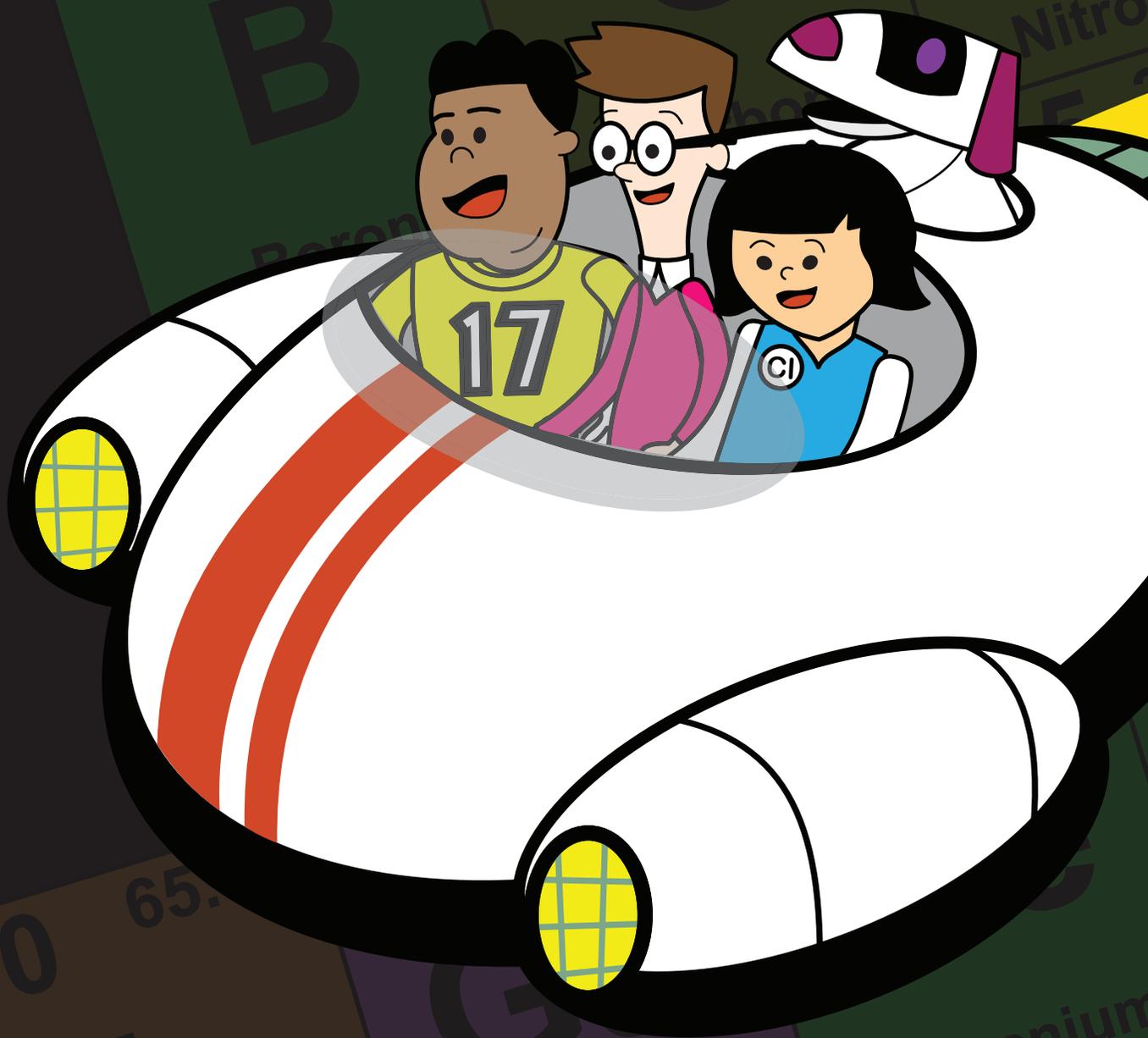


THE ADVENTURES OF  
**TEAM CHLORINE**

VOLUME #2: DISINFECTION CALLS



AND INTRODUCING:  
**CLETUS, THE ROBO-DOG**



# THE ADVENTURES OF TEAM CHLORINE

Team Chlorine is a trio of students who study the element chlorine. Why on earth are they so interested in chlorine, you may be wondering?

Because it's a naturally occurring element and it's also manufactured. That's surprising!

CLARK

Because it plays a super important role in helping to keep us healthy. That's surprising!

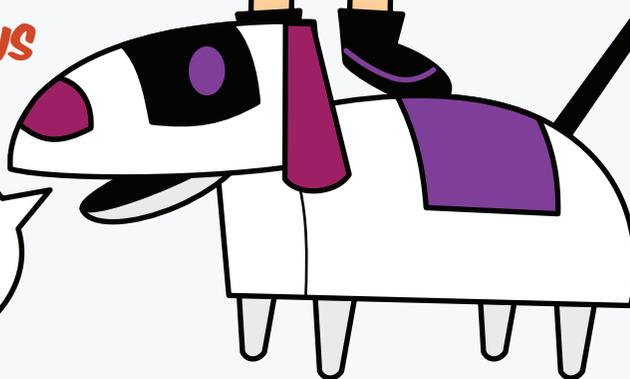
CLARA

CLARENCE

Because it's used in so many ways that affect us every day—in transportation, construction, technology, and more. That's surprising!

CLETUS

Guys, I think they get the idea: Chlorine is the Element of Surprise.

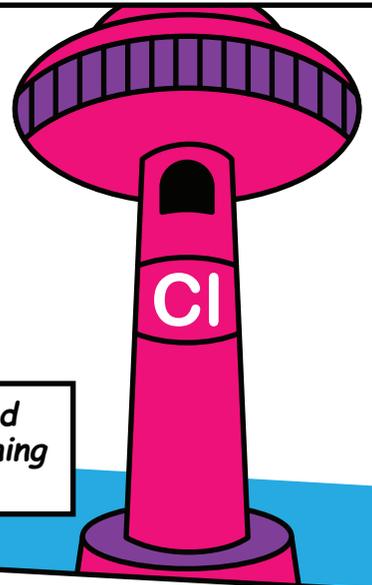


# DON'T BUG ME

THE FLU AND OTHER INFECTIONS

ZOOM

Our heroic trio had just finished traveling around the world learning about chlorine when suddenly...



I'm gonna be sick.

How could this have happened?

Not on me, please.

You must have caught a virus during our travels—the flu, a common cold, or even norovirus!

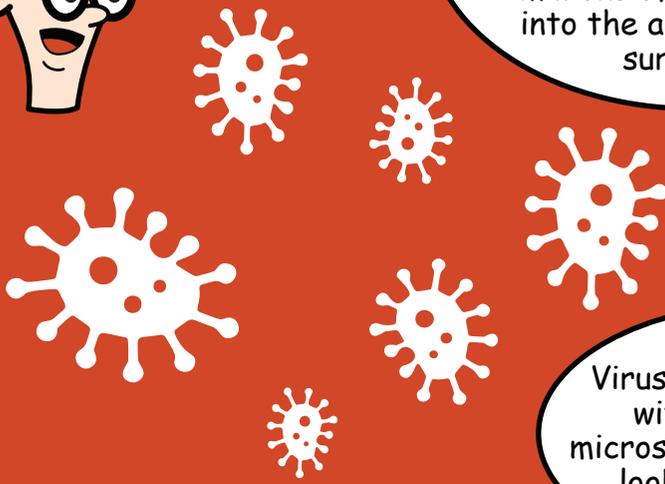
To the CI Computer!

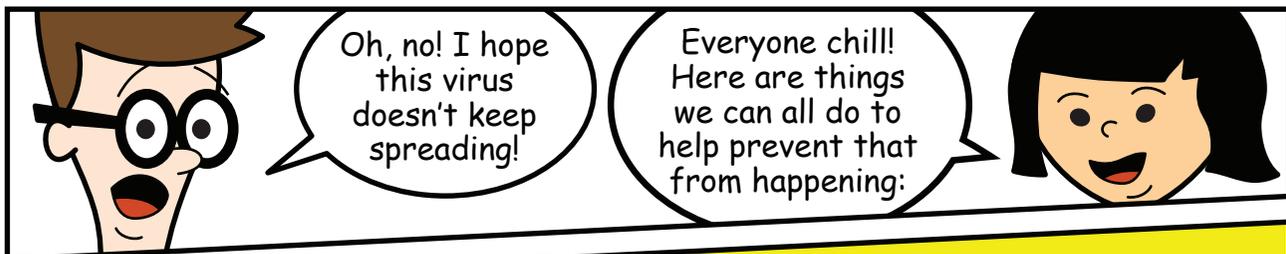
What is a virus?!

Viruses are germs that may spread from one person to another. When someone has a cold and coughs or sneezes, millions of germs shoot into the air and land on surfaces.

If you touch your mouth, nose, or eyes after touching a contaminated surface, you could become infected with a virus.

Viruses can only be seen with high-powered microscopes. Most of them look like hairy blobs.

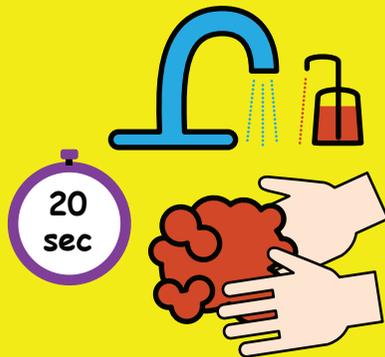




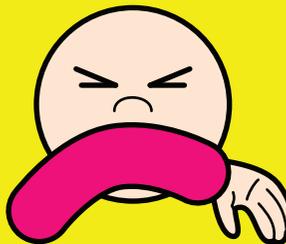
Oh, no! I hope this virus doesn't keep spreading!

Everyone chill! Here are things we can all do to help prevent that from happening:

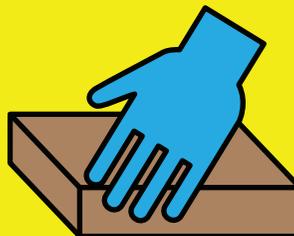
**1.** Wash your hands often with warm water and soap. Remember to scrub between your fingers and wash for as long as it takes you to sing the "Happy Birthday Song" twice.



**2.** Cover up coughs and sneezes with a tissue or the inside of your elbow. Be sure to throw the tissue away immediately and wash your hands!



**3.** Don't touch your eyes, nose, or mouth. Germs are good at hitching a ride on your hands to these spots where they can get into your body!

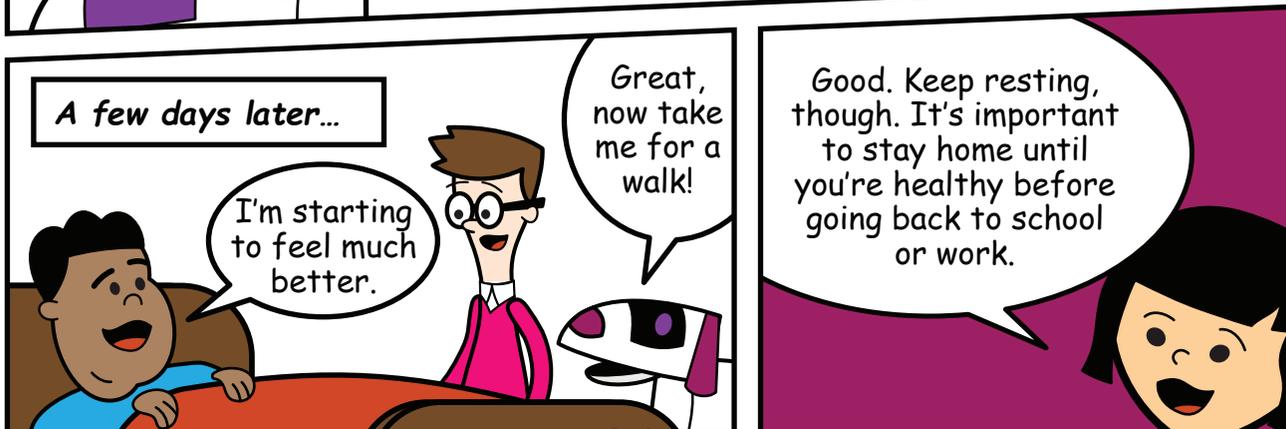


**4.** Adults can disinfect surfaces and help destroy germs by using a wipe or spray that contains bleach to kill germs on desks, door knobs, handrails, and other hard surfaces that a lot of people touch.



Remember, washing your hands includes using soap.

I'm looking at you, Clark!

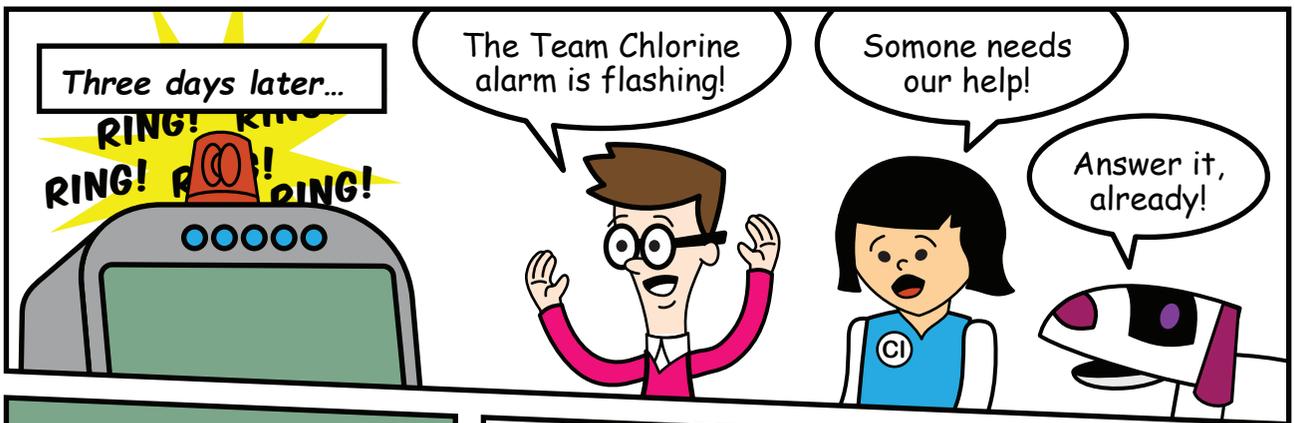


*A few days later...*

I'm starting to feel much better.

Great, now take me for a walk!

Good. Keep resting, though. It's important to stay home until you're healthy before going back to school or work.

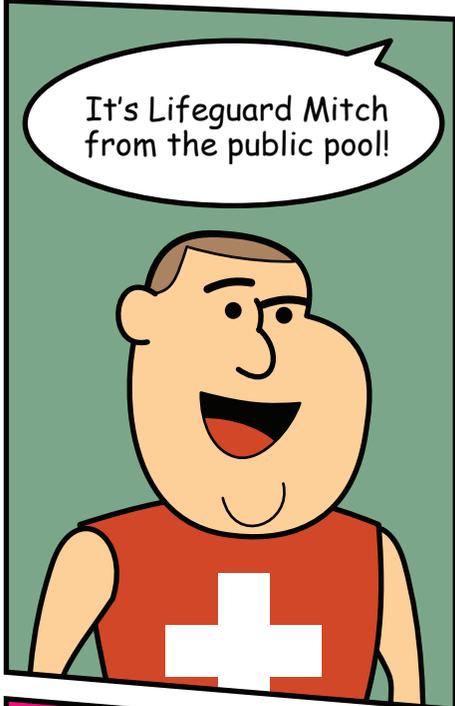


Three days later...

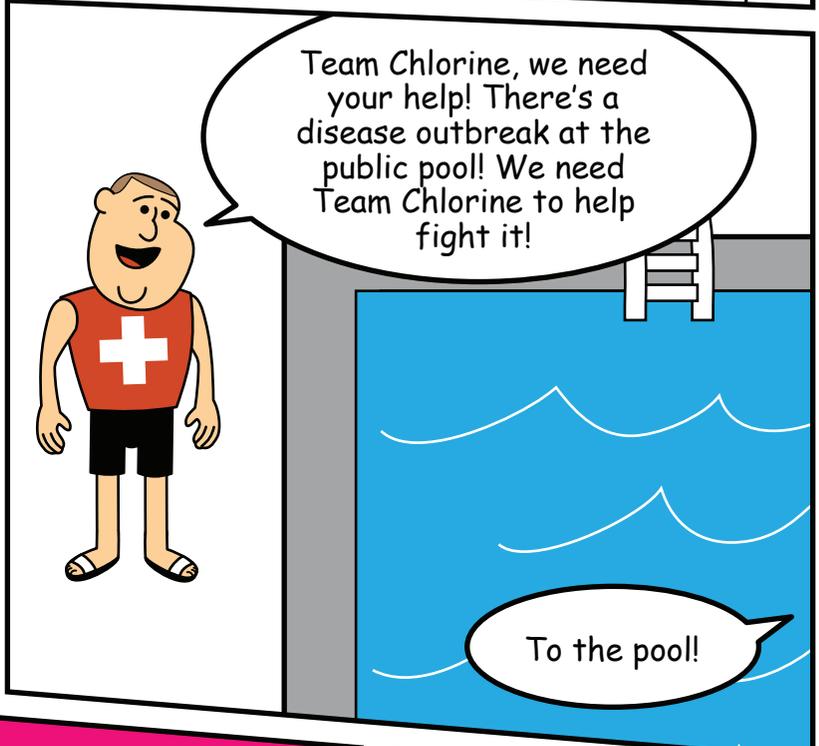
The Team Chlorine alarm is flashing!

Somone needs our help!

Answer it, already!



It's Lifeguard Mitch from the public pool!



Team Chlorine, we need your help! There's a disease outbreak at the public pool! We need Team Chlorine to help fight it!

To the pool!



Wait for me! I'm all rested and feeling healthy again!

It's go time!

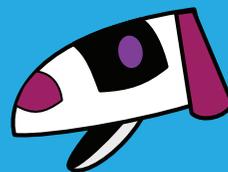


Let's go!

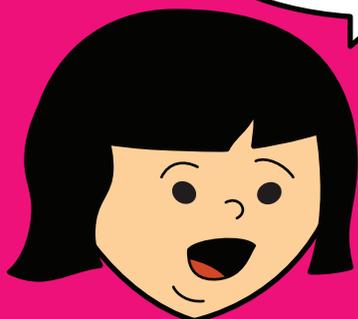
ZOOM

CI

Find more activities and answers to the ones in this book at [teamchlorine.com](http://teamchlorine.com).



Match the man with the chlorine history he made!



1. Carl-Wilhelm Scheele

2. Humphry Davy

3. John Leal

A. Advocated for water chlorination

B. Proved chlorine is an element

C. Discovered chlorine

Match the compound!

One reason why chlorine is such a valuable element is because it bonds very easily with other elements to form compounds. Match each compound below with its symbol, using the Periodic Table of Elements on the back cover to help you.



- Sodium chloride**  
Helps make your food taste great
- Hydrogen chloride**  
Your body makes it to help digest food
- Titanium dioxide**  
Used to make paint pigments
- Calcium chloride**  
Makes icy roads less slippery
- Sodium hypochlorite**  
Also known as household bleach
- Ferric chloride**  
Helps keep drinking water clean

A. NaOCl

B. FeCl<sub>3</sub>

C. NaCl

D. HCl

E. TiO<sub>2</sub>

F. CaCl<sub>2</sub>



Break the code!

Using the Periodic Table of Elements on the back cover, match the numbers below to the corresponding element symbol to discover the answer.

Question: What makes chlorine so amazing?

Answer: Chlorine

20 7      49 16 15 53 75

66 7 95 53 6      49 7 8 23 85 53 8 7

Mixed-up tale!

Fill in the blanks to create a silly story about healthy pool water.

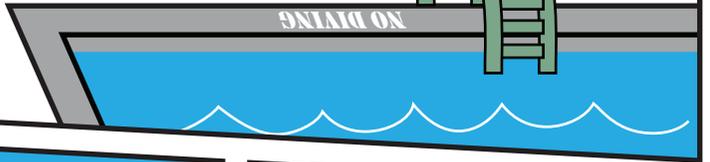
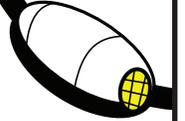


It was a beautiful summer day to go for a \_\_\_\_\_ . I \_\_\_\_\_  
 [noun] [verb (past tense)]  
 on my swim suit and headed for the town \_\_\_\_\_ . Before I got into the  
 [noun]  
 cool, refreshing \_\_\_\_\_ , I made sure to go and take a \_\_\_\_\_ so I wouldn't  
 [noun] [noun]  
 bring any \_\_\_\_\_ into the water. My friend \_\_\_\_\_  
 [plural noun] [name of girl]  
 was supposed to meet me there, but it turned out she had a \_\_\_\_\_  
 [adjective]  
 stomach ache so she stayed home. It's not a good \_\_\_\_\_ to go swimming if  
 [noun]  
 you are \_\_\_\_\_ because you can \_\_\_\_\_ your germs into the water  
 [adjective] [verb]  
 and make other \_\_\_\_\_ sick. I \_\_\_\_\_ in the pool for  
 [plural noun] [verb (past tense)]  
 a long time and the only reason I got out was to go and use the \_\_\_\_\_ .  
 [noun]  
 It's very important that all swimmers keep pool water \_\_\_\_\_  
 [adjective]  
 by using the bathroom.

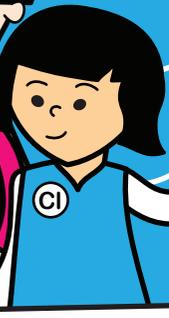
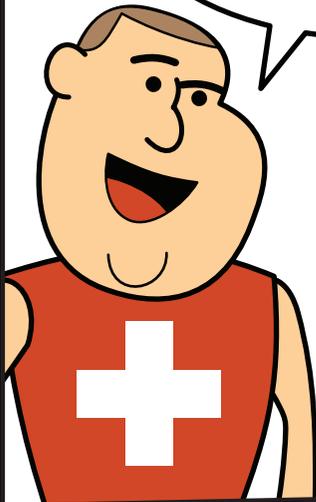
# POOL PROBLEMS

Thanks for coming!

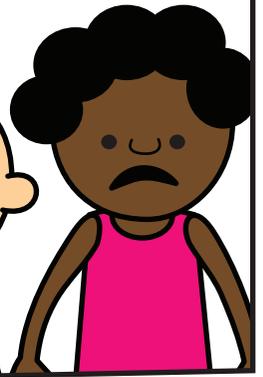
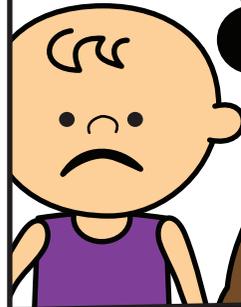
What's the problem, Lifeguard Mitch?



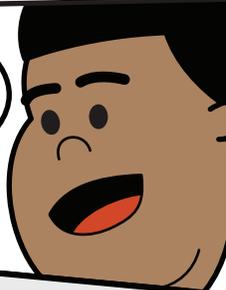
Some swimmers got sick and we don't know why, but we think it might be something in the water.



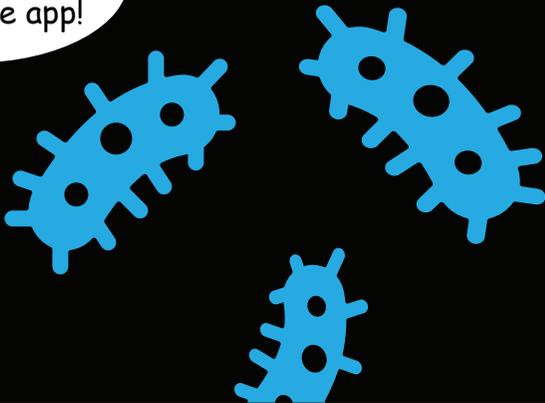
Ughh...



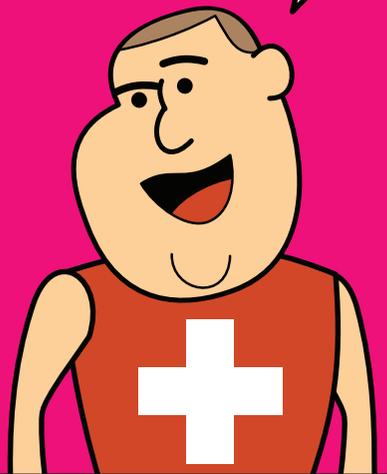
Swimmers can bring germs into pool water on their bodies. Pool water can also become infected with algae.



Check it out in the CI Tablet's microscope app!



That's why we treat our pool with chlorine and adjust the water's pH. It helps protect swimmers by fighting germs and algae in the water.





Of course! But pH and chlorine levels need to be monitored. Always check that pool water is healthy for swimming by using your senses:

**1. Look at the water.**

Does the pool water look clear and blue? You should be able to see through the water down to the drain or stripes painted on the floor of the pool. If the water is cloudy and colored, there may be algae in it. Don't go in!

**2. Touch the side of the pool.**

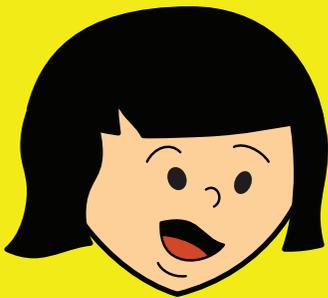
Does the pool wall around the water line feel slimy? If it does, there are probably germs living on the wall. Don't go in!

**3. Smell the pool area.**

Is there a strong chemical odor around the pool? If there is, the pool manager may have to treat the water. Don't go in!

**4. Listen for noise.**

The sound of a pool pump is a good sign!



Of course, don't ever use your sense of taste when it comes to pools. If you do get some water in your mouth, don't swallow it.

Hey, everyone! I'm noticing that it's awfully quiet here.

Looks like the pool pump might be broken.

POOL PUMP ROOM

The pump circulates water through a filter and to a place where pool chemicals are added.

Thanks, Team Chlorine! I won't let any swimmers in the pool until that's fixed.

**POOL CLOSED**  
FOR MAINTENANCE



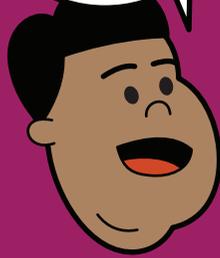
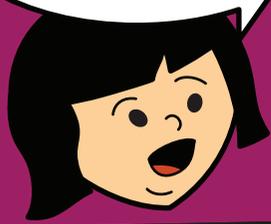
Swimmers play an important role in keeping pool water safe.

Following these three rules will help ensure you don't bring germs into the water:

1. Shower before swimming.

2. Don't swim when you have diarrhea—and don't return for 2 weeks afterward.

3. Don't pee in the pool. Always get out to use the bathroom and wash your hands afterward.



Cletus, bring up some information!



Long story short: Don't drink pool water, kids.

### Common viruses that infect pool water

#### *Pseudomonas aeruginosa*

[soo-do-mo'-nuhs air-oooh-gi-no'-sa]

- Fast-moving bacteria with a whip-like tail
- Enters pool on swimmers' bodies or in dirt tracked into the pool area
- Causes a bumpy, itchy skin rash and an earache known as "swimmer's ear"

#### *Shigella sonnei*

[shi-gell'-uh so'-nay]

- Rod-shaped bacteria
- Enters pool water by swimmers who use the bathroom and don't wash their hands
- Causes diarrhea if swallowed

#### *Cyptosporidium parvum*

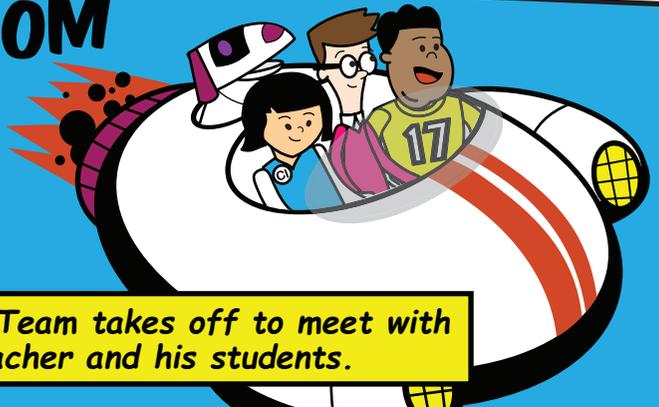
[sip-to-spor-ih'-dee-um par'-vum]

- Microscopic parasite surrounded by a protective shell
- Enters pool water in the poop of infected swimmers
- Causes diarrhea if swallowed

Don't forget—we're due at the water treatment facility.



ZOOM

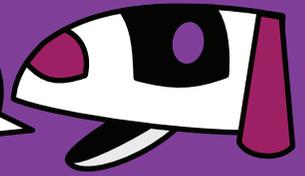


The Team takes off to meet with a teacher and his students.

Did you know?

When your eyes turn red after being in a pool, it's not from the chlorine. In fact, it may indicate that the pool needs more chlorine.

Happy to report that chlorine doesn't turn hair green, either!



17 35.453

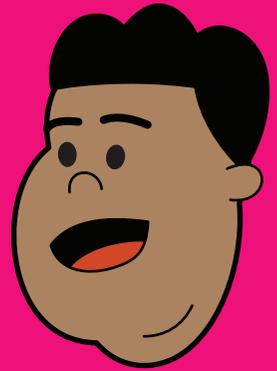
Cl

Chlorine

A quick history lesson

Chlorine was discovered in 1774 by the Swedish pharmacist and chemist Carl-Wilhelm Scheele while he was studying the mineral pyrolusite. Scheele mixed the mineral (which is the chemical compound manganese dioxide) with hydrochloric acid and produced chlorine gas. He noticed that the gas reacted with metals. However his discovery was not understood and it was believed the gas was a compound of oxygen.

Chlorine was not proven to be an element until 1810 by English chemist Humphry Davy.



Word scramble!

Unscramble the words. Then unscramble the circled letters to reveal a secret message.

I N R O H L C E  
U R I V S  
M I S M W N G I  
M E N E L T E  
E E E Z N S  
M O M O C N L O D C  
U R C A S E F

Secret message:

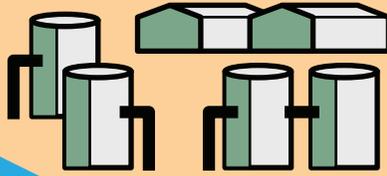


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**H<sub>2</sub>O WOW!**



**ZOOM**



Thanks for meeting with us, Team Chlorine. I brought my students here to learn all about drinking water.

Just being here makes me want to lap up a nice big bowl of tap water!

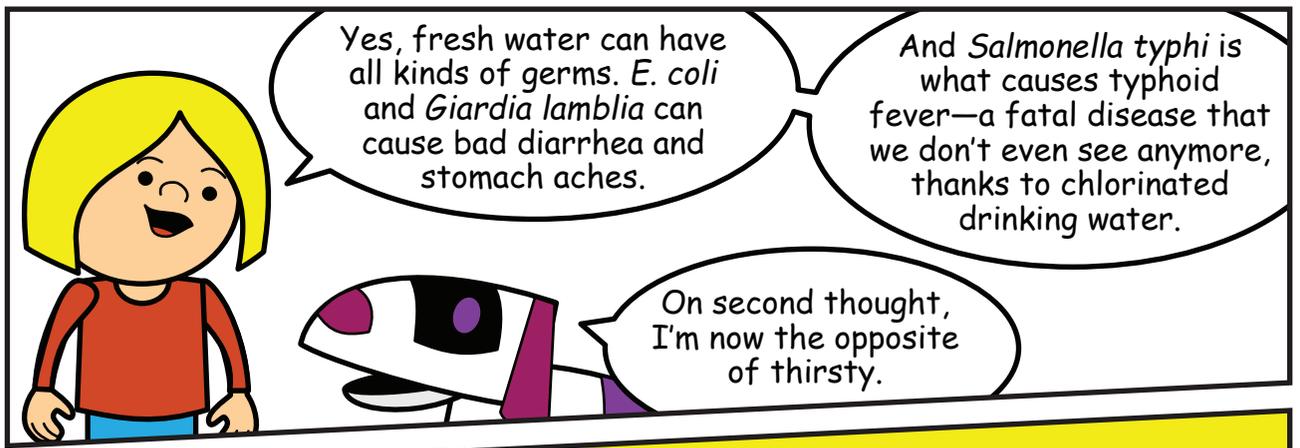


We've been reading about communities around the world that don't have facilities like this one.

They have to walk miles every day to get drinking water, and it is not always clean.

They can catch some horrible diseases from drinking poor quality water. And there are many places in the world like this today.

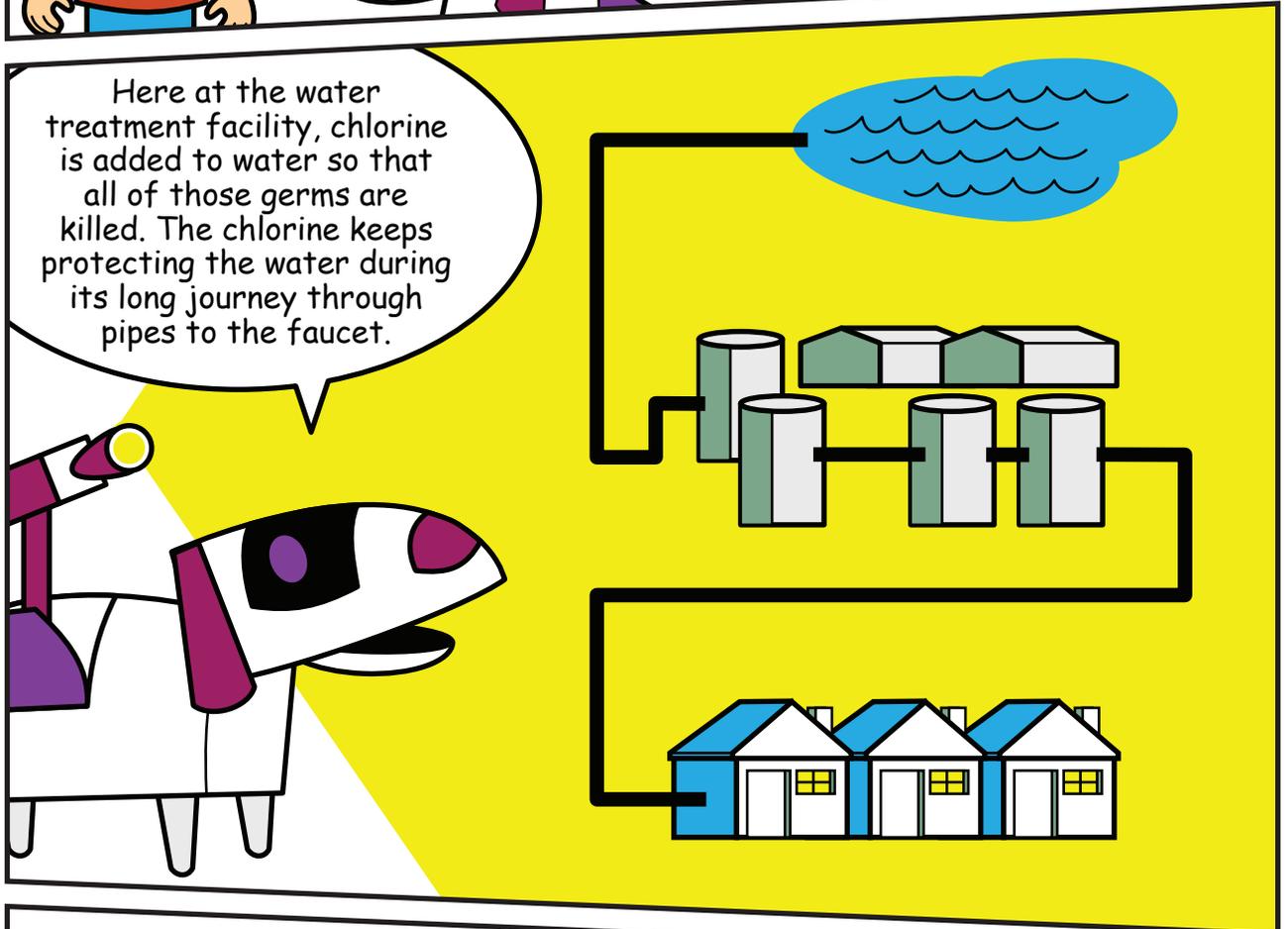
Before we had water chlorination in our country, we also had high rates of waterborne diseases. Lots of people got sick and many died—especially babies and children.



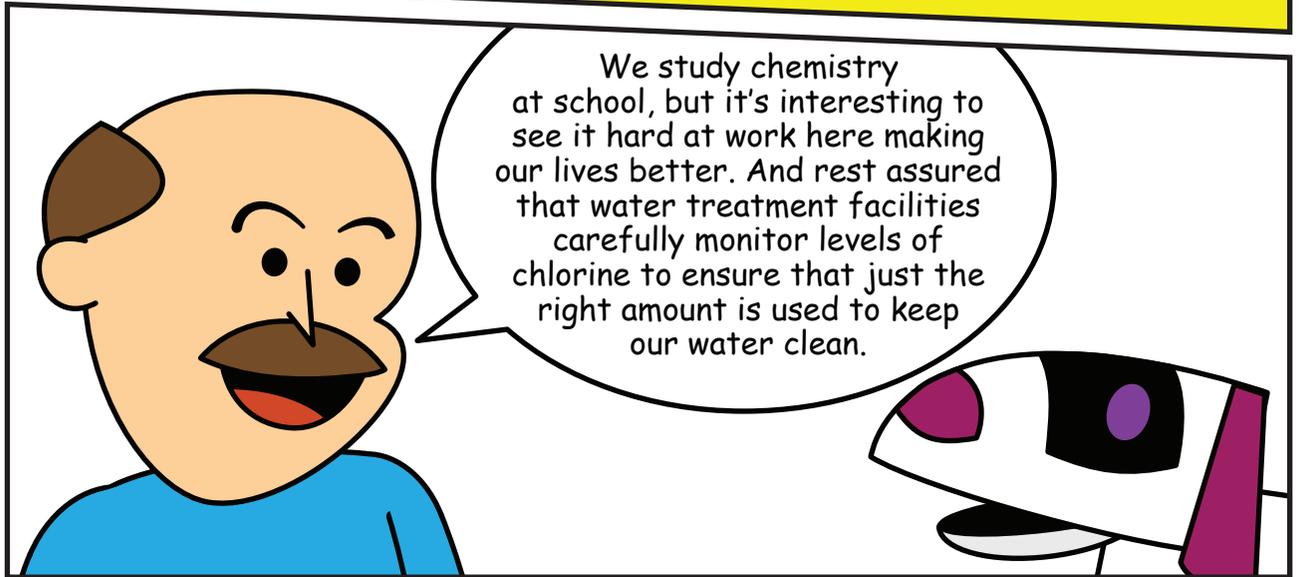
Yes, fresh water can have all kinds of germs. *E. coli* and *Giardia lamblia* can cause bad diarrhea and stomach aches.

And *Salmonella typhi* is what causes typhoid fever—a fatal disease that we don't even see anymore, thanks to chlorinated drinking water.

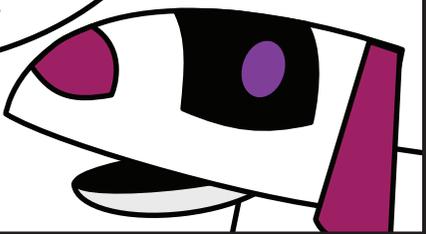
On second thought, I'm now the opposite of thirsty.



Here at the water treatment facility, chlorine is added to water so that all of those germs are killed. The chlorine keeps protecting the water during its long journey through pipes to the faucet.



We study chemistry at school, but it's interesting to see it hard at work here making our lives better. And rest assured that water treatment facilities carefully monitor levels of chlorine to ensure that just the right amount is used to keep our water clean.



## DID YOU KNOW?



In 2010 the United Nations declared that clean drinking water and water sanitation are at the core of all human rights. Without access to these essentials, poverty and disease thrive.

In 2015, the United Nations announced Sustainable Development Goals—17 ways to ensure a sustainable future for people everywhere. Providing safe drinking water and wastewater sanitation is one of those goals.



Read up on how chlorinated drinking water has been saving lives for over 100 years.



### The history of drinking water chlorination

At the beginning of the 20<sup>th</sup> century in America, waterborne diseases like typhoid fever and dysentery were rampant. Deaths from these diseases were very common.

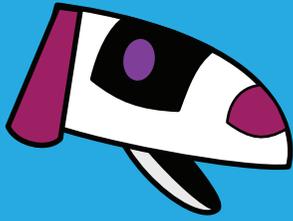


Cities and industries were thriving, and newly built sewer systems were infecting drinking water sources. A pioneering physician named Dr. John L. Leal thought water chlorination was the answer. He knew chlorine was a safe and effective disinfectant used to help control some infectious disease outbreaks.



Thanks to Dr. Leal's persistence, residents of Jersey City, New Jersey became the first Americans to have continuous access to chlorinated municipal drinking water, starting in 1908. Within a decade, 33 million people across the country did. Rates of waterborne disease plummeted and life expectancy increased dramatically.





Word  
search!

Find the words below that  
are related to chlorine.  
Some are products that  
are made with chlorine  
chemistry.

pharmaceutical  
sunscreen  
element  
paint  
disinfectant  
chlorine

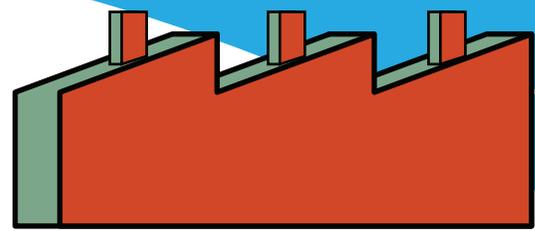
battery  
water  
solar panel  
compound  
bleach  
pool

smartphone  
reaction  
airbag  
tire

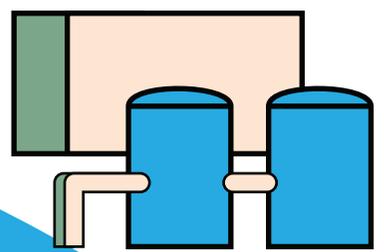
A C T X V U E C N T E J Y P N  
A U X E P R A E S I M B H R B  
W A T E R N E O L R D A E E U  
S C H L O R I N E E R L H A U  
L G A H C L L M E M E X Q C G  
P E Z S C D Z J A M E T N T F  
C O N T N A T C E F N I S I D  
M U O A A J E N O I O X L O G  
S J A L P U T L A M H C O N A  
U Q B O T R P P B E P Q G M B  
S O Z I W D A A Y L T O G F R  
X F C G O E O L B Y R V U O I  
K A C C U S M F O B A O H N A  
L Y R E T T A B C S M R D R D  
W S D I B V X E N X S P J D L

# CHLORINE IS PART OF YOUR COMMUNITY

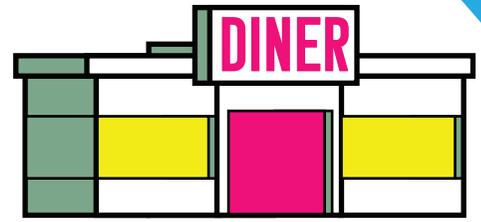
The element chlorine helps make life better in many different ways. That's because chlorine bonds easily with many other elements, creating all kinds of "chlorine chemistry" that is hard at work every day in a lot of places you go.



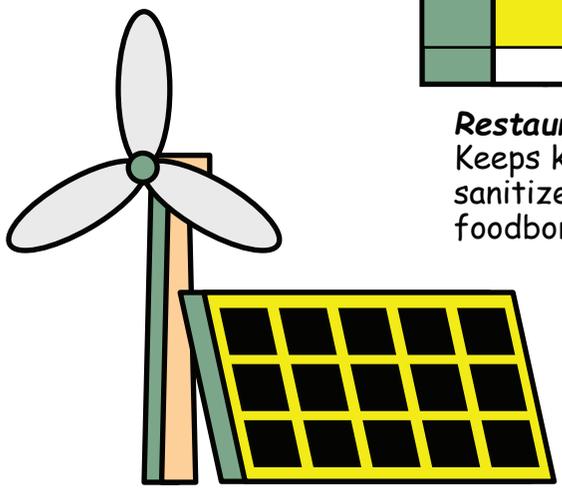
**Factory**  
Used to make many different products, from contact lenses to solar panels and a vast amount of things in between.



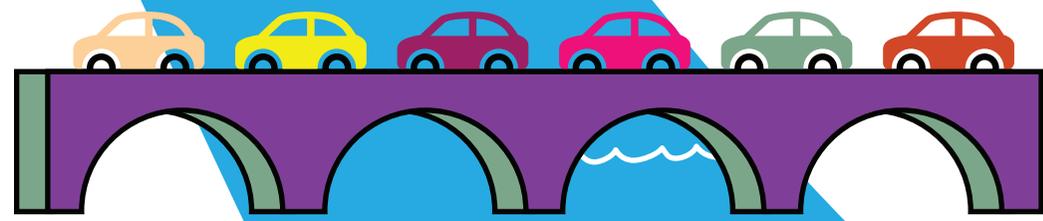
**Water Treatment Facility**  
Added to our drinking water here to help ensure that it is safe to drink.



**Restaurant**  
Keeps kitchen surfaces sanitized to help prevent foodborne illness.



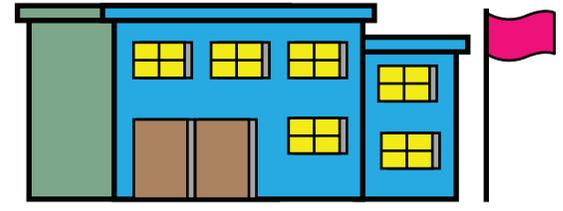
**Alternative Energy**  
Solar panels, hybrid car batteries, wind turbines—these are just a few of the innovative energy sources it helps produce.



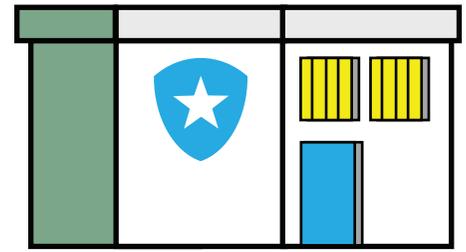
**Transportation**  
Cars, trains, planes, ships, and even spacecraft all rely on it for many of their materials and parts.



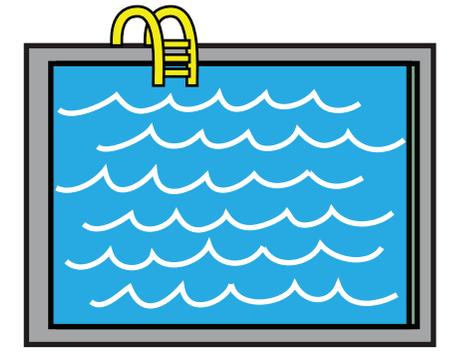
**Home**  
Brings safe drinking water to your faucet and is used to help make all kinds of products in your home—windows, gutters, siding, flooring, paint, and more.



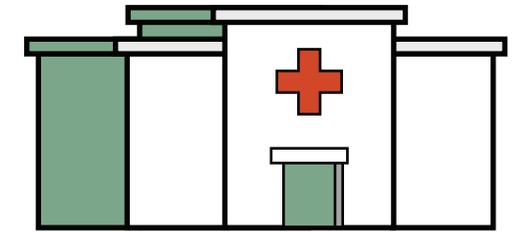
**School**  
Keeps surfaces sanitized to help prevent the spread of flu and other diseases.



**Police Station**  
Helps make many of the important products police officers rely on, including bullet-resistant vests, helmets, and glass.



**Pool**  
Ensures that pool water is sanitized and healthy for swimming.



**Hospital**  
Essential to disinfection and key in producing healthcare products like pharmaceuticals, inhalers, blood bags, tubings, medical devices, and more.

Back at headquarters...

Chlorine does a lot to help our community stay healthy.

VRRRRRRR

It really is amazing how many ways we rely on it every day to help us with disinfection—and more!

No wonder it's known as the Element of Surprise.

Hey! I wanted to say that!

Cl  
CHLORINE

The Element of Surprise

# JOKE CORNER



How often should you joke about elements?

Periodically.



Why are elements so important?

Because they matter.



Why can't you trust atoms?

Because they make up everything.



Why are chemists so good at solving problems?

Because they always have a solution.



What should you do if nobody laughs at a chemistry joke?

Keep telling it until you get a reaction.



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1. THE WORK MUST BE REPRODUCED IN ITS ENTIRETY WITHOUT ALTERATIONS.
2. COPIES OF THE WORK MAY NOT BE SOLD.

# PERIODIC TABLE OF ELEMENTS

1 H Hydrogen 1.008 6.94	2 He Helium 4.003 20.180
3 Li Lithium 6.94 22.990	4 Be Beryllium 9.012 24.305



Alkali Metals  
Alkali Earth Metals  
Transition Metals  
Other Metals  
Lanthanides  
Actinides  
Metalloids  
Other Non Metals  
Halogens  
Noble Gases  
Unconfirmed

Atomic Number  
Black = Solid  
Red = Liquid  
Blue = Gas  
Grey = Unknown  
At.0°C 1 bar

17 35.453  
**Cl**  
Chlorine  
Atomic Weight  
Chemical Symbol  
Name

19 39.098 <b>K</b> Potassium	20 40.078 <b>Ca</b> Calcium	21 44.956 <b>Sc</b> Scandium	22 47.867 <b>Ti</b> Titanium	23 50.942 <b>V</b> Vanadium	24 51.996 <b>Cr</b> Chromium	25 54.938 <b>Mn</b> Manganese	26 4.000 <b>Fe</b> Iron	27 58.933 <b>Co</b> Cobalt	28 58.693 <b>Ni</b> Nickel	29 63.546 <b>Cu</b> Copper	30 65.38 <b>Zn</b> Zinc	31 69.723 <b>Ga</b> Gallium	32 72.63 <b>Ge</b> Germanium	33 74.922 <b>As</b> Arsenic	34 78.96 <b>Se</b> Selenium	35 79.904 <b>Br</b> Bromine	36 83.798 <b>Kr</b> Krypton
37 85.468 <b>Rb</b> Rubidium	38 87.62 <b>Sr</b> Strontium	39 88.906 <b>Y</b> Yttrium	40 91.224 <b>Zr</b> Zirconium	41 92.906 <b>Nb</b> Niobium	42 95.96 <b>Mo</b> Molybdenum	43 (98) <b>Tc</b> Technetium	44 101.07 <b>Ru</b> Ruthenium	45 102.91 <b>Rh</b> Rhodium	46 106.42 <b>Pd</b> Palladium	47 107.87 <b>Ag</b> Silver	48 112.41 <b>Cd</b> Cadmium	49 114.82 <b>In</b> Indium	50 118.71 <b>Sn</b> Tin	51 121.76 <b>Sb</b> Antimony	52 127.60 <b>Te</b> Tellurium	53 126.90 <b>I</b> Iodine	54 131.29 <b>Xe</b> Xenon
55 132.91 <b>Cs</b> Caesium	56 137.33 <b>Ba</b> Barium	57-71 <b>Lanthanides</b>	72 178.49 <b>Hf</b> Hafnium	73 180.95 <b>Ta</b> Tantalum	74 183.84 <b>W</b> Tungsten	75 186.21 <b>Re</b> Rhenium	76 190.23 <b>Os</b> Osmium	77 192.22 <b>Ir</b> Iridium	78 195.08 <b>Pt</b> Platinum	79 196.97 <b>Au</b> Gold	80 200.59 <b>Hg</b> Mercury	81 204.38 <b>Tl</b> Thallium	82 207.2 <b>Pb</b> Lead	83 208.98 <b>Bi</b> Bismuth	84 (209) <b>Po</b> Polonium	85 (210) <b>At</b> Astatine	86 (222) <b>Rn</b> Radon
87 (223) <b>Fr</b> Francium	88 (226) <b>Ra</b> Radium	89-103 <b>Actinides</b>	104 (267) <b>Rf</b> Rutherfordium	105 (268) <b>Db</b> Dubnium	106 (269) <b>Sg</b> Seaborgium	107 (270) <b>Bh</b> Bohrium	108 (277) <b>Hs</b> Hassium	109 (278) <b>Mt</b> Meitnerium	110 (281) <b>Ds</b> Darmstadtium	111 (282) <b>Rg</b> Roentgenium	112 (285) <b>Cn</b> Copernicium	113 (286) <b>Nh</b> Nihonium	114 (289) <b>Fl</b> Flerovium	115 (289) <b>Mc</b> Moscovium	116 (293) <b>Lv</b> Livermorium	117 (294) <b>Ts</b> Tennessine	118 (294) <b>Og</b> Oganesson

57 138.91 <b>La</b> Lanthanum	58 140.12 <b>Ce</b> Cerium	59 140.91 <b>Pr</b> Praseodymium	60 144.24 <b>Nd</b> Neodymium	61 (145) <b>Pm</b> Promethium	62 150.36 <b>Sm</b> Samarium	63 151.96 <b>Eu</b> Europium	64 157.25 <b>Gd</b> Gadolinium	65 158.93 <b>Tb</b> Terbium	66 162.50 <b>Dy</b> Dysprosium	67 164.93 <b>Ho</b> Holmium	68 167.26 <b>Er</b> Erbium	69 168.93 <b>Tm</b> Thulium	70 173.05 <b>Yb</b> Ytterbium	71 174.97 <b>Lu</b> Lutetium
89 (227) <b>Ac</b> Actinium	90 232.04 <b>Th</b> Thorium	91 231.04 <b>Pa</b> Protactinium	92 238.03 <b>U</b> Uranium	93 (237) <b>Np</b> Neptunium	94 (244) <b>Pu</b> Plutonium	95 (243) <b>Am</b> Americium	96 (247) <b>Cm</b> Curium	97 (247) <b>Bk</b> Berkelium	98 (251) <b>Cf</b> Californium	99 (252) <b>Es</b> Einsteinium	100 (257) <b>Fm</b> Fermium	101 (258) <b>Md</b> Mendelevium	102 (259) <b>No</b> Nobelium	103 (262) <b>Lr</b> Lawrencium