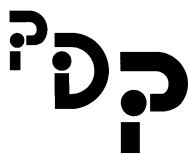


Life of Fred[®]
Chemistry

Stanley F. Schmidt, Ph.D.



Polka Dot Publishing

Conversion factors were taught in:

Life of Fred: Fractions

Life of Fred: Decimals and Percents

Life of Fred: Pre-Algebra 0 with Physics (on 28 pages)

Life of Fred: Pre-Algebra 1 with Biology

Life of Fred: Pre-Algebra 2 with Economics

Chemistry is where conversion factors are used a lot. It will be taught as if you had never seen it in the five previous books.

MY APPROACH TO TEACHING CHEMISTRY

In order to be a well-educated adult, you probably don't need to learn what a racemic mixture means.* But knowing the really basic stuff—such as that the chemical symbol for carbon is C and that organic compounds are those that contain carbon—is common knowledge. It's like knowing that World War I came before World War II.

A big part of high school chemistry is in learning a scientific attitude—how to approach new problems. Learning all the tricks and rules for doing chem problems is much less important than understanding how chemists could discover the weight of a single helium atom. In the beginning of this book Fred is going to find that weight *using only ordinary scales*. He will find that a helium atom weighs approximately 0.000000000000000000000000666 grams.

HOW CHEM IS DIFFERENT THAN MATH

You have to call 911 more often. Shattering test tubes, burns, and explosions all add to the excitement.

HOW CHEM IS LIKE MATH

If it is taught right, it can be a lot of fun.

Welcome to the adventure!
Stan

* (ray-SEE-mick) An organic compound that has equal amounts of dextrorotatory and levorotatory molecules = a racemic mixture. Discussions of racemic mixtures rarely come up on prom night.

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Chapter One

Chem Lab Down the Hall

Fred taught his math classes in the Archimedes Building. It was the only building on the KITTENS University campus with an auditorium classroom large enough to hold the 805 students for his beginning algebra class.

Fred was explaining exponents.

He had written on the board: $\frac{x^m}{x^n} = x^{m-n}$

He asked, “What if m equals n?”

He wrote $\frac{x^n}{x^n} = x^{n-n}$

“And this simplifies to $1 = x^0$. Anything to the zero power is equal to one.”

Fred was about to show that if you let m equal zero, $\frac{x^m}{x^n} = x^{m-n}$ would turn into $\frac{1}{x^n} = x^{-n}$, when Joe staggered into the classroom.

He was bleeding.

A broken piece of glass tubing was stuck in his wrist. Three algebra students in the front row passed out. They were obviously not pre-med students.

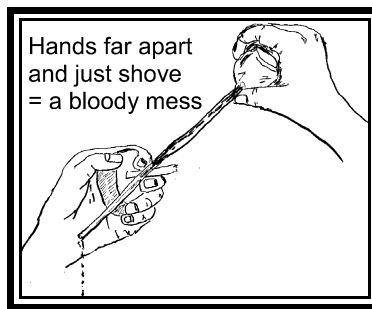
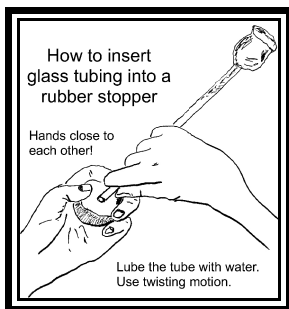
An algebra student, who was a veteran with overseas battle experience, stood up and said, “Let’s see what you got here, sonny. Looks like a bit of a flesh wound. Nothing serious.”

Fred passed out.*

The veteran walked Joe down the hall and back to the chem lab where Joe had been working. He located the first-aid box and dressed the wound.

* The last part of Shakespeare’s *Hamlet* was very much like this scene in *Life of Fred: Chemistry*—bodies all over the place and lots of blood.

On the chem lab wall were giant posters. Joe hadn't noticed them.



Some student had “decorated” the poster on the right.

Fred and his algebra students followed the trail of blood to the chem lab. He was still feeling a bit wobbly, but he was concerned about Joe.

Fred asked Joe, “Where’s the rest of the chemistry class? You weren’t working alone here, were you? That’s not permitted for beginning chem students. And where are your shoes?”

That was too many questions for Joe to answer. Often when asked a bunch of questions, people just answer the last one. Joe said, “I’m barefoot.”

“I know that,” Fred said. “It’s a standard rule in chem labs: NO BARE FEET. There might be broken glass on the floor.”

Joe explained that he had arrived at the lab a half hour before it was scheduled to begin so that he could have extra time to mess around with the equipment.

There was broken glass all around the places where Joe had been working.

The veteran told Joe, “Hey man. Looks like you’re set up for a second Purple Heart.”

Fred translated, “Joe, your feet. . . . I mean. . . . bleeding.” Fred passed out again. Teaching mathematics is one of the most accident-free professions on earth. Fred wasn’t used to seeing any kind of trauma.

The vet picked up Joe and set him in a chair. Another student swept up the glass. One student had called KITTENS Hospital telling them that there was a medical emergency in the chem lab in the Archimedes Building.

The medical team was used to visiting the chem lab and seeing wounds from broken glass, chemical burns from concentrated sulfuric and nitric acids, and inhalation of toxic fumes that contain chlorine (Cl), bromine (Br) or hydrogen sulfide (H₂S).

When they arrived, they saw Fred passed out on the floor and guessed that he had breathed toxic fumes. They put his 37-pound body on a stretcher. He awoke and hopped off the stretcher and said, “I’m okay. I just fainted. It happens a lot.” (It does happen more frequently to people who haven’t eaten in *days*.)

They left.

Joe picked pieces of glass out of his feet and tossed them on the floor. The student who had been sweeping kept sweeping. Everyone who knew Joe, knew that he might step on that same piece of glass a second time if it wasn’t swept up.

The veteran bandaged up Joe’s feet and told him he should “see a medic pretty soon.”

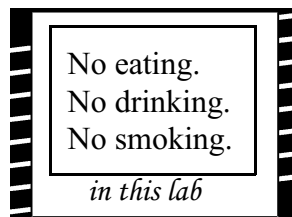
Fred knew Joe didn’t understand army talk and translated, “Joe, you should see a doctor today.”

Joe said, “I thought a medic was a doctor for a headic [headache].” He popped a couple of jelly beans into his mouth and chewed them.

The veteran pointed to another poster on the wall.

Joe protested, “But I’m not fat. That sign is for people who eat too much.”

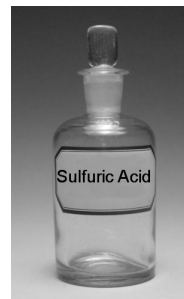
The algebra students couldn’t believe what they were hearing. They left the lab. It was getting near ten o’clock when the beginning algebra class was scheduled to end.



Fred and Joe were alone. Fred explained to Joe that there were poisonous chemicals in the lab and that getting even little amounts of them in his body—Fred didn’t use the word *ingesting*—would be bad for him.

Fred pointed to a bottle of sulfuric acid (H_2SO_4) and sang the famous chem song:

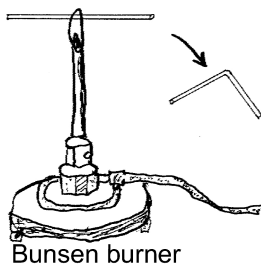
Johnny was a student. ♪
Johnny is no more.
What Johnny thought was H_2O ♪
Was H_2SO_4 .



Joe didn't understand the song, but he told Fred that he knew why you shouldn't smoke in a chem lab: It gives you lung cancer.

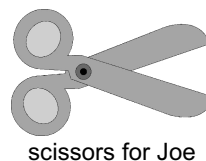
Fred shook his head. The truth was that even if you smoke a lot in a chem lab, there is a good chance you will never get lung cancer! Instead, you will be burned to death or blown to bits. Organic compounds (those that contain carbon), such as methane or butane, are highly flammable. Fumes of some solvents can be explosive.

The students for the ten o'clock chem lab started to come in. Today there were supposed to work with glass tubing. The two exercises were to learn to insert glass tubing into black rubber stoppers and to practice heating the tubing over a Bunsen burner flame and bending it into a right angle.



The students couldn't find any glass tubing. Someone must have used it all up. (We are not going to name any names.)

Three of Joe's fingers were badly burned. The experiment manual had clearly warned: BE CAREFUL YOU DON'T TOUCH THE MELTED GLASS. As an adult, Joe still uses kids' scissors. They don't have pointy ends.



scissors for Joe

Please take out a piece of paper and answer these questions in writing before looking at my answers on the next page. It is much easier just to look at the questions and turn the page and look at the answers—but you won't learn half as much if you do that.

Your Turn to Play

1. Express as a decimal 10^{-2} .
2. Express as a fraction in simplest form 2^{-4} .
3. Simplify 98396^0 .
4. Without looking back in the text, list as many of the chem lab safety rules as you can.
5. Can you guess why the veteran told Joe that he should see a doctor soon?

For fun, here is a list of the elements we have encountered so far.

H	hydrogen	
He	helium	→ → Used to blow up balloons that float in the air.
C	carbon	→ → Every organic compound contains carbon.
O	oxygen	→ → About 21% of the air you breathe is oxygen.
Cl	chlorine	
Br	bromine	
S	sulfur	

There are only 90 naturally occurring elements. Every particle of matter is made up from these 90. You have already met seven of them. Learn about dozen more and you will know all the important ones. You will probably never need to know about thulium (Tm).

..... **COMPLETE SOLUTIONS**

1. $10^{-2} = \frac{1}{10^2}$ since $x^{-n} = \frac{1}{x^n}$
 $= \frac{1}{100} = 0.01$
2. $2^{-4} = \frac{1}{2^4} = \frac{1}{16}$
3. 98396^0 equals 1 since anything to the zero power equals one. $x^0 = 1$
4. A. Read any safety posters or warnings in experiment manuals.
 B. When inserting glass tubing into rubber stoppers, lube the tube with water, keep your hands close to each other, and use a twisting motion.
 C. No bare feet.
 D. Sweep up any glass on the floor.
 E. Work under supervision—not alone.
 F. Avoid chemical burns and toxic fumes.
 G. No eating, drinking, or smoking in the lab.
 H. Don't touch melted glass.
5. Joe should see a doctor: (1) to remove any glass splinters that were still in his feet, (2) to clean the wounds and perhaps apply antiseptic to prevent infection, and (3) perhaps to stitch up the larger lacerations (fancy word for jagged tears or wounds) so that they will heal better, and (4) to treat the burns on his fingers.

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