

Pool Chemistry: Explained In Simple Terms

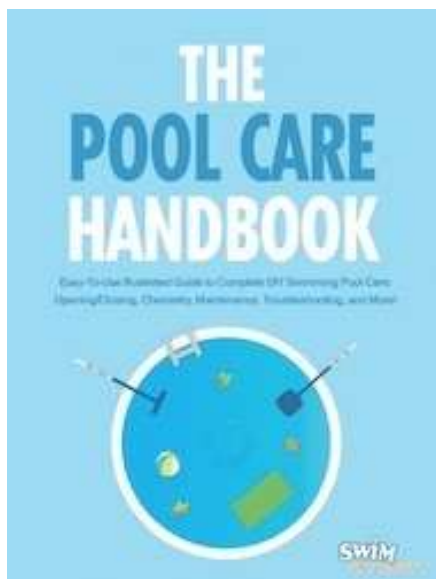
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Remember being sat in science class at school thinking, “pfft, as if I’ll ever use the periodic table in my adult life”?

Yeah, we’ve all been there.

While you weren’t totally wrong, there’s a lot of crossover between chemistry and pool care, so understanding basic pool chemistry is a must for anyone who owns or maintains a pool.

Now let’s dive into the basics every pool owner should know about pool water chemistry.



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Pool Chemistry In a Nutshell

The only way to keep your swimming pool water clean and clear is to keep your chemistry balanced. Period.

If your chemistry is off, it doesn't matter how aggressively you filter or how hard you scrub and vacuum your pool, the water will eventually turn.

The foundation of pool chemistry is about creating the right conditions for sanitation, which includes:

- **pH Level:** How acidic or alkaline the water is, which is influenced by the substances in the water itself. The scale goes from 1 (very acidic) to 14 (very alkaline), with 7 being neutral.
- **Total Alkalinity:** It keeps your pH stable. You can almost think of alkalinity as adding a layer of armor to your pH, absorbing fluctuations caused by external factors like rain, debris, or body oils.
- **Calcium Hardness:** How much calcium is present in the water. It's simple; the more calcium you have in your pool, the harder your water is.

Having each of these properly balanced isn't enough to keep your pool water crystal clear, but again, it will help you create the perfect environment for effective pool sanitation.

Pool sanitation includes:

- **Sanitizing Agent:** This stuff actively kills bacteria and other microorganisms in your water. Most people use chlorine, but you can also use bromine, biguanide, or minerals to sanitize your pool water.
- **Pool Stabilizer:** Especially important for outdoor pools that are exposed to the sun, cyanuric acid, or chlorine stabilizer, protects the chlorine in your pool from being burnt off by the sun's ultraviolet rays.

- **Pool Shock:** A powdered form of chlorine, or granular oxidizer, pool shock is a super-dose of chlorine when your pool water chemistry needs a swift sanitizing kick.

That's a basic overview of what's involved when it comes to pool chemistry, but now let's take a deeper look at each of these factors.

Creating The Right Conditions

You wouldn't roast a chicken without preheating the oven, and the same approach should be taken with your pool. (Don't worry, I have a degree in analogies.)

Pool water pH, alkalinity, and calcium hardness all have an influence over your sanitizer chemicals, so getting these balanced beforehand is essential.

pH Level

pH level tells you how acidic or alkaline (basic) something is. It's measured on the pH scale from 1 to 14 where the lower numbers are acidic, the higher numbers are alkaline, and 7 is neutral.

To give you some real-world examples:

- Lemon juice has a pH level of 2 (very acidic)
- Urine has a pH level of 6 (acidic)
- Tap water has a pH level of 7 (neutral)
- Seawater has a pH level of 8 (alkaline)
- Bleach has a pH level of 13 (very alkaline)

The ideal pH level for your pool water is slightly alkaline at **7.4 to 7.6**.

This is where pool sanitizer—like chlorine—works best, as well as preventing your water from turning cloudy. It also plays nice with your swimming pool equipment, such as your pool heater or filter system.

If your pH is too low, you can raise it by adding soda ash to your pool water. Baking soda (sodium bicarbonate) works too, but it's better for raising alkalinity — which I'll talk about in the next section.

If your pH is too high, you can lower it by [adding muriatic acid](#). Dry acid (sodium bisulfate) works too, but it will leave sulfates behind that can eventually build up and cause problems later on.

Pro Tip: your pH will gradually become more acidic over time, so you can probably get away with waiting it out a bit if you're only slightly over the recommended range.

Unfortunately, your pH level is extremely sensitive and likely to fluctuate over time, which brings us to...

Total Alkalinity

This is NOT the same as alkaline (a higher reading) on the pH scale.

Alkalinity, also called "[total alkalinity](#)", is the measure of all alkaline substances in the water, and unlike pH, it's measured in parts per million or PPM.

This is important because alkalinity acts as a layer of armor for your pH level, absorbing fluctuations caused by temperature changes and foreign substances like rain, debris, or even humans (eww).

The ideal range for alkalinity should be between **80 and 120 PPM**, depending on the type of sanitizer you use.

While pH and alkalinity aren't the same, they do tend to correlate.

If your alkalinity is low, your water becomes too acidic, potentially corroding your pool surfaces and equipment as well as burning your eyes and skin. You'll need to add a total alkalinity increaser like sodium bicarbonate to bring it back up.

If your alkalinity is high, your water becomes too alkaline (basic), potentially becoming cloudy, causing scaling of pool surfaces, and, of course, more burning of the eyes and skin.

Unfortunately, there is no such thing as an "alkalinity decreaser" product on the market. So in order to lower Total Alkalinity in your pool, you'll need to first add a pH decreaser to lower both total alkalinity *and* pH in your pool.

Once the Total Alkalinity is where it needs to be, you can work on bringing the pH back up with a pH increaser like soda ash, which I mentioned earlier.

Note: Just a heads up, we wrote a whole article about total alkalinity if you feel like getting deeper into this stuff.

Calcium Hardness Level

[Calcium hardness](#) is a measure of how much calcium is present in the water.

If you ever hear of water referred to as “too soft” or “too hard”, this is what they’re talking about. [Hard water](#) describes water that is high in mineral content whereas [soft water](#) is generally low in calcium and magnesium ions.

Your pool water can be too “hard” or too “soft” too, depending on where you live and the water source you used to fill it up in the first place.

To balance the water chemistry in your pool, you’ll need to make sure that the water’s calcium hardness is where it needs to be in order to allow your pool chemicals to do their jobs.

The recommended range for calcium hardness is somewhere between **200 ppm to 400 ppm (200 to 275 ppm** for concrete and plaster pools) and for best results, be sure to always keep your pool water well within that recommended range.

Low Calcium Hardness: If your calcium hardness level is too low, you’ll start to notice scaling of pool surfaces, etching of plaster pool walls, and corrosion of your pool equipment.

This is bad news for your pool but luckily, it’s very easy to remedy. To bring the levels back up to where they need to be, simply add calcium hardness increaser (calcium chloride compound) to your pool at the recommended levels.

High Calcium Hardness: While low calcium hardness levels can cause damage to your pool fittings, high levels of calcium hardness lead to excess calcium, which eventually results in murky, cloudy pool water.

All of the chemicals, factors, and changes you make affect the big picture when it comes to pool chemistry. One of the main things that can cause high calcium hardness levels in your pool is a high pH level.

Before throwing anything in the water to fix the problem, try testing the pH and lowering it if the level is outside of the recommended range.

Pro Tip: Be sure to only adjust pH once you've properly adjusted the Total Alkalinity first.

If lowering the pH doesn't do the trick, there are several other ways to solve the excess calcium, cloudy water dilemma.

- **Shock the pool**

Also known as "hyper-chlorinating," [shocking your pool](#) approximately once per week is just a good idea for overall pool maintenance. Especially after a big pool party or heavy rain, pool shock will help to keep your pool water properly sanitized and clean.

Pool shock is generally composed of calcium hypochlorite (also chlorine-free versions exist) which not only sanitizes your pool water but also increases the amount of dissolved calcium in the water, raising your calcium hardness levels.

- **Add pool water clarifier**

[Pool water clarifier](#) is a big helper for your filter. If your water is cloudy, it means the particles are too small for your filter to grab onto when your water circulates through. Clarifier works by binding the tiny particulate into larger bundles that are big enough to get picked up by your filter.

- **Add flocculant**

Flocculant is a type of pool water clarifier that just works a bit differently. Adding flocculant to the pool causes the floating particles to settle to the bottom by breaking the surface tension of the water.

These larger bound particles can then be easily vacuumed up and out of your pool.

Keeping Your Water Sanitized

Okay, so you've got a handle on pH, alkalinity, and calcium hardness, but here's where the real magic happens.

There are many chemicals that go into keeping a pool looking and feeling its best but pool water sanitizer is the number one key to a clean and sparkling pool.

No matter how much you filter, fill, skim, or vacuum your pool, without sanitizer, the water would quickly turn into a stinky swamp. Between the constant assaults of nature (leaves, bugs, rain, birds, dust) and swimmers (hair, skin, sweat, body products), your pool water is always being contaminated.

Sanitizing Agent

Water sanitizer is the most important chemical you'll ever add to your pool for the crucial reason that it keeps all of that contamination under control, as well as fighting the good fight against algae, bacteria, and viruses that threaten the safety of swimmers.

Sanitizer, however, cannot function without the other components (calcium hardness, total alkalinity, and pH) all being properly balanced. As you can see, everything goes hand-in-hand.

The two main types of sanitizing agents out there are chlorine and bromine. Each has its own benefits and drawbacks that may make it the best choice for your family pool.

[Chlorine](#) is, by far, the most widely-used sanitizer due to its availability, sheer potency, and inexpensive cost.

Chlorine sanitizes by the process of oxidation in which a molecule loses an electron during a chemical reaction — essentially destroying contaminants at their most basic level.

It can be found in several forms, the two most common of which are granules and tablets.

Granule chlorine is used by pouring it directly into the filter or pump where the granules dissolve, adding chlorine to the water as it travels through your filtration system.

[Chlorine in tablet form](#) is a bit more effective, however, as tablets can be placed in floating dispensers, [skimmer baskets](#), or automatic chlorinators for optimum dispersal throughout your pool.

The “Goldilocks” number you’re looking for when it comes to chlorine levels in your pool is 3 parts per million. A more flexible range of 2-4 ppm is often recommended by pool care professionals, but anything less than 3 ppm is not a clean pool and in danger of bacterial infestation.

Bromine is the first runner-up when it comes to sanitizing your pool water. Instead of oxidizing contaminants in your pool, [bromine](#) forces apart the molecular structure of bacteria and debris, thereby obliterating them and their icky potential.

Alone, bromine is more stable than chlorine and can take more of a beating than chlorine before breaking down. While a bit more expensive than chlorine, bromine tablets actually contain a bit of chlorine in their formulation as well.

The major downside to bromine is the byproduct of its cleansing: bromamines. These are the smelly waste products similar to chloramines. They're not nearly as pungent as chloramines but still reduce bromine's overall cleaning ability.

Aim to keep your bromine levels around 5 ppm at all times while never letting them drop below 3 ppm.

Biguanide is a less common sanitizer used in pools for those who wish to go chlorine-free. Biguanide, also known as PHMB (Preservative-free polyhexamethylene biguanide), started its career as a surgical disinfectant in the same category as hydrogen peroxide.

It works by clumping contaminating particles together into water-insoluble clusters that can easily be removed by your pool filtration system. Biguanide levels in your pool should always be between 30 and 50 ppm.

The benefits of biguanide are plentiful. It doesn't turn your hair green (blondes, rejoice!), it doesn't produce chloramines, so you'll never get that nasty "chlorine" smell, and it's much gentler on skin and eyes.

There are a few drawbacks to using this sanitizer, however. It's more expensive than traditional chlorine, it can make your pool water cloudy, it's not as effective as other methods, tending to lose power quickly over time, and most frustratingly, the clumps it causes can clog your pool filter.

It can be a great sanitizer alternative, however, for pool owners with sensitive skin or chlorine allergies. Make sure to do your homework before making the switch — this product will significantly change how you use the other chemicals on this list.

Pool Minerals can also be used as a supplement to other sanitizing chemicals, allowing you to use less chlorine over time. Mineral systems are not a replacement for chemical sanitizers but can be a great way to cut down on the massive amounts of sanitizer you usually need to dump into your pool.

Mineral systems contain the metals copper and silver, both of which are known to sanitize water. Copper works as an algaecide and silver works as a bactericide. When the metals come in contact with water, they release a host of positively charged ions, demolishing the negatively charged contaminants.

In addition to copper and silver, most mineral systems also contain borates that keep algae at bay and magnesium chloride that soothes your skin whenever you swim.

If you opt for a mineral system to supplement your sanitizer regime, make sure to keep your chlorine level squarely at 0.5 ppm for best results.

Pool Stabilizer

Chlorine can be purchased in either “stabilized” or “unstabilized” form. These are two very different flavors of sanitizer that require a bit of explanation.

Stabilized chlorine is chlorine combined with cyanuric acid, a precursor to a variety of bleaches, disinfectants, and herbicides. The addition of cyanuric acid to the chlorine acts as a buffer or protector for the sanitizer against the harmful rays of the sun, allowing it to last between 3 and 5 times longer than without it.

When chlorine is exposed to ultraviolet radiation from the sun, another oxidation reaction occurs, burning off a ton of the needed sanitizer from its useful work in your pool water.

Cyanuric acid works to “stabilize” the chlorine that you’ve just added to your pool. It stabilizes the chemical bonds and prevents a significant amount of oxidation that the sun would otherwise cause, wasting your chlorine and your hard-earned cash.

Stabilized chlorine is especially beneficial for outdoor pools, protecting the chlorine from the sun so it can live to fight another day.

Unstabilized chlorine is the [calcium hypochlorite](#) we talked about earlier (pool shock). It’s simply chlorine that has not been combined with cyanuric acid. It doesn’t have its knight in shining armor and is therefore vulnerable to swift destruction by the sun.

Although weaker when it comes to outdoor pool sanitation, this type of chlorine does have important uses. It works very well for indoor pools, as a weekly pool shock treatment, or as a supplement to your normal chlorine when you’ve been having a ton of crazy parties.

If you're a control freak and want to add the cyanuric acid yourself, that works too. It can sometimes be a good idea to use unstabilized chlorine and a separate supplement of cyanuric acid so as to more carefully measure the amounts of each you're adding to your pool.

Be careful though, too much can result in the infamous "[chlorine lock](#)" problem.

There's nothing wrong with this method. Many people just prefer the one-stop-shop of stabilized chlorine.

Pool Shock

I'm *shocked*, I tell you. Just *shocked*.

Now you already know all about [pool shock](#) — also known as "unstabilized" chlorine is a chemical that you need to use periodically in your pool (usually once per week or after a big pool party) to "super-chlorinate" your pool.

It's called super-chlorinating because, rather than adding a small dose of chlorine once in a while, you're giving your pool a big dose all at once. But why is shocking necessary?

When the chlorine your pool gets used up (i.e. oxidizes bacteria and contaminants), the chemical reaction produces a byproduct called chloramines (or bromamines if you use bromine as a sanitizer). Chloramines are what cause the stinky "pool smell" that we generally associate with chlorine.

Shocking your pool eradicates chloramines and bromamines to rid your pool of that icky smell and allows the sanitizer to do its best work.

It's a good idea to shock your pool once a week, after heavy rain, or just when your pool is getting a lot of use. Remember to always shock your pool at night to protect the chlorine from the destructive rays of sunlight that would burn much of it away.

Other Chemicals To Be Aware Of

Even if you implement everything we've covered to a T, sometimes, life happens and your pool chemistry will be thrown out of whack.

Maybe an animal died in your pool. Maybe algae suddenly took hold. Maybe your water clouded up. Or maybe you just decided to take a last-minute vacation to the Bahamas.

Whatever the reason, it's worth knowing about these specialized chemicals in case you ever need them.

Pool Flocculant or Clarifier

As I mentioned earlier, flocculant can be used to decrease calcium levels in your pool when you've noticed the water getting a bit cloudy. Flocculant and clarifier are very similar chemicals but they work very differently.

So, when your pool gets cloudy, [flocculant and clarifier](#) are going to clear things up.

Flocculant is a chemical that treats the cause of cloudy pool water. It could be excess calcium, particles of dust (and other contaminants), or bits of floating algae that are mucking up your beautiful pool.

When you pour flocculant into your pool, the chemical works by breaking the surface tension of the water, causing the particles to clump together and sink to the bottom. After that, you can simply vacuum the bottom of the pool, ridding yourself of cloudiness once and for all.

Clarifier also clears up cloudy pool water but works in a different way. While flocculant is a clarifier, clarifier is not a flocculant. Adding clarifier to your pool is a stop-gap measure for when you need your pool clear in a hurry.

It quickly binds tiny particles together, allowing your pool filter to pick them up when they may have been too small in the first place. When your pump is running, the filter is more likely to grab onto the larger clumps of matter than it would have without it.

As you can see, flocculant actually treats the cause of cloud water while clarifier just treats the symptoms. Both are good products to keep on hand and have their uses, depending on the situation you're dealing with.

Keeping your pool water clear and completely transparent is not only for aesthetics, but it's also for safety too. Being able to see the bottom when jumping in or through the water if a swimmer is struggling makes having clear water a dangerous safety issue that both clarifier and floc can solve.

Pool Algaecide

[Algaecide](#) is a specific chemical used to kill algae in your pool if it happens to sneak in past the first two lines of defense. Yes, that's right. Algaecide should actually be your third line of defense against algae. Here's why:

Your sanitizer of choice, if maintained properly in balanced pool water, should keep potential algae blooms at bay. Things do happen, however, and maybe a recent storm or possum infestation briefly threw your pool chemistry out-of-whack.

No problem. If that happens, your second line of defense is to shock your pool.

Since chlorine is really your best bet when it comes to preventing an algae outbreak, it's a good idea to use algaecide only as a temporary bandage while you get your sanitizer levels and chemistry balance back to where they need to be.

Metal Sequestrant

Earlier we learned that some metals (like copper and silver) have anti-algae and antibacterial properties and are therefore used in conjunction with sanitizer to keep pools clean. These metals are very useful but only in the recommended doses.

Depending on where you live, your local water might contain a high level of dissolved metals like iron and copper (hard water) which eventually make their way into your pool water whenever you top-up.

If left to their own devices, these metals can cause unsightly staining on your pool surfaces. Cleaning stains is no fun but once you've done it you can actually prevent future stains by using metal sequestrant.

Metal sequestrant is a very useful pool chemical that, when poured into the water, binds to the floating metal particles and locks them in little chemical bubbles. These bubbles prevent the metals from settling down on surfaces and making themselves at home.

Some Pool Chemistry Pointers

Now that you know what pool chemicals are out there and what you might need, it's time to start testing... regularly!

Having chemicals and knowing what they do means nothing if you don't know what the levels are in your pool water.

Regular Testing

This can't be understated. Regular testing needs to become a way of life if you want to have a sparkling, clean, and refreshing pool all year round.

It may seem tedious, even redundant at times when your pool is looking great, but it doesn't take long for the water to turn murky and algae to start blooming.

Starting out, you should be testing your pool water once a day at roughly the same time. Only once you become familiar with the levels and how they shift from day to day, can you start testing less frequently.

Test your water *before* and *after* adding any of the chemicals mentioned throughout this article. Guessing will only make things worse. After all, you need to have a good idea of your starting point before you put on your chemist's coat to do some science.

Constant fluctuations in temperature, weather, usage, and other environmental factors will have an on-going impact on the needs of your pool. The only way to know what you need is to test.

Testing is pretty easy too. You can get quick test strips for random checks, [test kits](#) for an in-depth analysis, and for the serious testers out there: digital pool water testing kits.

Don't forget to get a professional opinion once in a while too. Taking a sample into your local pool supply store four times a year is a smart move for any pool owner.

Water Circulation

This may go without saying, but keep the water moving! Adding chemicals to your pool without [proper water circulation](#) just won't cut it. The chemicals need circulation to dissolve and disperse properly.

Moving water through your filter is the only way to keep it clean so it's a good rule of thumb to run your pump and filter system for approximately 8 hours per day, every day.

Chemical Storage

Last, but not least, it's worth mentioning that most of these chemicals we talked about today are strong and can be dangerous if improperly handled. Make sure to store all pool chemicals in a cool, dry place, and out of reach of children.

Check the labels of each bottle, bucket, or bag to get specific storage instructions for more information on how to prevent chemical reactions, fires, and harmful gases caused by an accidental spill or mixture.

Conclusion

Once you get an idea of how all of the chemicals work together to maintain your pool, diving into pool chemistry is really not such a daunting prospect after all. Owning a pool can be a lot of work but it also brings an amazing amount of pleasure and fun to your life too.

Just remember, we made this guide so you don't have to memorize everything overnight! It's okay to keep coming back, learning something new, and building on your knowledge over time.

Now, get out there and enjoy your swimming pool!

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