IN THE NEWSPAPER OR ON TV

A **synoptic chart** is used for forecasting weather. There are different symbols on the map that represent different types of weather.

One symbol you will see is a blue line with blue triangles on it. This represents a **cold front**. A cold front is a transition where cold air replaces warm air in the atmosphere. Cold fronts generally move from northwest to southeast. The air that arrives with this front is much colder and drier. When a cold front comes through temperatures can drop more than 15 degrees in the first hour.

A **warm front** is the opposite of a cold front. It is represented on the map by a red line with half circles on it. In this front warm air replaces the previous colder air. Warm fronts usually move from southwest to northeast. The air is warmer and has more moisture, which causes warmer weather but more humidity.

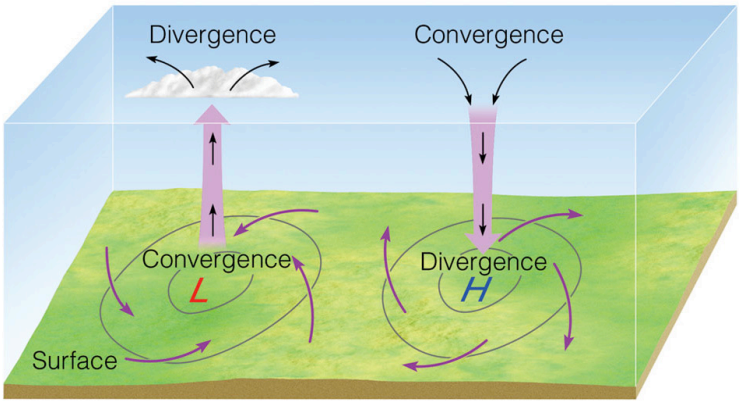
Stationary fronts occur when a warm or cold front just stops moving. Once the front begins to move again it will either become a cold or warm front. There is a noticeable temperature change or shift in wind direction when crossing from one side of a stationary front to the other.

An **occluded front** is a developing cyclone. This front usually has a preceding warm front and a faster moving cold front. North of the warm front is a mass of cooler air that was in place before the storm even entered the area. As the storm grows, the cold front rotates around the storm and catches the warm front. This rotation forms an occluded front, which is the boundary that separates the new cold air from the older cold air front already in place north of the warm front. The symbol for an occluded front is a purple line with alternating half circles and triangles.

Squall lines are shown by a red line then two dots and then another red line. This symbol represents a line of severe thunderstorms. These storms can cause precipitation, straight winds, lightening, hail and tornados.

A **trough** is lengthened area of low pressure that is typically associated with a cyclone wind shift. It is shown by a dotted orange line.

Low pressure on a weather map is shown by an upper case red L. Low pressure moves in a counterclockwise motion in the northern hemisphere and a clockwise motion in the southern hemisphere. This is a cyclone.



High pressure is when an area of higher pressure that moves in a clockwise motion in the northern hemisphere and a counterclockwise in the southern hemisphere. This can be referred to as an anticyclone. An anticyclone is opposite of a cyclone. It is a weather phenomenon where there is downward movement of the air and a high pressure area over part of the plants surface that is affected by the high pressure.

Water & Agriculture

The origins of agriculture – the production of food crops by humans – began in the Mesopotamia area (current day Iraq and Syria) and the Nile Valley in Egypt about 7,000 years ago. The rivers would flood and grain-bearing plants would grow in the nutrient rich fields after the flood waters receded.

The people living there learned to pick the grains and save the healthiest looking seed for the next growing season. Repeating this selection process over many years has resulted in many of the grain crops such as wheat, barley, and oats that we grow today.

Crop production is limited by the amount of rainfall received. When farmers manually add water to crops it is called irrigation. On average farmers can get double the production from crops when they can add irrigation water.

Rice was one of the first crops to be irrigated. Early forms of irrigation were dams built across rivers to divert the water into ditches and dikes and then to small plots of land. The early Egyptians were the first to control the Nile waters, organize workers, and increase the amount of food that they could produce.

When a community has excess food, they are able to build and work on other things, which will give rise to a more successful community. This is how Egypt became the great civilization of its day.

Now, with the use of electrically powered pumps, people can pump water out of the rivers or deep underground aquifers and irrigate crops. Farmers can even grow crops and build towns in the desert if water is available. Agriculture uses 65% of the fresh water on earth – more than other uses. Industries use 24% and domestic (household) use is 7%. Agriculture uses water for crops, animal feed, fiber (clothing), animal production, fuel (ethanol), and forestry and paper products.

Fashion Sense

Animal furs have always been valuable. Warm, soft, and often waterproof, furs and hides evolved from a basic clothing necessity during early eras to fashionable hats, coats, purses, and other luxurious items in the 19th century. As demand for fur-based fashions increased and the supply of fur-bearing animals, particularly the beaver, in Europe decreased, many adventurous men and nations turned to the unexplored territories of North America as a new source of those valuable fur-bearing animals.

Long before the arrival of Europeans, American Indians had been trading with each other. They exchanged agricultural products, shells, seeds, hides, and flint. Indirect trade also occurred with nations from great distances. Shells from the Pacific Northwest became very prized in the Great Plains due to their local rarity.

Trappers, traders, and fur companies from England, France, Spain, and America moved into our area in order to supply furs to Europeans and Americans for popular fashions like the Beaver felt top hat. Many furs were also obtained through trade with the native people living in river valleys. The fur trade began as early as the 1660s and continued into the 1880s. In what is now South Dakota, trade peaked in the early 1800s, and posts and forts were established along the Missouri, James, Big Sioux, Cheyenne, White, and Minnesota Rivers. These rivers provided water for those living at the forts, were home to many of the fur-bearing animals like the beaver and muskrat, and most importantly provided a route of transport for furs and trade goods. These waterways really were the highways of the time.

Fur companies were large-scale operations that shipped furs to the East Coast and to European cities. Several companies operated in what is now South Dakota. The Pierre Chouteau, Jr., and Company had a trading post near present-day Fort Pierre. The Missouri Fur Company established Fort Manuel on the Missouri River near the present-day border of North and South Dakota.

Gold Mining in the Black Hills

General George Custer explored South Dakota in 1874. During his trip, gold was discovered in the southern Black Hills. News of his find traveled quickly and people came to find their fortunes. By 1875, almost 4,000 people were hunting the mountains and streams for gold.

By the end of 1875 miners were all over the Black Hills, including up by the northern town of Deadwood. Two brothers, Moses and Fred Manuel, found the Homestake claim near the current town of Lead. It was the richest source of gold in the area and later became known as the Homestake Gold Mine. That mine continued to operate for 126 years. It closed in 2002.

Mining is no longer a way to make a living in the Black Hills, but it continues on a much smaller scale. During the spring and summer gold panners come to work the rivers and creeks for small pieces of gold.

HOW TO FIND GOLD IN A STREAM:

1. Go where the gold is found. People who pan for gold say it's best to start looking for gold in streams where people have already found gold. Gold is 19 times heavier than water and stays on the bottom of a creek. It gets stuck in rocks and pieces of wood. Look for places where gold might get stuck.

2. Put four handfuls of material from the stream bottom in a gold pan and add water. Hold the pan under water and let the lighter materials swirl away. Do this until about half of the materials in the pan are removed.

3. Lift the pan out of the water and swirl it around. Tip the pan so the water flows over the side and is gone. Repeat this until nearly all the material in the pan is gone.

4. Separate the gold from the remaining materials. Modern gold miners use a tool called a suction pipet. If you don't find gold, keep trying. It takes a lot of practice and time to find it.

Help Conserve Our Water Resources

At school and at home, you can help protect our water resources.

- Turn off the tap in your bathroom while you brush your teeth.
- Take shorter showers. (Get a timer and time yourself.)
- Don't let the water run constantly while you're washing or rinsing dishes.
- Fill a pitcher with tap water and put it in the fridge, rather than running the tap every time you want a cold drink!
- Clean sidewalks and driveways with a broom—not the water hose!
- Water your lawn in the early morning to avoid evaporation.
- Repair dripping faucets.
- Place a layer of mulch around trees and plants to retain water.

How Animals Survive a Drought

Domestic animals depend on us to put water in their water bowls and make sure there is water in the water tanks but wild animals must come up with a different solution to find water. Some wild animals can simply walk away and go look for a source of water. Animals like camels can store water in their bodies to get them through to the next water hole. Giraffes get a lot of the water they need by eating the leaves of the acacia tree. There are some aquatic animals like snakes, frogs and salamanders that can walk to larger wetlands to survive a drought.

Other species, especially insects, fish, amphibians, some turtles and some snakes use a strategy called "estivation" (which is related to "hibernation"). These species must stay in place and create a state of inactivity and reduced metabolism. They don't eat, drink or move during this time. An example of this is when the lungfish of Africa and Australia creates a cocoon to protect from water loss and then they reduce their breathing and heart rates. They can survive this way for three years. Other species that can use estivation to survive are large bodied salamanders, some freshwater turtles and frogs, some aquatic snakes and even crocodiles. Reptiles use 90 to 95% less energy when they are estivating.

Animals that estivate are trying to survive an extreme environment.

Some crustaceans (crabs, lobsters, and shrimp) will lay eggs that can remain dormant and not hatch until the rains come. So while the adults will die off their offspring will survive. Kangaroos are able to delay the development of their babies until the season is good enough to ensure the food supply and the babies' survival. Some animals change metabolically by secreting solid uric acid crystals instead of liquid urine, in order to conserve water.

Earthworms can use both hibernation and estivation to survive. When it starts to get cold, the worm will dig down below where frost could reach them—sometimes seven or eight feet into the ground. They stay there until it warms up outside and then they come back up to the surface. This of course, is hibernation. But worms can't live with too much heat, light or drought. They go into estivation to get away from these things. Estivation is summertime hibernation. A hibernation during a time when they would normally be active.

Science, Technology, Environment, & Society Indicator 2

Analyze the relationships/interactions among science, technology, environment, & society.

How Plants Survive a Drought

Many plants react to a drought by slowing down or stopping their growth and conserving the water they have access to. Grass is a good example of this technique. During a drought, you will notice that green grass turns into yellow dried up grass. Believe it or not the grass is not dead. Instead, the grass went into dormancy or half sleep so it stops growing and conserves water. It is not "dead" but is not thriving or growing. Plants can apply many different strategies to help survive during severe lack of water over a period of time.

Water is very important to a plant because it allows them to make their food during a process called photosynthesis. They make it by using sunlight, water and carbon dioxide to chemically create their own food. Without water to assist this process the plants won't grow and will eventually die. The more ways plants can develop to conserve, store, or tolerate less water the better their chances of survival become. Plants that store their own water, like cactus or succulents (with fat, fleshy leaves) can live in low water areas like deserts. These plants have most of their roots in the top one half inch of soil to quickly adsorb the rains that occasionally fall. Because stored water in an arid or desert environment would be attractive to thirsty animals, these plants have developed protection systems like camouflage, spines and toxicity to animals.

Deciduous trees (they drop their leaves in the fall) have their own drought survival mechanism. Their tactic, during a severe drought is to drop their leaves early to conserve the water they have. This will cause them to go dormant and slow their growth. During a moderate drought they can close the openings in their leaves that are known as "stomata" where transpiration and exchange of CO^2 (carbon dioxide) and O^2 (oxygen) occurs.

Certain characteristics indicate that a plant has adapted to low water requirements: Plants with silvery, hairy, or fuzzy leaves, or leaves with a waxy coating lose less water from their surface. Plants with long taproots, which are able to reach water stored a long way underground, can survive droughts better.

Some plants survive drought by producing many seeds that have hard waxy coatings. Some of these seeds can survive for over 200 years. Producing seeds is an excellent drought survival strategy.

Science, Technology, Environment, & Society Indicator 2

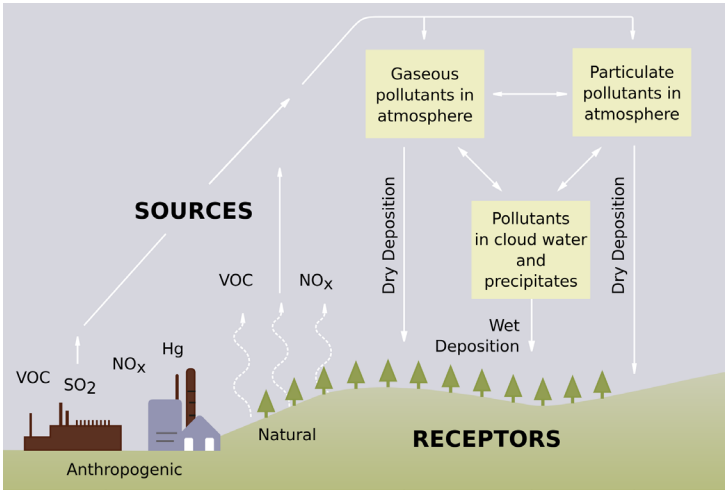
Analyze the relationships/interactions among science, technology, environment, & society.

Acid Rain

Think about when you get caught outside in a rain storm: you are probably worried about your clothes getting wet or that you will be cold when you get into a dry environment. Imagine being a fish and the possibility of rain, a natural event on our planet, affecting your environment which affects your source of food, oxygen and your life.

Acid rain is proving to have many effects in our environment: scientists have observed fish populations disappearing in some lakes and it has been found to speed up the natural decay of stone monuments and historical buildings by "eating away" at the stone. Acid rain is formed when chemicals, naturally occurring such as erupting volcanoes and decaying vegetation, and man-made occurring such as factory emissions from burning fossil fuels, enter the atmosphere. Those chemicals in the form of sulfur dioxide and nitrogen oxide gas react with water, oxygen and other chemicals to form acidic mixtures such as sulfuric acid and nitric acid. Any atmosphere precipitation such as rain, snow, fog and mist with a pH level of 5 or below is considered acidic on the pH scale. (pH is a measurement of how acidic or basic a substance is on a scale from 0 to 14; pure drinking water is 7, soda is 2.5 and sea water is 8.2. Normal rain is 5.7 but when sulfur dioxide and nitrogen oxide enter the atmosphere, they can change the scale of rain to 5 or below.)

Acid enters our environment through two ways: wet deposition (deposited by moisture) and dry deposition (deposited by dust or smoke). Most of the electricity that is used in our modern life comes from burning fossil fuels such as coal, natural gas and oil. Man causes acid rain by releasing two pollutants into the atmosphere when fossil fuels are burned: sulfur dioxide and nitrogen oxides. (Coal is responsible for most of the U.S. sulfur dioxide emissions and a large part of nitrogen oxide emissions. In 1952, London was covered in a layer of fog, containing pollutants from burning coal, known as acid fog, and 12,000 people died.) Wet deposition is when the acid chemicals in the air are blown into a wet area and fall as rain, snow, fog or mist. In this form, it affects a variety of plants and animals and their environment. Dry deposition is when the acid chemicals mix with dust or smoke and settle to the ground by sticking to objects such as trees, cars, buildings and homes. About half of the Earth's acidity falls from the atmosphere through dry deposition. If rain falls, it can then wash off the chemicals, leading to runoff that enters our waterways.



Acid rain is a problem all over the world because air pollution can be carried over long distances. When acid gases are released, they go high up in the sky, and then they are pushed by strong winds towards other countries. For example, the acid rain in Sweden is caused by air pollution in Britain and other countries of Europe. The pollution produced in Britain ends up mostly in Scandinavia – which are the northern countries in northern Europe. In the U.S., the winds blow the air pollution to certain areas in Canada.

There are many ways that you can lower the amount of acid that enters our atmosphere by little, every day actions to conserve energy since energy production causes the largest portion of the acid deposition. You can:

1. Turn off lights, computers and other appliances when not in use.
2. Use energy-efficient appliances such as washers, dryers, refrigerators, etc.
3. Only use electric appliances when you need them
4. Keep your thermostat at 68°F in the winter and 72°F in the summer
5. Carpool, use the bus, walk or bike whenever possible
6. Buy vehicles with lower nitrogen oxide emissions
7. Most importantly, educate yourself

The DL on the QB...
...or Quiz Bowl Instructions

Hello from the Sioux Empire Water Festival Quiz Bowl Committee! We hope your schools will enjoy the festivity and your students all go home Water Wizards! If you're interested in participating in the Quiz Bowl Event, this booklet has all you'll need to win!

HERE'S HOW YOU PLAY!

Officials: The quiz bowl officials consist of a Water Wizard, an official timer and a judge. The Water Wizard will govern the quiz bowl, instructing the students on the particular aspects of the game and asking the questions. If any given answer is questioned, the wizard will make a final decision on whether it is acceptable or not. The timer will control the official time clock and keep score.

WHAT YOU NEED TO DO BEFORE THE FESTIVAL!

Each participating school will select four (4) students for their team, one of which should be designated as the spokesperson. To allow all schools to participate in the Quiz Bowl, we must limit each school to one (1) representative team. We encourage each participating school to hold their own competition to choose their team members.

PLAY BEGINS!

The Water Wizard will select and ask a question from the quiz bowl information enclosed in this packet. Have your students study the enclosed information. Each participating class has received this packet in advance. All teams will be asked the same set of questions to ensure fairness. The format consists of two parts, the first with team play and the second with individual play.

PART ONE: TEAM PLAY!

The Water Wizard will ask the appropriate team a question. The team has 10 seconds to start their answer and timing begins after the Water Wizard has completed the question. The team may consult with each other before the spokesperson gives the answer. The answer must be started before the buzzer sounds. Regardless of whether the first team answered the question correctly or not, the play goes to the second team. If the question was not answered correctly by the first team, the second team gets the opportunity to answer the missed question, and a new question of their own. Each correct answer is worth one (1) point. No points will be deducted for a wrong answer. Play continues back and forth between the two teams until the end of ten (10) minutes of play. Play will end when the timer sounds. If the timer sounds during a question then that question may be completed.

It will benefit the team to answer questions quickly to ensure their team has adequate time to complete as many questions as possible, resulting in the highest score possible.

PART TWO: INDIVIDUAL PLAY!

This part consists of a list of questions asked consecutively and open to all participants, regardless of team. The first player to hit their buzzer will answer the question. The player has five (5) seconds to start their answer and may not consult their team members. If the question is answered correctly, their team will receive one (1) point. No points will be deducted for wrong answers. In the event of a wrong answer, the Water Wizard will give the correct answer and then proceed with another question which will be open to all players again. Play will proceed this way for five (5) minutes.

AT THE END!

At the end of the session, team points will be tallied and announced. At the end of the day, after all sessions have been completed, the final scores will be reviewed. All sessions that win will receive a prize. In the event of a tie, prizes will be given to both teams. All participating classes will be notified of the winning teams.

A team will be disqualified if they are not at the auditorium and ready to play within five (5) minutes of the start of their session. The judge reserves the right to disqualify a team in the event of tardiness or unsportsmanlike conduct.