The self-ionization of water and ph worksheet answers

The pH level in a saltwater aquarium is a constant concern to most marine aquarists. Whereas the occupants in a fish-only system can tolerate a fairly wide range of pH levels for periods of time with no major harm, the occupants of a reef tank, which includes both fish and invertebrates, rely heavily on a constant pH level in the right range just to survive, let alone thrive. The accepted pH level in a basic saltwater system is between 7.6 and 8.4, but reef tanks are more sensitive, and therefore need to be kept at the higher end of the pH scale, 8.0 to 8.4. To control or adjust pH, one must first understand what it is. Although understanding the chemistry of how ions interact can be complicated, developing a layman's understanding of pH is not hard. pH (power of Hydrogen) is simply a measurement of the acidity or alkalinity of any solution. A pH of 7 is considered to be "neutral," neither acid or alkaline, while pH above 7 is alkaline or "base," and below 7 is acidic. The normal trend for water in a saltwater system is for the pH to move downward, or more acidic, which stems from the addition of acids to the aquarium. These acids come from several sources, the primary ones being: Excess carbon dioxide (CO2) from respiration caused by lack of sufficient gas exchange Nitric acid from biological filtration (nitrification) Organic acids from metabolic wastes Of course, respiration and metabolic wastes are a natural part of the ocean. However, the reason that seawater pH does not change is that the water contains a number of chemicals, such as bicarbonate, calcium, carbonate, borate, and hydroxide, all of which act as natural "buffers" that retard the drop in pH. So where does alkalinity come into all of this? The degree to which a solution maintains its pH when acid is added is termed the "alkalinity" of the solution. Related terms used in reference to aquariums are carbonate or calcium hardness, and its German equivalent, KH or dKH. The amount of "buffers" in seawater determines the alkalinity. When the pH in a saltwater system starts to drop, it is an indication that the buffers are getting worn out, and it indicates that the increase in acidity needs to be corrected. To raise pH, easy methods are to add bicarbonate of soda (baking soda), or a commercial pH adjustment product.To lower a high pH, quick-fix remedies are to add some vinegar or lemon juice, or a commercial pH reduction product.For stabilizing pH, the generally accepted "tried and true" method is still performing regular partial water changes. This not only refreshes the natural buffers but also restores the trace minerals in the aquarium's water. Of course, reducing the causes of the drop in pH is always wise. Removing all uneaten foods and fish waste from the tank on a regular basis will go a long way toward retarding a drop in pH.Use a simple doser to automatically add buffers as well as calcium, iodine, other essential trace elements, and supplements.Installing a calcium reactor, although a more expensive option, can provide a no-hassle solution to control radical pH and alkalinity problems. Keep in mind that any major adjustments in the pH level in your tank should be done slowly. Raising the pH from 7.4 to 8.4 in a matter of a few minutes can induce pH shock in almost any saltwater fish (and invertebrates), causing death. If you are making major adjustments, do it slowly, as you would when acclimating new arrivals to your tank. Saltwater, without outside influences, will maintain a steady pH. If this is so, why does the pH in your saltwater aquarium change, usually dropping lower? In most cases, the pH drop is due to the acid produced by the production and reduction of ammonia. The ammonia is created by the livestock in the tank as it eats food and produces waste (mostly detritus) which then decomposes. Uneaten food on the bottom of the tank also produces ammonia as it decomposes. The same is true with any dead critters that are left in the tank. A regular tank maintenance program that removes fish waste and uneaten food, along with partial water changes with new saltwater, will usually keep the pH in your aquarium at the proper level and make pH adjustments a thing of the past. Have you set up an aquarium and then noticed that the pH of the water continues to rise? Could rocks or gravel that were added as decor in the aquarium affect the water pH? Yes. If your rocks are actually limestone, they are the cause for the pH elevation in your aquarium water. Limestone is calcareous (contains calcium) and is known for its ability to both harden the water and increase the pH. In fact, if someone asks how to raise water pH, one method we suggest is to place crushed limestone, coral, oyster shell or any highly calcareous material in the filter. Your local tap water may also be naturally hard (containing calcium and magnesium) and alkaline (containing carbonate), which adds further to the high pH. We'd definitely recommend testing the rock to see if it contains calcium carbonate and if there is any doubt, remove it entirely. If the tank pH stabilizes, you've found the culprit. If you don't want to give up on the rocks you have, you should determine what they're composed of. Test the composition of your rock by putting a few drops of ordinary white vinegar on it. If the vinegar foams, the rock is calcareous and this will affect the hardness and pH of the water. Limestone is probably the most frequently encountered calcareous rock, followed closely by marble. Another means of testing an unknown rock is to fill a bucket with water from the water source you plan to use. Then test and record the pH, hardness, nitrate and phosphate. Place the rock in the bucket and let it soak for a week, then test the water again. If there are no changes, the rocks are not likely to cause a problem in your aquarium. If the parameters change considerably, we'd advise against using the rock in question in your aquarium. Although pH can be altered, we don't advise attempting to make major changes in the pH of your local water. It is very difficult to keep the pH stable over time, and you may be faced with an even more dangerous situation as a result: fluctuating pH. Changes in pH are stressful—if not lethal—to your fish. Furthermore, sudden changes in pH can damage the beneficial bacterial colonies that eliminate wastes in your aquarium. In other words, keeping the pH at a steady state is just as important as the actual pH value itself. We suggest choosing fish that thrive in the pH of the water source that you have or find a water source that is already in the range you desire, rather than attempting to make major changes in the pH. If your water is naturally hard and alkaline, choose fish such as African cichlids that thrive in that environment. If your water is naturally soft and acidic, consider fish such as members of the popular Tetra family, almost all of which relish that type of water. Over time, the pH in the aquarium water will change due to the chemicals produced by the fish and bacteria in the aquarium. It is important to perform regular partial water changes in your aquarium to remove the old water and add new water that will be at the normal pH again. For local water that is low in hardness and alkalinity, using some calcareous rocks in the aquarium will raise the hardness and alkalinity and stabilize the pH. The term pH stands for "power of Hydrogen," and since "H" is the atomic symbol for the hydrogen element, the "H" in pH is always capitalized. The pH is the acid-base balance of a solution and is measured in a range from 1 to 14. Water, or H2O, is composed of hydrogen and oxygen atoms. Neutral water contains equal amounts of hydrogen ions (H+) and hydroxide ions (OH-) and is given a pH value of 7.0. Dissolved chemicals and minerals in water can change the balance of those ions from a neutral state to be acidic if there are more hydrogen ions than hydroxide ions, or basic if there are fewer hydrogen ions. Acidic solutions have a pH value of less than 7.0, while basic solutions have a pH value of more than 7.0. The further these values decrease or increase from 7.0, the more acidic or basic (respectively) the water becomes. There is no "normal" pH that applies to all fish. Because fish originate in ponds, rivers, streams, lakes, and oceans that have different pH levels, the optimum pH levels for fish varies by species. Saltwater fish prefer a basic pH of 8.0 or above. African cichlids often come from lakes that have a pH value above 8.0. Tropical fish from the Rio Negro in Brazil may live in acidic water with a pH of 5.5 or lower. Keep in mind that pH is not static; it changes over time. In fact, it may even change over the course of a single day. In nature, due to plant respiration and photosynthesis, pH typically drops at night and rises during the daytime. The pH may change as new fish are added or removed, as water is added or changed, and as the biological processes change in the aquarium. Angelfish 6.5 - 7.0 Clown Loach 6.0 - 6.5 Goldfish 7.0 - 7.5 Harlequin Rasbora 6.0 - 6.5 Hachetfish 6.0 - 7.0 Neon Tetra 5.8 - 6.2 Plecostomus 5.0 - 7.0 Silver Dollar 6.0 - 7.0 Tiger Barb 6.0 - 6.5 Zebra Danio 6.5 - 7.0 Illustration: The Spruce / Martisa Patrinos Significant pH changes are particularly hard on young and sick fish. In a number of species of fish, breeding occurs only within a specific pH range. If you are planning a new aquarium it's wise to know the pH of your water source, so you know beforehand if it is compatible with the species of fish you want to keep. Some fish such as Discus, and certain other cichlids, thrive in very narrow ranges of pH, which should be taken into consideration when setting up their aquarium. When moving fish from one aquarium to another it is important to match the pH levels. Sudden changes in pH account for many fish losses that occur when fish are brought home from a pet shop. Neon tetras are particularly sensitive to sudden changes in pH, and can easily be shocked when moved. Changes in the pH, especially sudden changes, can prove harmful or even fatal to fish. As the pH rises, it increases the toxicity of chemicals such as ammonia. It is an important factor to monitor while breaking in a new aquarium. The pH should be tested at least once a month, though preferably every two weeks, to allow for the detection of trends before they become a problem. Keep test results in a logbook for future reference. Remember that because pH can vary based on time of day, testing at different times of day can yield different results even though nothing is wrong. For this reason, testing should take place at the same time of day, preferably in the afternoon. Any time there is a fish illness or death, the pH should be tested. If the tank is treated with medication, the pH should be checked when treatment is begun, on the final day of treatment, and again a week later. Perform water changes as needed when the pH starts to vary from the optimum range for the fish. It is also wise to test your water just before purchasing new fish. Check with the shop where you are purchasing the fish to see what their water pH is. It's important that the pH of water the fish is currently in is not significantly different than the pH of your water at home (preferably within 0.2 units above or below the home pH value). I recommend sticking to the axiom of "if it's not broken, don't fix it". Don't spring into action simply because the textbook says the optimum pH for your fish is 6.4. and your water tests out at 7.0. As long as the pH is stable, and the fish show no signs of distress, it's best to leave the pH at the level of your local tap water. Also, most aquarium fish sold today are raised in fish farms that do not keep the fish in the pH of the natural habitat water. So, a pH of 6.8-8.0 is a safe range for keeping most freshwater fish. If the fish are not thriving, or if testing shows that a trend is occurring, such as a steady drop or rise in pH, the problem should be addressed. Pet stores sell commercial products designed to raise the pH or to lower it, if necessary, to adjust the pH of your local tap water. Proactive water care is always your best bet. Performing frequent partial water changes, and vacuuming the gravel are the most important things you can do to keep water pH stable. Over time, the biological filter bacteria that break down fish wastes will utilize the alkalinity (carbonate) in the water and the pH will gradually drop (become more acidic). You can prevent this by doing water changes to remove the lower pH water and adding fresh, dechlorinated water that has higher alkalinity to raise and stabilize the pH level.

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