DOWNLOAD PDF WHAT CAUSES THE CORROSION (RUSTING)? 17

Chapter 1 : The causes and effects of corrosion in piping - Smith Boughan

Corrosion is the deterioration of a metal as a result of chemical reactions between it and the surrounding environment. Both the type of metal and the environmental conditions, particularly gasses that are in contact with the metal, determine the form and rate of deterioration. All metals can.

Set up Jar 1 Add a tablespoon of iron filings to the bottom of the jar. Pour enough water into the jar to completely cover the iron filings. This jar acts as your control because it has all the components we commonly associate with rust formation. Do not put on a lid. Knowing that this jar is our control, why would we want to leave the lid off of the jar? Set Up Jar 2 Add a tablespoon of iron filings to the bottom of the jar. Add a teaspoon of calcium chloride to the jar. The purpose of this is to remove all water vapor from the atmosphere. Make sure to screw the jar lid on tightly. Set Up Jar 3 Add a tablespoon of iron filings to the bottom of the jar. What do you think the purpose of adding oil is? Carefully pour water into the jar until a one inch layer is formed. After a couple of seconds, where does the oil layer go? Set Up Jar 4 Add a tablespoon of iron filings to the bottom of the jar. Add enough water to completely cover the iron filings. Add one tablespoon of vinegar. Set all your jars in a quiet place and wait until you see rust in one of your jars. Results You are likely to get results in hours. The filings in Jar 1 and Jar 4 will show rust; the filings in Jar 2 and 3 will not. Jar 4 is likely to have more rust than Jar 1. So how does rust form, exactly? Rust chemistry is fairly straightforward: To get to the oxygen, however, these electrons need to travel through water! Rust appeared on the iron filings in Jar 1 because all reactants were present: The iron was in the filings, the oxygen came from the air, and of course, you added the water. Jar 2 had no water because the calcium chloride removed moisture from the air. Because only oxygen and other gasses in our atmosphere were present in the jar, no rust could be created. In Jar 3, the layer of oil prevented the oxygen in the air from meeting up with the water and iron underneath. In Jar 4, the vinegar created a chemical reaction of its own with the iron filings. This made it easier for the oxygen in the air to react with it and create rust. Disclaimer and Safety Precautions Education. In addition, your access to Education. Warning is hereby given that not all Project Ideas are appropriate for all individuals or in all circumstances. Implementation of any Science Project Idea should be undertaken only in appropriate settings and with appropriate parental or other supervision. Reading and following the safety precautions of all materials used in a project is the sole responsibility of each individual.

Chapter 2 : What is Rust? (with pictures)

What is Rusting. Rusting is the red or orange coating that forms on the surface of iron when exposed to air and moisture. It is a type of corrosion.

What Causes a Nail to Rust? The silvery sheen of a new nail gives way to reddish-brown spots, which then spread to cover the entire nail. The sharp outline softens, covered in rough scale and eaten away with tiny pits. Eventually, the rust reaches the core, until you can break the nail between your fingers. Finally, the nail crumbles entirely, leaving only a powdery stain. The cause of all this is a chemical reaction between the iron in the nail and oxygen dissolved in the water it encounters. Chemical Reaction The formation of rust depends on two chemical reactions. The first is known as anodic dissolution, which takes place when the iron in the nail is exposed to water. The water reacts with the iron by stealing two electrons from the iron, leaving it positively charged. Any oxygen dissolved in the water then interacts with the positively charged iron in a second chemical reaction, bonding with it to create ferrous oxide. Ferrous oxide is the reddish substance most commonly referred to as rust. Causes of Rust Since one of the chemical reactions that causes rust requires the presence of water and the second reaction requires oxygen, rust can only form when both water and oxygen can reach the iron molecules in the nail. Unfortunately, both water and oxygen are readily available in the atmosphere, so even unprotected nails in a desert environment will succumb to rust, although iron exposed to high humidity or seawater will rust much more quickly. Steel rusts as well as iron because it is an alloy chiefly composed of iron. Sciencing Video Vault Scaling Scaling is the ferrous oxide which remains attached to the nail. Since the ferrous oxide is a bulkier molecule than the original iron, it takes up more space, which distorts the shape of the nail as it rusts. This also accounts for the fact that when a whole barrel of nails rusts, they meld together into a cohesive mass. The ferrous oxide from one nail is bonding with the ferrous oxide of its neighbors, welding them together. Scaling is what causes rusty hinges to stick and squeak and rusty chains to creak. Corrosion Corrosion is the most destructive aspect of rust. Since the ferrous oxide is less durable than the original iron, it easily pits and flakes away. Worse, unlike the oxides of copper, ferrous oxide does not provide any sort of protective patina. A rusty nail can rust to the core without the outer coating of rust providing any protection. When too much of the original iron has been converted to fragile ferrous oxide, it will lose structural integrity and crumble to dust. Given enough time, water and oxygen, even large chunks of iron machinery will literally rust away to nothing. What Causes Metals to Oxidize or Rust? About the Author This article was written by the Sciencing team, copy edited and fact checked through a multi-point auditing system, in efforts to ensure our readers only receive the best information. To submit your questions or ideas, or to simply learn more about Sciencing, contact us here.

Chapter 3 : What exactly is rust? - NCH Europe

What Is Corrosion. Corrosion is a natural event that causes the weakening of a material, usually a metal, or its characteristics due to reactions with the environment.. Some environments are more suitable for the chemical combination of metals with elements to create compounds and come back to their low energy levels.

Contributors Corrosion is a process through which metals in manufactured states return to their natural oxidation states. This process is a reduction-oxidation reaction in which the metal is being oxidized by its surroundings, often the oxygen in air. Corrosion is essentially the creation of voltaic , or galvanic, cells where the metal in question acts as an anode and generally deteriorates or loses functional stability. Corrosion is a commonplace occurrence, like the rusting and flaking of an old iron yard piece. Here we will explore the process by which corrosion takes place and the different ways unwanted corrosion can be controlled. Energy, often large amounts, are poured into winning the desired metals from their natural ores; manufacturing some metal products can be very costly. Corrosion causes deterioration of manufactured products, damaging their structure and ultimately rendering the product useless. Allowing corrosion is not cost efficient and can inhibit productivity; understanding and preventing corrosion is important for maintaining infrastructures and machinery or any products that face corrosion. Conditions for Corrosion of Metals There are three main components necessary for corrosion to occur: These metals, such as iron, will spontaneously return to their natural states. The placement of the metal in the Galvanic Series will contribute to its likelihood of corrosion; the higher a metal in the Galvanic Series the less likely it is to corrode. This effect is amplified when two metals at opposite ends of the Galvanic Series are in contact: Other environmental factors contribute to corrosion such as pH, salt concentration, and oxygen concentration, along with the velocity of the water and temperature. How Corrosion Occurs Corrosion can occur in two general ways; over the entire surface of the metal Generalized Corrosion , or in local spots or areas Localized Corrosion. Typically never happens, aside from in acidic conditions. This uniform corrosion over the entire surface of the metal is rare and leads to overall thinning which has little effect outside of fatigue and stress conditions. The most common, and most detrimental, form of localized corrosion is pitting. Pitting is when the attack happens in one single location on the surface and creates a pit, or small cavity, in the metal. This type of corrosion attack is hard to prevent, engineer against, and often times difficult to detect before structural failure is met due to cracking. Pipes are often compromised due to pitting. Understanding Corrosion as an Electrochemical Process a Voltaic Cell Corrosion happens through a series of reduction-oxidation reactions , similar to those of a battery. The metal being corroded acts as the anode; the metal is oxidized, forming metal ions and free electrons. The free electrons reduce the oxygen, often times forming hydroxide, and providing a complimentary cathodic reaction. The dissolution of the metal at the anode has two possible outcomes; the metal ions can go into solution, becoming hydrated, or the metal ions can form a solid compound that collects on the surface. In the former case, further oxidation of the metal ions can occur and an open pit can form. In the latter case, a protective barrier may be formed and the collection of solid metal ions will inhibit further corrosion. The subsequent reactions model a galvanic cell; reduction-oxidation reactions occur in a way similar to those of batteries. Typically, the metal that is lower on the Galvanic Series will act as the anode and corrode faster than without the presence of the second metal, while the second metal gains a stronger resistance to corrosion. These reactions and their directions can change or be altered due to the environment. Corrosion prevention Corrosion can be prevented through using multiple products and techniques including painting, sacrificial anodes , cathodic protection electroplating , and natural products of corrosion itself. The paint forms a barrier between the metal and the environment, namely moisture. Utilization of a metal lower on the Galvanic Series to be attacked first, instead of the metal in use. The sacrificial anode can be replaced as needed. Some corrosion processes will create solid metal compounds that will coat the initial site of corrosion and prevent further corrosion at that site. In the illustration below the iron is coated with a thin layer of zinc which is acting as a sacrificial layer for the iron. Instead of the the iron corroding, the Zn acts as the sacrificial anode in the cell and protects the iron.

Chapter 4 : Why Do Some Things Rust? | Wonderopolis

Rust actually means Oxides of Iron, formed by conversion of iron or steel by www.nxgvision.com is a noun. The process of formation of Oxides of iron, due to reaction of various elements like Oxygen, Moisture, Salt etc present in the environment promoting the oxidation of iron and steel structurals and objects is called Rusting.

Prevention of Corrosion Explained: A Simple Electroplating Experiment written by: Corrosion products from oxidation do not adhere to the metal surface, and the resultant pitting deteriorates the structure. Some environments are more suitable for the chemical combination of metals with elements to create compounds and come back to their low energy levels. Corrosion is a serious condition of the substance that may produce massive damage to the product, including bridges, buildings, water systems, and home appliances, unless suitable prevention and control techniques are applied. If an electrical circuit is completed, the metal atoms become positively charged ions, causing pitting or the development of a crack. The rate of pitting corrosion is greater in portions where welding operations have caused micro structural transformations. Localized corrosion may initiate fatigue that can intensify by the action with corrosive agents like seawater. In an electrochemical corrosion, the strength of iron is reduced due to the oxidation of its atoms that is called rusting, by which oxides are formed. Metal corrosion will also occur by a chemical reaction with gaseous substances like acid vapors, ammonia gas, and gases containing sulpher. Corrosion particularly signifies the process that is related to the weakening or degradation of the metal parts, and the processes are generally electrochemical in nature. Rust formed is brittle and prominent as a reddish crust on the exposed fresh iron surface. Formation of rust can be minimized by the exclusion of the air and water from the surface of the iron by the application of paint, oil, grease, or a shielding coat of another metal such as chromium, zinc, or nickel. Stainless steels do not corrode because of the addition of protective coatings of nickel or chromium that form a rigid coating to withstand additional attack. Several techniques are being employed for this purpose. Galvanization is a metallurgical process in which a zinc coating is applied on steel or iron to avoid rust, since the corrosion resistance of zinc is superior to those of steel and iron. Coatings of zinc achieve corrosion prevention of the protected metal by the formation of a physical obstruction, and by functioning as an anode if this obstruction is destroyed. On exposure of zinc to the atmosphere, zinc oxide is formed by the reaction of zinc with oxygen that further reacts with molecules of water in the air to form zinc hydroxide. Reaction of zinc hydroxide with carbon dioxide in the atmosphere creates a thin and insoluble layer of zinc carbonate that prevents further corrosion. Preservation of iron and steel by the process of galvanization is preferred because it is economical and simple in application. Here, the metal to be protected is coated by a thin layer of another metal having non-rusting properties by reducing it. Normally, the metals involved form the electrodes, which are processed inside an electrolyte by passing electric current DC across the electrodes, through the electrolyte. In this process the electrode which is connected to the negative of the supply gradually gets covered with the metal of the electrode connected to the positive of the electric supply which slowly disintegrates or reduces and becomes attached over the other electrode. The electrode connected to the negative is the one which is being electroplated for the required protections. The above process can be explained and witnessed through a small experiment. You will need the following materials for the experiment:

Chapter 5 : The causes of rusting- Learn Chemistry

Within about two weeks, but between one day and the next, every piece of metal in the basement had a patina of rust or other corrosion on it; the acid had eaten the cork which fell into the bottle, leaving the vapors free to escape into the air.

Acid, Base, Chromium, Corrosion, Electroplating, Galvanization, Iron, Oxidation, Rusting, Steel What is Corrosion Corrosion is the process of deterioration of a substance due to chemical, electrochemical or other reactions that take place on the surface of that substance. Corrosion can occur on both metal and nonmetal surfaces. The corrosion of a material affects the structure of the material surface. The most common example for corrosion is rusting. Here, the color and the quality of the steel is changed. Corrosion can also take place on nonmetal surfaces such as table tops and skin. When some corrosive chemicals are dropped on these surfaces, deterioration of that surface may occur. Chemicals that cause corrosion are known as corrosive chemicals. These chemicals can cause visible destruction of surfaces that are permanent damages. The surface can be skin, eye, wood, metals, etc. Chemicals should be handled with care. The following actions can reduce corrosion, Painting the surface Handling chemicals with care What is Rusting Rusting is the red or orange coating that forms on the surface of iron when exposed to air and moisture. It is a type of corrosion. This is caused by the chemical reaction between the metal surface and the moisture and oxygen in the air. The most common substances that undergo rusting are iron and steel. Rusting does not happen due to chemical spills. But some chemicals can accelerate rusting by increasing the electrical activity between iron and oxygen. Rust on Chains The rusting on iron or steel is also known as metallic oxidation. This is because the metal atoms on the surface get oxidized by oxygen in the air in the presence of water. The rate of rusting depends on several factors such as the humidity of the air, the surface area of metal that is exposed to air, etc. There are several methods for the prevention of metals from rusting. Some of these strategies are given below. Environmental modifications Galvanization â€” A zinc coating can prevent iron from rusting by acting as a sacrificial anode. Corrosion inhibitors â€” These are chemicals that can avoid rust formation by interrupting the oxidation reaction on the metal surface. Paints â€” A coating of paints can avoid the initiation of rusting. Electroplating â€” A thin layer of a metal Ex: Nickel , Chromium is deposited on steel surface. However, stainless steel is an exception because it shows no rusting. Chromium can form a thin film by reacting with oxygen in air and water. This thin film prevents the stainless steel from rusting. Corrosion is the process of deterioration of a substance due to chemical, electrochemical or other reactions that take place on the surface of that substance. Rusting is the red or orange coating that forms on the surface of iron when exposed to air and moisture. Corrosion can occur on different surfaces such as skin, wood, metals, etc. Rusting mainly occurs on surfaces of iron and steel. Corrosion can happen due to exposure to air or spread of chemicals on the surface. Rusting can happen due to exposure to air and moisture. Corrosion can be observed as a skin burn, wood surface destruction or rusting. Rusting can be observed as red or orange coating on the surface. Conclusion Corrosion is a type of oxidation. Rusting is a type of corrosion. The main difference between corrosion and rusting is that corrosion can happen due to chemicals whereas rusting does not happen due to chemicals but can be accelerated by some chemicals. Her interest areas for writing and research include Biochemistry and Environmental Chemistry.

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Chapter 6 : Corrosion - Wikipedia

Corrosion is an electrochemical reaction that appears in several forms, such as chemical corrosion and atmospheric corrosion, the latter of which is the most common form. When acidic substances (including water) come in contact with metals, such as iron and/or steel, rust begins to form.

Corrosion is a natural process that involves the deterioration of metal components. How Corrosion Occurs Corrosion is an electrochemical reaction that appears in several forms, such as chemical corrosion and atmospheric corrosion, the latter of which is the most common form. Rust is the result of corroding steel after the iron Fe particles have been exposed to oxygen and moisture e. Oxygen causes these electrons to rise up and form hydroxyl ions OH. Where the affected iron particles were, has now become a corrosion pit, and where they are now, is called the corrosion product rust. Corrosion can happen at any rate, depending on the environment that the metal is in. However, since atmospheric corrosion is so widespread, it is recommended to take effective precautionary measures when it comes to corrosion prevention. This is a corroded tank. Removing and Treating Rust Depending on the situation and application, you may be able to treat the area that has corroded. If the affected area is small and treatable, you may require some tools and products to remove it. Begin by removing the rust from the metal using a tools such as a grinding wheel or needle gun. Be careful not to cause any additional damage to the metal. You will also want to take this time to look at the application as a whole for other premature signs of corrosion. How Can I Prevent Corrosion? One of the best ways to prevent corrosion is to apply an Anti-Corrosion Protective Coating. A protective coating protects its substrate by preventing contact between the substrate and harsh environments atmospheric, chemical, etc. A tank experiencing corrosion. Si-COAT Anti-Corrosion Protective Coatings can be applied to a wide range of applications, such as structural steel, bridges, machinery and equipment, areas with heavy corrosion, tank exteriors, metal roofs, cladding, and more. Si-COAT AC protective coatings are ideally applied to where the necessary coverage is essential and maximum protection, adhesion, elasticity and longevity are required. Posted on Monday, September 12, in Blog.

Chapter 7 : Difference Between Corrosion and Rusting | Definition, Process, Causes, Prevention

Rust only forms on the outside of a metal surface because it requires exposure of oxygen and water to rust. If you find an old metal table or steel rod that's been left outside that you try to scrub clean of rust, anything shiny under the surface you see has not been exposed yet to both oxygen and water.

Jan 24, In fact, depending on the degree of these factors, a piping system can actually show signs of corrosion in merely a few years after being installed. But how exactly does that happen and what does it mean to your building and the people inside it? The effects of corrosion The cost of corrosion can be expensive. It can impact the health of employees and those who frequent your commercial building. Studies have shown that consuming water with high levels of toxic metals â€" lead and copper â€" can lead to acute and chronic health problems. Pipe corrosion can also damage the aesthetic quality of your water and it can be a waste of money in many ways: Corroded water can hurt the efficiency of hot water heaters and cause premature failure. It can cause premature failure of plumbing systems and fixtures. It can result in stained fixtures and potential odors. The causes of pipe corrosion Corrosion in a piping system, and the rate at which it happens, is usually related to one or more factors. The pH of the water: In copper piping systems, if the pH is under a certain level it harms the protective barrier of the pipe and leads to corrosion. Oxygen in the water: Oxygen degrades metals, gradually converting the metal to rust. As this happens, impurities are deposited into water lines or collected on the piping wall, creating restrictions and blockages. Minerals in water can either help or harm corrosive levels. For instance, high levels of calcium can cause a level of build up. It turns out, the hotter the water, the more pronounced the corrosion. These water issues are some of the things that can lead to corrosion in your piping system. And the effects of that corrosion can lead to numerous health problems along with wasting you money in many ways. The technicians at Smith-Boughan can help you avoid, monitor and repair any piping issues that you may have. Be sure to contact us today by phone at , email us to info sbmech.

Chapter 8 : Rust - Wikipedia

Corrosion of "free iron" on stainless steel is always faster than corrosion of the unal- loyed steel itself because the free iron "contamination" is anodic to the stainless steel, so it corrodes to protect the stainless steel, just like zinc corrodes to protect carbon.

What caused the corrosion on all this piping? April 9, 4: I am a plumber and on a recent service call was tasked with dealing with a leak inside a bathroom vanity. I found no leak, just a stain in the bottom of the cabinet. However, all the metal inside the cabinet was corroded. The shutoffs, trap, and supply tubes brass , and the copper were corroded and had patina. The escutcheons, and more troubling, the braided "stainless" lines connecting the three piece faucet were completely rusted. I spoke with a coworker who told me he had seen something similar when a dripping faucet was uncorrected for a long duration and condensation formed on all the piping. The homeowner told me that the faucet had dripped for a while, but it was years ago. I inspected again and found that the hinges and hardware for the vanity were similarly corroded. I should also note that there is a shower in the bathroom, but they do not use it. The common household source is bleach. Over the course of a few months the weekly drying of the bleach impregnated cloth inside the unventilated vanity ate away at the plumbing. There is another source: If the house was built or renovated in the s this may be the issue. In after Hurricane Katrina a lot of that tainted drywall was installed into flooded homes. Did they have any remodeling done around that time? Within about two weeks, but between one day and the next, every piece of metal in the basement had a patina of rust or other corrosion on it; the acid had eaten the cork which fell into the bottle, leaving the vapors free to escape into the air. Not that many people would have such hanging around their house, though -- that is, unless they were stripping the mortar off of recycled bricks, maybe glass bricks in this case, I might guess. Water losses are a huge thing. I have spent years chasing this shit down. I know the answer. I have seen so many rusted bullshit "stainless" connections. And everything else under there. They all get the treatment. Everything gets rusted or patina or whatnot. I know this because I was sick of seeing it all the time and had to prove it to other people, so I bought a bunch of stainless toilet connections, the braid ones, and I set them in a closet and every two weeks I sprayed them once with whatever cleaner. They were the most popular cleaners. Four setups, the four most popular cleaners. I think whoever is making those stainless steel fittings is lying. And I know so because we had a metallurgy lab too. Used heavily in new construction from the late nineties through around o. Lots of it in Florida. Had a flexible hose under the sink burst, plumber could see it was all corroded even though it was fairly new. Definitely leaning towards cleaning products now. Thanks for all the answers.

Chapter 9 : forging rust on un machined surface

Rust is an iron oxide, a usually red oxide formed by the redox reaction of iron and oxygen in the presence of water or air moisture. Several forms of rust are distinguishable both visually and by spectroscopy, and form under different circumstances.

Does it affect water pipe lines? Rust is a chemical reaction. Can metals that are not alloys of iron rust? I see rust textures in advertisements, games and movies regularly. Will it corrode, and if so, will it corrode faster in mild temperatures, cool or under a lamp that is 40 watts? I am in year 9. I used water spray, salt water, tap water and white vinegar mixed with water. I used three iron strips in each. They were all submerged completely except for the spray of course. In the end vinegar rusted the most. It formed a lot of rust and it lost the most weight too. Tap water was next then salt water. I am supposed to explain why what happened happened. Can anyone help me? I need it for my bibliography! Thank you for visiting wiseGEEK. Generally, the accessed date works for bibliographies calling for a date. This helped so much with my science fair project! This was very useful. Can anyone provide any help? Other metals undergo oxidation to form oxides, but the resulting material is an iron oxide, not rust. Will soda coke oxidize rust metal? All sodas contain phosphoric acid. This is where the bubbles come from, this also decreases the pH of the soda and speeds up the rusting process. To the doctor who said co2 does not cause oxidation you are wrong co2 is corrosive. What gives rust its orange-red color? The element Fe iron is what turns rust red. Does the presence of sodium speed up the rusting process? Sodium increases the conductivity of water, making it a better electron transfer medium and speeding up the oxidation process. Any health effects upon exposure to deep well water containing rust due to corrosion in the pipeline? Depends on many factors, generally speaking, however, no. However, rust on piping makes an excellent site for harmful organisms to form colonies, and severely rusted pipes tend to have poor seals, allowing a whole host of things to seep into your water. If you have high iron in your water it is generally a good idea to find a way to reduce it either though treatment which well water often needs anyway or replacing damaged pipes. How can rust be prevented with just a simple substance? There are whole fields of science dedicated to this question. Generally speaking, coating iron in any compound that seals off the iron surface from oxygen: What are the positives and negatives of rusting? Well, the negatives part is easy. If the metal rusts away, it can fail, potentially causing great damage or bodily injury. The positive is a bit harder to answer. The short version is rusting is bad. However, not all rust is the same. For example, the Statue of Liberty was originally the color of a freshly minted penny. Over time as the surface copper oxidized, it formed a hard protective layer protecting the rest of the metal surface from exposure to oxygen, and greatly slowing down the "rusting" of one of the world most iconic national treasures. Why does the metal rust more when the plating is scratched? Often metal is treated to resist rusting, but this treatment is only "skin deep. Do you think iron would rust slowly, quickly, or at all in distilled water? Very slowly, or depending on what exactly your "iron" is made from, not at all. The tap water and salt water could be a toss up depending on where you get your tap water from, and how much salt you put in it. Also make sure you use the distilled water to make your salt water otherwise you will have salty tap water and it will spike your results. As for removing them from the water, I would say no. However, drawing some of the water off, and pouring it back into your sample jar several times a couple times a day could increase the dissolved oxygen content of your water samples and will increase the rate of oxidation. How long do you think an experiment like this would take? Depends how much rust are you looking for, the quality of your iron and the properties of your sample water types. Most often, nails are galvanized or treated in some way to resist rusting and may takes weeks or longer to show any real signs of rusting. Why does water rust less than coca cola, or apple juice? And why does the iron in the apple juice turn black? Coca-Cola and apple juice have a lower pH than water. Low pH solutions will rust iron faster, and the reason it turns black in apple juice is much like a blue and yellow marker make green; the compounds in apple juice, when mixed with iron, form a material black in color. I have an indoor water fountain with metal cups are now rusting What will rust faster in just plain tap water - an iron nail or a small piece of steel wool? I am guessing steel wool because of the surface area. Can anyone

verify this for me? I have heard a wide variance of answers, so is there a definitive one please?