ARCHIMEDES and the DOOR OF SCIENCE

by Jeanne Bendick

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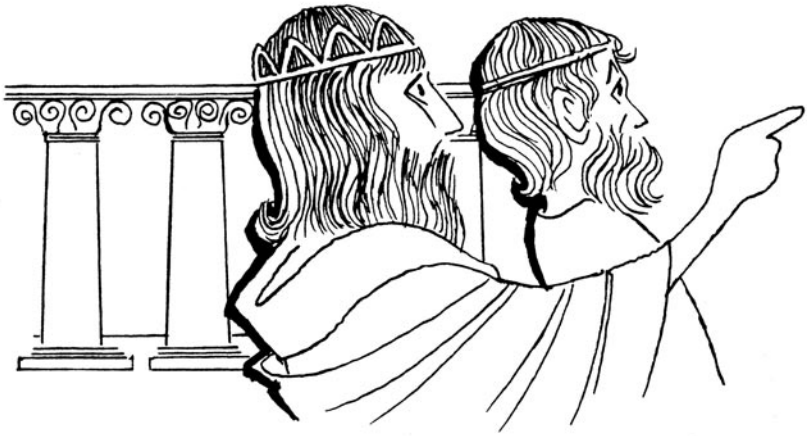
and the
DOOR OF SCIENCE

written and illustrated by
Jeanne Bendick

Purple House Press
Kentucky



Published by
Purple House Press
PO Box 787
Cynthiana, Kentucky 41031

Classic Books for Kids and Young Adults
purplehousepress.com

ISBN 9781948959476 Hardcover
ISBN 9781948959568 Paperback

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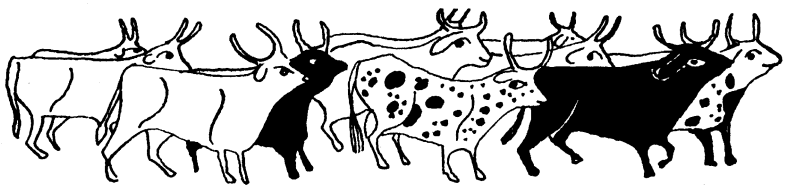
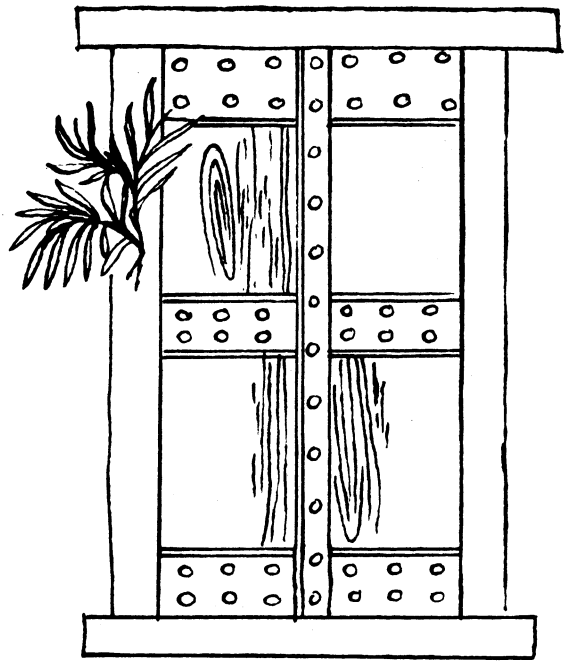




Chapter 1

WHO WAS ARCHIMEDES?

ARCHIMEDES was a citizen of Greece. He was born in 287 B.C. in a city called Syracuse, on the island of Sicily.

When Archimedes was born, an olive branch was hung on the doorpost of the house to announce to all of Syracuse that Phidias the astronomer had a son. A slave dipped the baby in warm water and oil and then wrapped him in a woolen band, from his neck to his feet, like a papoose.

The birth of Archimedes was celebrated by two family festivals. When he was five days old, his nurse, carrying the tightly wrapped baby in her arms, ran round the circular hearth in the main living room of the house, with all the other members of the household, both the family and the slaves, running behind her. This ceremony put the baby forever under the care and protection of the family gods.

The tenth day after he was born was Archimedes' name day. Phidias had a party for all the family and their friends. In front of all the guests he solemnly promised to bring up his son and to educate him as a citizen of Greece. Then he gave the baby his name—Archimedes.

It was just a single name, without a first or last one. Maybe Archimedes was named after his grandfather, or a friend of the family, or a god. Much thought went into giving the baby a name, which was carefully chosen to bring him luck. Then the guests piled their presents near the swinging cradle, a sacrifice was offered to the gods, and finally a great feast was served.

The family gods must have looked kindly on the baby Archimedes, and his name must have been well chosen, for he grew up to be one of the greatest scientists the world has ever had.

Most of the things *you* know about science would have dazzled and bewildered him. But many of the things you know about science *began* with Archimedes.

What was so unusual about a man who spent almost his whole life on one small island, more than two thousand years ago?

Many things about Archimedes were unusual. His mind was never still, but was always searching for something that could be added to the sum of things that were known in the world. No fact was unimportant; no problem was dull. Archimedes worked not only in his mind, but he also performed scientific experiments to gain knowledge and prove his ideas.

Many of his ideas and discoveries were new. They were not based on things that other people before him had found out.

Imagine what this means.

Nowadays we do not have to think about most things *from the beginning*, because we have the knowledge of all the things that people have learned over thousands of years.

The great mathematicians of modern times have the knowledge and the proofs of thousands of other mathematicians to help them. The greatest scientific discoveries are based on things other scientists have learned, bit by bit.

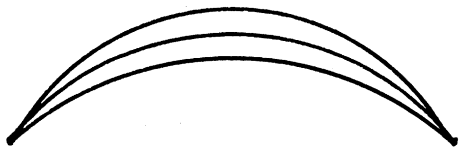
A famous scientist (Sir Isaac Newton) once said that he was able to see so far because he stood on the shoulders of giants. Archimedes was one of the giants. He was one of the first.

The scientists who came after him had more and more to work with. Archimedes had only the principles —the basic ideas—of the great mathematics teacher, Euclid, and these ideas—

that a straight line is the shortest distance between two points,

and that the next shortest distance is a shallow curve,

and that each deeper curve is longer.



That's not much! But the mind of Archimedes—that curious, logical, wonderful, exploring mind—made up for the things people before him had not found out.

Archimedes began the science of mechanics, which deals with the actions of forces on things—

solid things, like stones and people,
liquid things, like water,
gases, like air or clouds.

He began the science of hydrostatics, which deals with the pressure of liquids.

He discovered the laws of the lever and pulleys, which led to machines that could move heavy loads, or increase speeds, or change directions.

He discovered the principle of buoyancy, which tells us why some things float and some things sink and some things rise into the air.

He discovered the principle of specific gravity, which is one of the basic scientific tests of all the elements.

An element is a substance that is made of only one kind of atom. There are no combinations of atoms in an element. Gold is an element, and so is silver, and so is lead. They are each made of one kind of atom.

The gas, hydrogen, is an element, and so is oxygen. But if you mix them together you get water, which is not an element, but a compound.

Archimedes discovered that every element, and even every combination of elements, has a different density, or weight for its size—and that this is a good way to tell one substance from another, even if they look alike. The density of any substance, compared with the density of an equal amount of water, is its *specific gravity.*

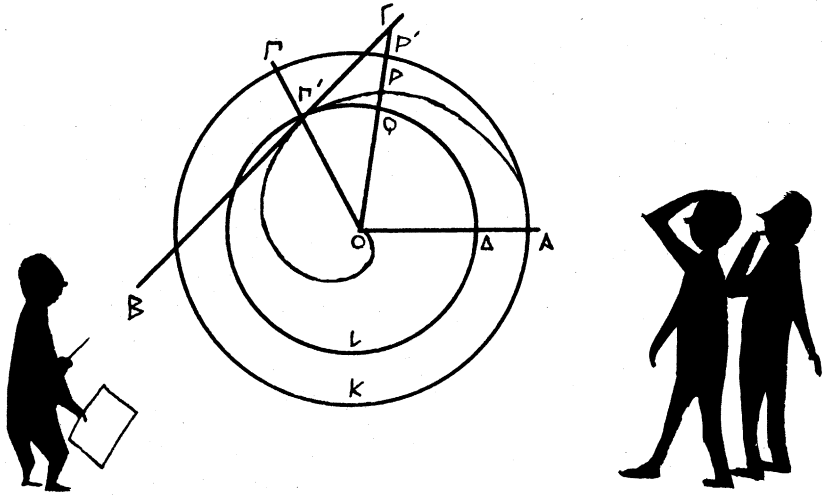
He invented the Archimedean screw, a device that is still used to drain or irrigate fields and load grain and run high-speed machines.

He invented a kind of astronomical machine that showed eclipses of the sun and moon. He estimated the length of the year, and the distances to the five planets that were known to the ancient world.

For three years his war machines defended the city of Syracuse against a great Roman fleet and army.

But although he was a great inventor he considered inventing an amusement, and mathematics his real work.

Archimedes wrote brilliantly on almost every mathematical subject except algebra, which was unknown to the Greeks. (You can't have algebra without the idea of zero, and no one thought of zero until hundreds of years after Archimedes lived.) Some of Archimedes' mathematical theories were so complicated that even today they can be understood only by experts.



He was the first to show that numbers unimaginably big, bigger than all the things there are, could be written and used.

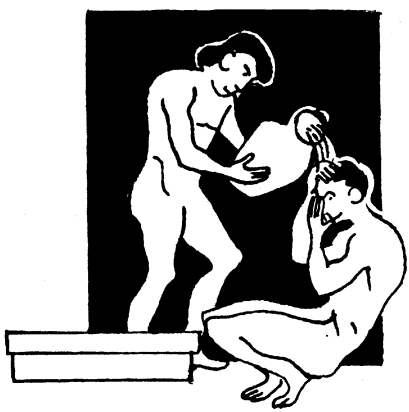
He lit the flame that led to the invention of calculus, which is the mathematics of changing rates and speeds and quantities.

The door to modern science opened through the mind of Archimedes.

But probably the most important thing Archimedes gave to the world was a logical way of *thinking* about mathematics. He had a way of taking things in order, step by step, so that he could prove or disprove his ideas as he went along.

Archimedes lived in one of the greatest civilizations the world has ever known, among many brilliant minds, and yet he was outstanding even there.

What was the world of Archimedes like?



ARCHIMEDES and the DOOR OF SCIENCE

Most of the things you know about science would have dazzled and bewildered Archimedes. But many of the things you know about science *began* with him. The curious, logical, wonderful, exploring mind of Archimedes founded several branches of science, discovered many scientific laws and principles, and so very much more.

As an inventor, a few of the amazing things he created were the Archimedes screw to drain and irrigate fields, a machine to show eclipses of the sun and moon, and war machines designed to defend his city of Syracuse from the Romans. In spite of all these achievements, Archimedes considered inventing an amusement, and mathematics his real work. He wrote brilliant proofs and theories on almost every mathematical subject.

Jeanne Bendick introduces Archimedes through humorous yet easy-to-understand explanations of his inventions and contributions—and shows us that the door to modern science opened through the brilliant mind of Archimedes.

Purple House Press

ISBN 978-1-948959-77-3

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