

Water Properties True/False Quiz

(1) Like most liquids, water contracts (gets smaller) when it freezes.

Your Answer	Correct Answer	Explanation
	False	Actually, water expands (gets less <u>dense</u>) when it freezes, which is unusual for liquids. Think of ice -- it is one of the few items that float as a solid. If it didn't, then lakes would freeze from the bottom up (that would mean we'd have to wear wet suits when ice skating), and some lakes way up north would be permanent blocks of ice.

(2) Water has a high surface tension.

Your Answer	Correct Answer	Explanation
	True	True. Water has the highest surface tension among common liquids (mercury is higher). Surface tension is the ability of a substance to stick to itself (<u>cohesion</u>). This is why water forms drops, and also why, when you look at a glass of water, the water "rises" where it touches the glass (the " <u>meniscus</u> "). Plants are happy that water has a high surface tension, because it helps them to draw water from the ground up through their roots and stems.

(3) Condensation is water coming out of the air.

Your Answer	Correct Answer	Explanation
	True	This is actually true. Water that forms on the outside of a cold glass or on the inside of a window in winter is liquid water condensing from water vapor in the air. Air contains water vapor (humidity). In cold air, water vapor condenses faster than it evaporates. For example, when warm air touches the outside of a cold glass, the air next to the glass gets chilled, and some of the water in that air turns from water vapor to tiny liquid water droplets. You might also find it interesting that clouds in the sky and the "cloud" you see when you exhale on a cold day are condensed water-vapor particles. <u>(It is a myth that clouds form because cold air cannot hold as much water vapor as warm air)</u>

(4) More things can be dissolved in sulfuric acid than in water.

Your Answer	Correct Answer	Explanation
	False	Not true. Sulfuric acid might be able to dissolve a car, but water isn't known as the "<u>Universal Solvent</u>" for nothing! It can dissolve more substances than any other liquid. This is lucky for us... what if all the sugar in your soft drink ended up as a pile at

the bottom of the glass? The water you see in rivers, lakes, and the ocean may look clear, but it actually contains many dissolved elements and minerals. Because these elements are dissolved, they can easily move around with water.

(5) Rainwater is the purest form of water.

Your Answer	Correct Answer	Explanation
	False	Rainwater is usually fresh and clean, but it still contains small amounts of particulates that have been blown into the air by winds. Rainwater contains tiny particles of dust and dissolved gases, such as carbon dioxide and sulfur dioxide (<u>acid rain</u>). That doesn't mean rainwater isn't very clean—normally only about 1/100,000th of the weight of rain comes from these substances. For really pure water, you might want to look at distilled and deionized water. Distilled water comes from water vapor condensing after it has evaporated. Rain is produced by water evaporating from the earth, oceans, other water bodies and icecaps condensing in the sky, and even from you when you exhale. So, in a way, the distillation process is responsible for rainwater.

(6) To accurately read water height in a glass rain gauge, you read the center of the water column, not the edge (meniscus) where the water meets the glass.

Your Answer	Correct Answer	Explanation
	True	True. You do not use the edge of the water where it touches the glass, because the <u>adhesive</u> property of water (its "stickiness") causes it to literally rise up along the glass. A <u>meniscus</u> is a curve in the surface of a molecular substance (water, of course) where it touches another material. The correct height of the water in the rain gauge is seen at the center of the water column.

(7) You can float a paper clip on top of water if you very carefully place it flat on the water surface because of the molecular skin created by the interaction of air molecules with the top layer of water molecules on the surface.

Your Answer	Correct Answer	Explanation
	False	There is not really a "skin" at the water/air meeting point—it is just water below and air above. Molecules on the water surface don't have the same attraction to the air molecules above them as the other water molecules below them...water is attracted to water (cohesion). This inward net force causes the molecules on the surface to contract and to resist being stretched or broken. The cohesive forces between liquid molecules are responsible for the phenomenon known as <u>surface tension</u> . It is surface tension which allows things to float on water that you would not think could, such as paper clips and bugs.

(8) Sea water is slightly more basic (the pH value is higher) than most natural fresh water.

Your Answer	Correct Answer	Explanation
	True	Neutral water (such as distilled water) has a <u>pH</u> of 7, which is in the middle of being acidic and alkaline. Seawater happens to be slightly alkaline (basic), with a pH of about 8. Most natural water has a pH of between 6-8, although <u>acid rain</u> can have a pH as low as 4.

(9) Raindrops are tear-shaped.

Your Answer	Correct Answer	Explanation
	False	When you think of a drop of falling water you probably think it looks like this -  . When a drop of water comes out of a faucet, yes, it does have a tear shape. That is because the back end of the water drop sticks to the water still in the faucet until it can't hold on any more. Using high-speed cameras, scientists have found that falling raindrops look more like a small hamburger bun! Gravity and surface tension come into play here. As rain falls, the air below the drop pushes up from the bottom, causing the drop to flatten out somewhat. The strong surface tension of water holds the drop together, resulting in a bun shape (minus the sesame seeds).

Here's another explanation.

(10) Water boils quicker in Denver, Colorado (1 mile in altitude). than at the beach.

Your Answer	Correct Answer	Explanation
	True	Yes, it will take longer to cook your noodles on top of Mt. Evans, in Colorado, than at your beach house. The boiling point of water decreases as altitude increases. At the beach, water boils at 212° Fahrenheit (100° Celsius). But at 5,000 feet, about where Denver is located, water boils at about 203° F (95°C), and at 10,000 feet it boils at 193.7°F (89.9°C). This is because as the altitude gets higher, the air pressure (the weight of all that air above you) becomes less. Boiling occurs when the <u>vapor pressure</u> of water exceeds atmospheric pressure. Since there is less pressure pushing on a pot of water at a higher altitude, it is easier for the water molecules to break their bonds and attraction to each other and, thus, water boils at a lower temperature.

(11) If the relative humidity of the air is 100%, then water will not evaporate into the air.

Your Answer	Correct Answer	Explanation
	False	Although it is true that the volume of water in a pan placed outside where the relative humidity is 100% will not change, water from the pan is still evaporating. It is just that the same amount of water is evaporating as is condensing back from water vapor to liquid into the pan. At 100% relative humidity, equilibrium exists between water evaporating and condensing.

(12) A lightning storm is more dangerous to someone swimming in pool water than it is to someone swimming in salty ocean water..

Your Answer	Correct Answer	Explanation
	True	Most people will know that water and electricity don't mix and about the dangers of taking a bath with an electric hair dryer nearby. Pure <u>water (with no dissolved materials)</u> is actually an excellent insulator and does not conduct electricity, but you won't often find pure water in nature. Your bath water and your swimming pool contain plenty of dissolved salts to conduct electricity. Seawater has so much dissolved salt in it, that when lightning strikes it the electricity from the lightning kind of ignores your body because the excessive salt in the seawater makes the seawater such an excellent conductor.

(13) Rainbows have colors because the raindrops act as mirrors and reflect light directly back to you.

Your Answer	Correct Answer	Explanation
	False	Although you see colors in a <u>rainbow</u> because water drops are moving the light waves from the sunlight behind you back to your eyes, the raindrops are not acting like mirrors. Mirrors reflect light back perpendicularly, at 180 degrees. Thus, the light does not change colors. But raindrops act as tiny prisms, rather than like mirrors. The light going into the raindrops is bounced around a few times and the angles are changed, which is responsible for the different colors (wavelengths) being separated and sent back to you to see.

(14) A water molecule is "polar" because it looks like a seesaw: The oxygen atom is in the middle and hydrogen atoms are at opposite ends of the oxygen atom.

Your Answer	Correct Answer	Explanation
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False

It may be true that water molecules are "polar," but the term polar is referring to a water molecule that looks more like the head of Mickey Mouse, than like a seesaw. The hydrogen atoms in a water molecule are both on the same side of a water molecule. Since the hydrogen atoms have a positive electrical charge and the oxygen atom has a negative electrical charge, the charges are on opposite sides of the water molecule, which is what "polarity" means.

(15) Seawater is toxic to drink because your kidneys cannot get enough freshwater to produce enough urine to dilute the additional salt in your body to get rid of the excess salt..

**Your
Answer**

**Correct
Answer**

Explanation

True

Yes, that complex statement is true. Seawater is toxic because your body eventually fails when it has to try to get rid of the salt that comes from seawater. Your body normally gets rid of excess salt by having the kidneys produce urine, but it needs freshwater to dilute the salt in your body for the kidneys to work properly. Normally that is not a problem, as you are always drinking water and eating food with water. Tissue in your body also contains freshwater that can be used. But if there is too much salt in your body, your kidneys cannot get enough freshwater to dilute the salt, and your body will fail.

Groundwater True/False Quiz

- [Water-science activities](#)
- [Groundwater quiz home page](#)



If you are standing on the ground, it is a safe bet that you are also standing on water (more like, "over" water). Water exists in significant amounts below just about Earth's entire surface. Below are your responses to our groundwater true/false quiz, and some explanations to help make you more groundwater knowledgeable.

(1) The water table is the altitude (below ground) where the water level in a well will rise to when the well taps a confined aquifer.

Your Answer	Correct Answer	Explanation
	FALSE	Maybe it is not fair to start off with a trick question, but the correct answer is false. The only thing that makes it false is referring to "confined aquifer," instead of an "unconfined aquifer." A confined aquifer is an aquifer with layers of generally impermeable rock above and below the aquifer (aquifers tend to run in horizontal layers below ground). As water flows into this aquifer it gets "squeezed" between the rock layers, thus causing pressure to build up in the aquifer. Unconfined aquifers do not have this internal pressure (called <i>artesian pressure</i>), so if you drill a well into it, the water will only rise in the well casing up to the top of the aquifer (the water table); you will need a pump to get the water to the surface. In a confined aquifer if you drill a well, the pressure will push water up the well casing; sometimes all the way to the land surface—no pump is needed!

(2) If you ate canned corn last night, there is a good chance that it was irrigated with groundwater.

Your Answer	Correct Answer	Explanation
	TRUE	This is true. The American Midwest produces a lot of corn. Nebraska is not known as the "Cornhusker State" for nothing. During 2001, it produced more than 1 billion bushels of corn, third after Iowa and Illinois. Nationwide, Nebraska is the third state in groundwater use behind California and Texas; Nebraska used <u>7,710 million gallons per day</u> (Mgal/d) in 2005). Groundwater is used for irrigation more than surface water throughout the Midwest, so it is likely that when you eat canned corn for supper tonight, you are also "drinking" groundwater. Source: USA Economics and Statistics System (2001); USGS <u>Estimated Use of Water in the United States in 2000</u>

(3) Land subsidence occurs in areas underlain by highly fractured granite, which is readily dissolved by moving groundwater, especially when the water is slightly acidic.

Your Answer	Correct Answer	Explanation
	FALSE	This is false. You might be confusing land subsidence with <u>sinkholes</u>, and this statement is truer for sinkholes (not for the "granite" part). Sinkholes can occur when water, sometimes a bit acidic in nature, dissolves underground rock, often limestone or dolomite. The land surface can collapse, often dramatically, into the void space underneath. Land subsidence takes place on a larger scale and is usually a much slower process, but it still involves land that collapses. Actually, "sinks" is a more proper term. Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. The basic cause of land subsidence is a loss of support below ground. In other words, sometimes when water is taken out of the soil, the soil collapses, compacts, and drops. This depends on the type of soil and also on the type of rock below

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Your Answer	Correct Answer	Explanation
		the surface. More information: Land subsidence in the United States Land subsidence from groundwater pumping Land subsidence

(4) Water can flow in streams even during periods of drought due to groundwater seeping into stream banks.

Your Answer	Correct Answer	Explanation
	TRUE	Lucky for us this is true! If rivers dried up every time there was drought, we (and the fish) would be in trouble. Although we only see surface water on the Earth's surface, there is a strong connection between nature's surface-water and groundwater systems. Groundwater contributes to streams in most geographic areas and climatic settings. The proportion of stream water that comes from groundwater inflow varies according to a region's geography, geology, and climate. Water scientists (hydrologists) can determine the amount of water that groundwater contributes to streams by analyzing streamflow hydrographs. This groundwater component of a stream's flow is called "base flow." In a USGS study, streams in the United States were studied to see how much of the streamflow came from groundwater flow. The Forest River Basin in North Dakota is underlain by poorly permeable (water moves through it relatively slowly) silt and clay deposits, and only about 14 percent of its average-annual flow comes from groundwater. In contrast, the Sturgeon River Basin in Michigan is underlain by highly permeable (water

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Your Answer	Correct Answer	Explanation
		moves through it relatively quickly) sand and gravel, and about 90 percent of its average-annual flow comes from groundwater. The median value for 54 streams was 55 percent from groundwater.

(5) Artificial recharge to an aquifer can occur when people inject water down into a well to force it back into an aquifer so they can withdraw it later.

Your Answer	Correct Answer	Explanation
	TRUE	True, this is one way of using the same groundwater again and again. Sure, it costs money and takes time to do this, but if the groundwater is valuable enough (probably because enough surface water is scarce) it may make sense to artificially inject groundwater back into the same aquifers it came from for use on another day. In places where the water table is close to the land surface and where water can move through the aquifer at a high rate, aquifers can be replenished artificially. For example, large volumes of groundwater used for air conditioning are returned to aquifers through recharge wells on Long Island, New York. In Orlando, Florida, water is spread across small basins, sinks into the ground, and recharges the shallow surficial aquifer to be used for irrigation of local citrus crop fields.

(6) Big cities drill deep wells to tap naturally heated water because the heat kills bacteria and the water needs less treatment.

Your Answer	Correct Answer	Explanation
	FALSE	This is false, even if temperatures do increase the further down you go from the land surface. You do

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Your Answer	Correct Answer	Explanation
		not have to get to the center of the Earth before things get too hot for comfort. In some deep mines, about 3,000 feet down, temperatures can be as hot as in a desert. Water coming from these depths is hot, too, but not near the boiling point. Boiling water would be found at much deeper depths. Besides, it is a lot cheaper to just add some chlorine to water to kill bacteria rather than bear the cost of drilling a well a mile deep. Most aquifers are much closer to the land surface; many are just meters below the ground.

(7) Bottled water often is advertised as "artesian well water." Artesian water is groundwater that is naturally filtered by an aquifer composed of fine, porous material—this artesian water can be put directly into bottles.

Your Answer	Correct Answer	Explanation
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	FALSE	This is false. While it is true that artesian water, or even just "plain" well water, can sometimes be used directly for bottled water, this statement is false, because <u>artesian water</u> is not defined as being naturally filtered. A simple definition of artesian water is that it is water in the ground that is under pressure. Groundwater occurring in aquifers between layers of poorly permeable rock, such as clay or shale, may be confined under pressure. If such a confined aquifer is tapped by a well, water will rise above the top of the aquifer and may even flow from the well onto the land surface, as in a <u>spring</u>. Water confined in this way is said to be under artesian pressure, and the aquifer is called an <i>artesian aquifer</i>. The word <i>artesian</i> comes from the town of Artois in France, the old Roman city of Artesium, where the best-known flowing artesian wells were drilled in the Middle Ages.
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(8) The heaviest users of groundwater for drinking water and other public uses are the Southwest desert States, where surface water is scarce.

Your Answer	Correct Answer	Explanation
	FALSE	This is false, as the states in the Southwest desert use more surface water than groundwater. During 2005, Arizona, Colorado, Nevada, New Mexico, and Utah used about 9,090 million gallons per day (Mgal/d) of groundwater as compared to about 24,200 Mgal/d of surface water. It is true that these States are not highly populated, so maybe there is less demand by people for water, and maybe their surface water is enough to serve their purposes. It is no secret, however, where almost all of the water withdrawals in those States went—irrigation purposes; thus, about 6,910 Mgal/d, or about 76 percent, of groundwater was used for irrigation. Source: <u>Estimated Use of Water in the United States in 2005</u>

(9) The porosity and permeability of an aquifer define its ability to yield water to wells in productive amounts.

Your Answer	Correct Answer	Explanation
	TRUE	This is true. The two main characteristics of rocks that affect the presence and movement of groundwater are porosity (size and amount of void spaces) and permeability (the relative ease with which water can move through spaces in the rock). You probably know what a porous material is—it has lots of void spaces and openings, like a sponge. The rocks under our feet are not totally solid. They are full of cracks, fractures, and void spaces. For water to exist underground there must be void spaces to hold it. However, the rock also must be permeable enough to allow water to move (due mainly to gravity). Rock that is highly permeable has connections between the fractures and openings. These pathways acts as the highways along which water travels underground, and in the case of the owner of a well, hopefully towards his/her well.

(10) For some wells along the coastline that are drilled into porous aquifers, pumps are turned off twice a day (during periods of high tides), since tides temporarily raise saline groundwater levels, causing saltwater intrusion into freshwater aquifers.

Your Answer	Correct Answer	Explanation
	FALSE	This one is false, but some of the concepts are true. The water level in wells can be affected by tides and if the well depth is at the same level as the area where saline and fresh water are somewhat mixed (brackish water), then the tides might have a small influence on the salinity of the brackish water. But, for water-supply wells, you won't find many that are tapping water at the point where saline water and freshwater mix; hopefully the well would be tapping the freshwater above the saline-water layer. In that case, freshwater would

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Your Answer	Correct Answer	Explanation
		be always be accessed, despite the tides. Wells are drilled along the coasts and they do yield great amounts of freshwater. For example, there are huge paper mills on the coast of Georgia, and they use a lot of fresh groundwater. Since aquifers exist in generally horizontal layers below the land surface, that means freshwater aquifers can extend underneath the oceans. Drilling a well near the coast can still tap a freshwater aquifer. Saline aquifers also exist both underneath the oceans and under the land surface. If a well happens to be drilled into a saline or brackish aquifer, then the well can yield saline water (which neither you nor an orange tree would like to drink). Saltwater intrusion also can be a problem along the coasts. This can occur if a freshwater well is pumped too intensively for natural freshwater recharge from the surface to replenish it. In this case, salty water then can be drawn toward the well opening in the aquifer, thus yielding a mix of freshwater and saline water. Find out more: Saltwater contamination at Brunswick, Georgia

(11) Cities prefer to use groundwater for drinking-water supplies because surface water is in constant contact with streambeds and, thus, contains a higher concentration of dissolved minerals and other substances that must be removed.

Your Answer	Correct Answer	Explanation
	FALSE	This is false. Any water users will tend to use the water they can get to easier, cheaper, and with the least impact on the environment. In terms of water use, public supply refers to water used by organized groups of people—such as towns, cities,

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Your Answer	Correct Answer	Explanation
		and communities. During 2005, the Nation withdrew about 29,600 million gallons per day (Mgal/d) of surface water for public-supply uses as compared to about 14,600 Mgal/d of groundwater. Chances are that the water in that water tower on top of the hill near your house is full of water from a river, lake, or reservoir rather than groundwater. Now, it is true that if you dipped a jar into a creek and compared the water to water from a well, the groundwater would look a lot cleaner. The water probably would be a lot clearer (unless there is a lot of dissolved iron, which would turn the water brown) and you would not find floating leaf particles in groundwater. Actually, however, groundwater usually has more dissolved minerals and substances in it than surface water. Groundwater spends a lot of time moving through rocks underground—sometimes thousands of years. Water is also the top dog when it comes to being able to <u>dissolve substances</u>. Groundwater will often have <u>more dissolved substances than surface water will</u>. Source: USA Economics and Statistics System (2001); USGS <u>Estimated Use of Water in the United States in 2000</u>

(12) Excessive pumping of a well can reverse the natural flow of groundwater into a river, causing a fall in the water level in the river.

Your Answer	Correct Answer	Explanation
	TRUE	This is true! You might think that in comparison to a mighty river, a well is a small and insignificant thing, but that well can have a noticeable effect on a river's flow. There is <u>more of an interaction</u>

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Your Answer	Correct Answer	Explanation
		between the water in lakes and rivers and groundwater than most people think. Some, and often a great deal, of the water flowing in rivers comes from seepage of groundwater into the streambed. Groundwater contributes water to streams in most physiographic and climatic settings. The proportion of stream water that comes from groundwater inflow varies according to a region's geography, geology, and climate. Groundwater pumping can alter how water moves between an aquifer and a stream, lake, or wetland by either intercepting groundwater flow that discharges into the surface-water body under natural conditions or by increasing the rate of water movement from the surface-water body into an aquifer. A related effect of groundwater pumping is the lowering of groundwater levels below the depth that vegetation along the stream needs to survive. The overall effect is a loss of vegetation and wildlife habitat alongside the river. For more information: Sustainability of Ground-Water Resources

(13) Most wells are shallow because a significant amount of water cannot be obtained from wells where the underground water level is deeper than about 500 feet; it is impossible at the moment to pump water that deep in the earth to the land surface.

Your Answer	Correct Answer	Explanation
	FALSE	This is false. Most wells are indeed "shallow," although <i>shallow</i> is a relative term. Wells that produce water for peoples' uses are generally from dozens to hundreds of feet deep—you will not find

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Your Answer	Correct Answer	Explanation
		many production wells that go down 5 miles! It can be done, though. Water can indeed be pumped from below 500 feet, even if multiple pumps at different levels have to be used. It is true that it will cost a lot more to drill and maintain a deep well compared to a shallow well, so there is more incentive to find aquifers closer to the land surface. But, it comes down to economics. If water is valuable (and scarce) enough, then it can make economic sense to spend the money to pump deep water to the surface.

(14) Most wells used for irrigation, domestic and public-supply water use tap large open areas in subsurface rocks—including horizontal fissures, caverns, and lava tubes, which have connections to the land surface—thus allowing the aquifer to be recharged quickly by precipitation.

Your Answer	Correct Answer	Explanation
	FALSE	This is false. Have you ever heard this myth about groundwater? "There are rivers of water flowing below ground." For the most part, it really is a myth. Of course, it is true that there are caverns, lava tubes, and large fissures in the ground and some of these spaces have water in them ... ever hear of "cave diving"? A river can indeed <u>disappear into the ground</u>. These hydrogeologic formations, however, are not often used to supply well water for large uses, such as irrigation and water for households and drinking supplies. Why do all the work to find a cave full of water when there is plenty of water in the aquifers all over (under, actually) the Earth? The most productive wells tap highly porous and highly

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Your Answer	Correct Answer	Explanation
		permeable aquifers that have a reliable source of recharge. Think of a swimming pool filled with a huge sponge (highly porous and permeable), with a garden hose constantly keeping the pool full. If you put a big straw into the sponge, you could drink water out of it indefinitely, as long as you didn't drink faster than the garden hose refilled the pool.

(15) A cone of depression occurs when you drop your scoop of ice cream (made with groundwater) on the ground on a hot summer day.

Your Answer	Correct Answer	Explanation
	FALSE	This is false, although a <i>cone of depression</i> is an actual hydrologic term. In a different sense, this is true, remembering how my young daughter complained when her ice cream fell off her cone onto the pavement once. All pumped wells, to varying degrees, cause <u>cones of depressions</u> to form around the well casing at the water-table (the altitude, below ground, where below it the ground is saturated with water). If large cones of depressions form then the level of the water table can decline below the depth of the water intake for the well, and the well will pump less water and possibly go dry. If this happens, it will take time for the aquifer to recharge enough to raise the water level back to previous levels. That is why it is important to study the recharge characteristics of the aquifer that is tapped by a well—the well operator should not pump a well faster than it is recharged, as a cone of depression could form.