Life of Fred
Elementary Physics

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Polka Dot Publishing

A Note Before We Begin

In the last chapter of this book, Fred is telling the story of how physicists discovered things about the atom. He tells about how Heisenberg announced his uncertainty principle in 1927: *We will never be able to locate an electron exactly.*

We have lost the electron. When my father was delivering pianos back in 1927, he never lost a single piano.

1927

The first quarter century of our lives is the best time to learn new things. Four-year-olds can learn a new language a lot easier than forty-year-olds.

We have lost the electron.

We might lose pianos.

But we don't want to lose this chance to learn.

In the government schools, physics is often taught in the twelfth grade. Too much time is lost waiting that long. This book fills a big gap. The title of this book might have been *Physics after Arithmetic* or *Physics before Algebra*.

It fits nicely right here

Life of Fred: Fractions
Life of Fred: Decimals and Percents
Life of Fred: Elementary Physics
Life of Fred: Pre-Algebra 1 with Biology
Life of Fred: Pre-Algebra 2 with Economics

THREE THINGS FOR MAXIMUM SUCCESS

1. There is a *Your Turn to Play* at the end of each chapter/lesson. Please write out the answers on paper before you look at the Complete Solutions offered on the next page. It will help you to learn. Students who do this often do much better on the **Bridges** that come at the end of every five chapters.

2. Get a sheet of paper and head it with *Formulas*. If your handwriting is really good, *Formulas*. If your handwriting isn't so good, Formulas. You will not be graded on your handwriting skills.*

Write down each formula that you encounter in the book and draw a little picture.

3. I can't think of a third thing.

HOW THIS BOOK IS ORGANIZED

Each chapter is a lesson—40 chapters and six **Bridges** to cross. Enjoy your journey with Fred.

This is the last book in the Life of Fred series in which I ask you not to use your calculator. This is your last chance to practice your addition and multiplication tables. In *Life of Fred: Pre-Algebra 1 with Biology*, you can haul out your calculator and use it to your heart's content.

Reading is the fastest way to learn. It is much faster than watching videos or listening to a lecture. Just ask my daughter, Jill.

* That may come later in life. If you become a teacher and your handwriting at the blackboard looks like this, your students might giggle.

Contents

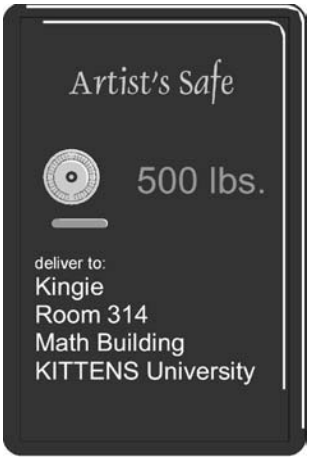
Chapter One
Friction

Fred always thought that early morning was one of the five best times of the day to go jogging. Other best times were the forenoon*, noon, afternoon, and evening.

It was morning. Fred got on his jogging clothes and headed out his office door. The routine was almost always the same. He would head down the hallway past the nine vending machines, down two flights of stairs, and out into the fresh morning air.

Today was different. He couldn't get down the hallway. A giant safe near the vending machines blocked his way.

There was a note attached to the safe that read, "This is as far as I'm going to deliver this safe. This is too heavy to carry. I quit."



This is silly, Fred thought. He shouldn't have tried to carry it. He could have slid it down the hallway.

Fred tried pushing the safe. No dice.**

What kept the safe from moving was friction—where the safe rubbed against the floor. If the safe were floating one inch off the floor, Fred could have pushed it down the hall with one hand.

Fred headed back to his office to think things over and do experiments.

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* The later part of the morning is called the forenoon.

** *No dice* is an idiom. *No dice* means that it doesn't work or it is useless.

An **idiom** is a phrase in which the individual words do not "add up" to what the phrase means.

When you say, "How do you do?" a person looking at the individual words might respond, "How do I do what?"

When you say, "Let's make a date to go fishing," this is silly. All the dates on the calendar have already been established: January 1, January 2, January 3. . . . If you really made a date, it might be something like January 42.

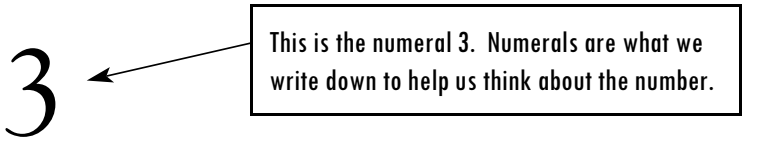
small essay

Math vs. Physics

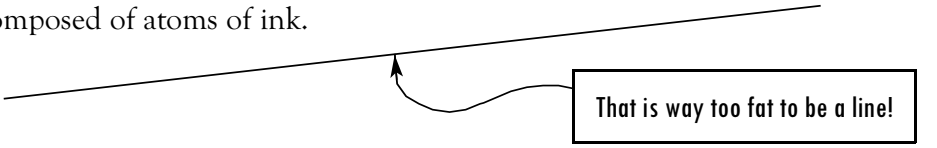
If this were just a math problem, Fred would have headed back to his office to think things over. He wouldn't have to do any experiments since math doesn't involve "stuff."

Physics deals with stuff—everything from atoms to stars. If you like to play with the dirt under your fingernails or with 500-pound safes sitting in the hallway, then you will need physics.

There is no stuff in mathematics. You will never be walking in a forest and trip over the number three.



You have never seen a line. Lines are infinitely thin. They are not composed of atoms of ink.



Mathematicians like to say that math is pure.

Physicists might say that math is fairy dust.

Mathematicians will point out that without this fairy dust physicists would be helpless. All of physics needs math.

end of small essay

When Fred got back to his office, Kingie was at work doing another oil painting.

"Your safe has arrived," Fred announced. "It's out in the hallway."

"Wonderful. If you would just bring it in, I would be grateful."

Everyone knows that Kingie wouldn't be much help in moving safes since he is a beanbag doll with no legs.

Fred said, "I'll try and get it moved, but first I need to learn more about friction. This is more than a math problem. The only way to find out about how friction operates is to do experiments in order to find out what is true."

He put three telephone books on his chair so that he would be tall enough to sit at his desk. The desk and chair that KITTENS University had supplied were not designed for teachers who are only three-feet tall.

Fred built a tiny safe that looked just like the real one in the hallway except that it was only two inches (5 cm) tall. He tied a string on it and pulled it across his desktop.

Then he turned it on its side and pulled it across his desktop.

Please write your answers down before you turn the page and see the answers. You will learn a lot more if you do it that way rather than just reading the questions and reading the answers.

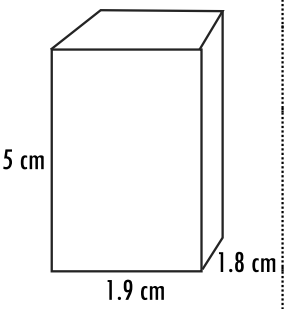
Your Turn to Play

1. The dimensions of the tiny safe were 1.9 cm wide, 1.8 cm deep, and 5 cm tall. When the safe was standing upright what is the area of the base that was touching the desktop?
2. When the tiny safe was placed on its side, what was the area touching the desktop?
3. Now I'm going to ask you to guess.

When the safe was lying on its side, the area in contact with the desktop was larger. Did that make it harder to pull the safe?

.....COMPLETE SOLUTIONS.....

1. The base of the safe is a rectangle. The area of a rectangle is length times width. $A = \ell w$.



$$(1.9)(1.8) = \begin{array}{r} 1.9 \\ \times\ 1.8 \\ \hline 152 \\ 19 \\ \hline 342 \end{array}$$

3.42 sq cm

2. The area of the side of the safe is (5)(1.8).

$$\begin{array}{r} 1.8 \\ \times\ \ 5 \\ \hline 90 \end{array}$$

9.0 sq cm

3. A lot of times we won't know what the physical law is until we experiment. Sometimes nature surprises us.

✔ Ask most three-year-olds, "Is the earth flat?" and they will say yes. If you tell them it is a sphere (a ball), they won't believe you and will tell you that people on the bottom would fall off.

✔ Ask most seven-year-olds, "If you throw a billiard ball and a cannon ball off a cliff, which will hit the ground first?" Most will say that the heavier thing falls faster. The surprising truth is that, except for the friction caused by air (wind resistance), everything falls at the same speed.

When Fred did his experiment, he found that it didn't matter whether the safe was upright or on its side. The force he had to apply to the string was the same. Many people would never guess that.

Friction is independent of the area of contact between the two rubbing surfaces.

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