Science and Living in God's World

Grade 7

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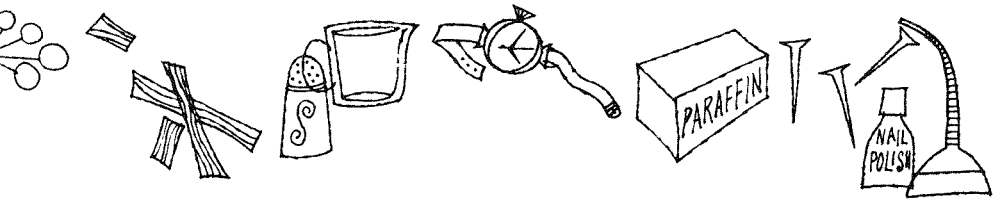
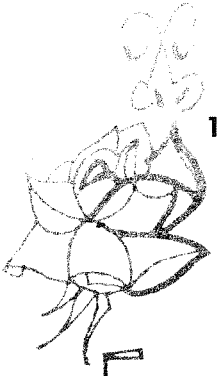
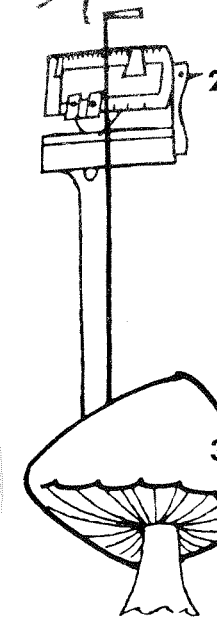
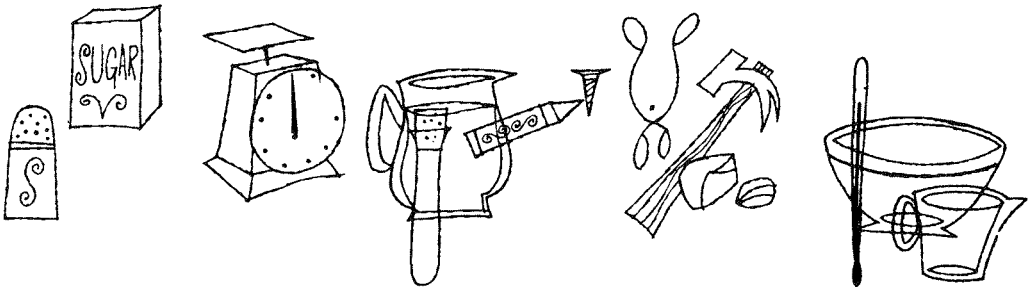
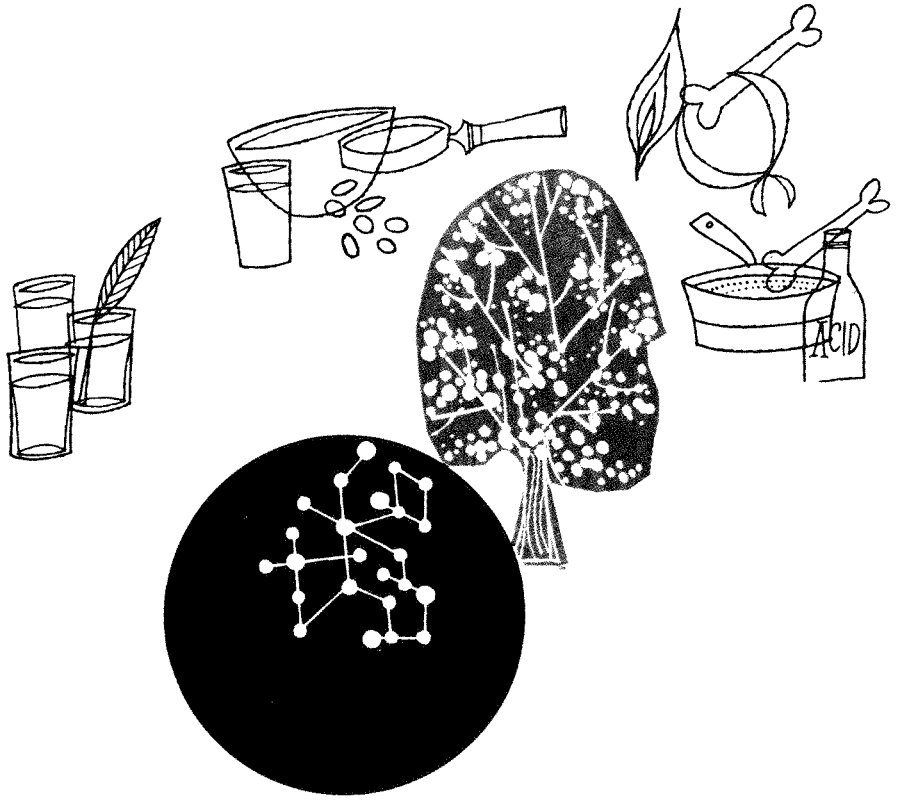










Introduction

It is God's plan that animals, like foxes and birds, use the material world to care for their physical wants. God's plan for man was greater. He gave man the power to seek truth. Because of this power, man searches for the causes of things, he uses the scientific method, and learns much scientific knowledge.

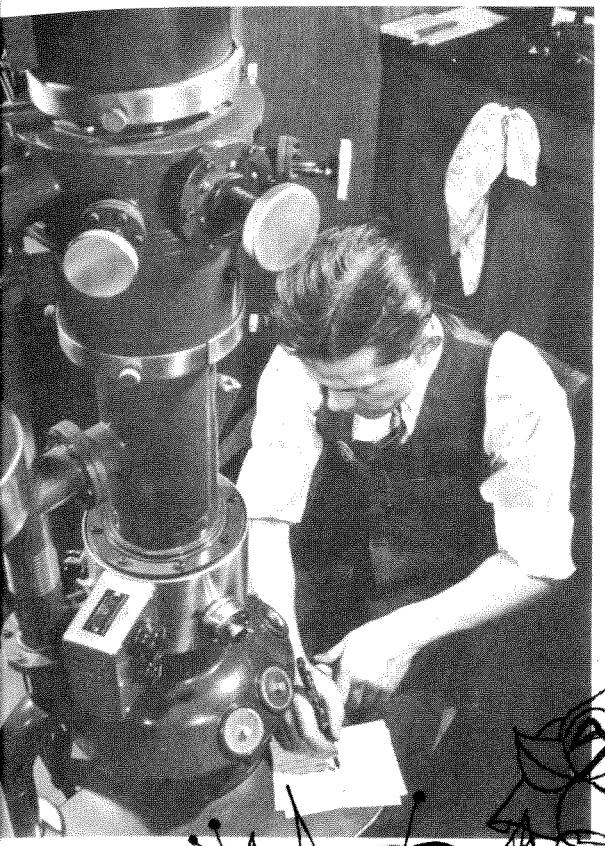
In the pages that follow, you will see how scientists have studied the material world and have found causes for the things we see and feel and hear. You will learn how one thing depends on others. Most important of all, you will learn how to look for

causes and how to think scientifically. Before you can be a scientist, you must know about science. It is good to know *about* science. But it is more important some day to be a scientist.

Of course, all of you are not going to be scientists. But you must know something about scientific discoveries to think and live in our scientific age. Words like atoms, satellites, and vitamins, which in the past were used only by scientists, now are used and understood by almost everyone. Nearly all American homes use appliances and materials, like electric washing machines, television, chemical fertilizers, and radiant heat. Science enables us to understand and to use such appliances and materials. Knowledge of science is not something for a few specialists. It is a necessity for all of us.

The study of science requires real contact with nature and careful observation of our world. This book merely introduces you to the study of science. You must go beyond this book and look with a scientific eye at things you used to take for granted. You should look in a scientific way at the trees of your neighborhood, the stars, the steaming of a tea kettle, and your food. You should try to apply your knowledge and interest in science to your immediate surroundings. Then you will begin to see how interesting it is to think scientifically.

Unthinking persons have sometimes said that science contradicts religion. Of course, this is a false opinion. Since God is the Author of the supernatural order of faith and of the natural order in matter, there can never be any contradiction between the two orders. There is a great need for Catholic scientists who can show that science leads man not away from God but to Him.



Unit 1

Science and the scientific way

God's world is a wonderful place in which to live. For about twelve years you have been enjoying the good things that God had ready and waiting for you. You have been warmed by the sun and cooled by breezes. You have marveled at the beauty of the stars and at the loveliness of flowers or snowflakes. You have been happy in the love of your parents and your friends.

You have been discovering God's wonderful world by using your eyes, ears, nose, mouth, and hands. You see the sun in the sky, and you hear raindrops falling on a roof. You taste the

sweetness of an apple, and you smell the fragrance of a rose. You feel the softness of a kitten's fur and the warmth of a campfire. Can you think of other sights, sounds, smells, and touch sensations that have helped you to know the world around you?

Now another way of learning to know God's world is opening up to you. As you grow older, you begin to look for causes of things. Looking for causes of things is learning to know God's world in a scientific way.

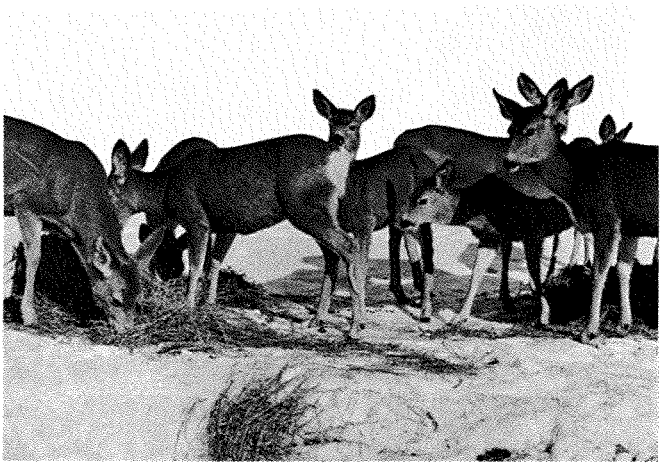
In this unit you will learn about the scientific way, and you will see some scientists at work. You will learn how scientists look for causes, how they attack problems, and how they follow up ideas. You will see how they discover the answers to questions and how their new knowledge is used.

In this unit you will also learn that new problems always come out of working on any one problem in the field of science. Solving such problems gives satisfaction and joy to the true scientist. If puzzles challenge you, and if you like to discover the answers to questions, you will like science. Perhaps you will like science so much that you will want to be a scientist.

Whether or not you become a scientist, the study of science will help you. The study of science is another path to God. When you trace out the causes of things, you will eventually find God, the highest Cause. This is the great thing that science can do for you—it can lead your mind to God.

Science asks why

To begin with, what do we mean by *science?* Science means knowledge of facts arranged in an orderly way. It also means a branch of such knowledge. For example, the knowledge of the stars is a science, the knowledge of living creatures is another science, and the knowledge of the laws of moving things and energy is still another. And finally science means skill. In this



Why does water freeze?

Why do animals have fur?

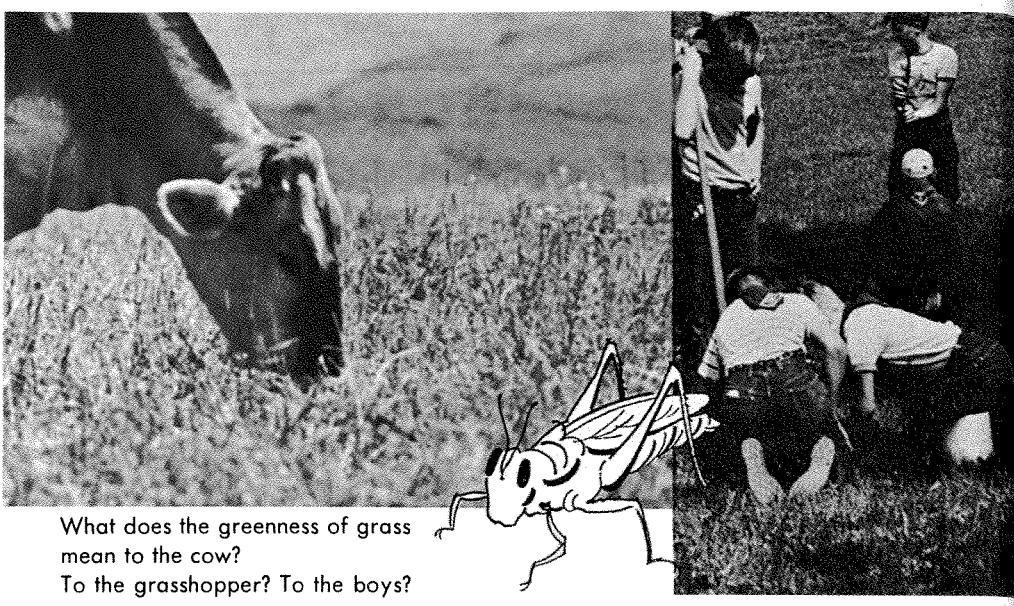
Why do plants have roots?

book science is used to mean knowledge of God's world and its creatures and how they are related to one another.

Of all God's creatures, man is the only one to whom God has given the gift of science. Some of us make better use of the gift than others, but each of us makes some use of science. You use science each time you learn a fact about God's world. You use science when you look for causes of things that happen.

Discovering facts and their causes

Let us take the fact that grass is green. A cow will eat grass without thinking about its color. A green grasshopper will make use of the color by hiding in grass but will not wonder what makes grass green. You, who are a human being, notice that grass is green. But you are not satisfied with just knowing that it is green. You wonder what makes grass green; then you wonder how you can discover why it is green.



What does the greenness of grass mean to the cow?
To the grasshopper? To the boys?

The best way to discover the facts about such things is the scientific way. By the scientific way, first you collect facts about grass and about color. Next you try to discover more facts about grass and color. Then you look over all the facts you have gathered. You notice a connection between some of the facts and the fact that grass is green. You find that you can put aside many facts about grass and about color because they have no connection with the greenness of grass.

Forming and testing a theory

The next step in the scientific way is to form an idea that may explain why grass is green. Perhaps the idea that occurs to you is that grass contains a material that makes it green. Until you can prove that your idea is true, you do not have an answer to your question about grass. Your idea is only a *theory*.

To prove your theory you have to test it. You have to try an *experiment*. If the experiment proves that your theory is wrong, you will have to form a different theory. If the experiment shows your theory is correct, you still have one more thing to do.

The final step in the scientific way is to repeat the experiment many times. If you get the same result each time you repeat the experiment, you have proved that your theory is a scientific

fact. Whenever anyone asks you why grass is green, you know the answer. Grass contains a material that makes it green. You can prove it to him by repeating your experiment.

Scientific thinking

If you become a scientist, you will learn to think in the scientific way. The scientific way is a special way of thinking. Not all thinking is scientific. The poet who describes the beauty of grass is thinking, but not in the scientific way. The historian who tells about the life of George Washington is thinking, but not in the scientific way. Poets, historians, and others who are not scientists can make use of science. The poet can make use of the science of sound to choose words for his poem. The historian can make use of science to discover facts about George Washington that will be part of the story. The football player can use the science of moving objects to throw a longer pass. But the scientist does something special that others do not do.

The scientist not only uses facts, but he also explains them. He looks for causes and reasons. And he learns how to prove that the causes he has discovered are the true causes of things.

Classroom experiments help you to test ideas and facts and teach you to think in the scientific way.

To find the causes of things, the scientist finds a connection among facts and among ideas. He finds the connection by *reasoning*. You are reasoning whenever you connect several facts in your mind and think them through so that you can figure out an answer to a question. The answer that you get is your *conclusion*. If you can test your conclusion and prove that it is right, it is a *fact* that you have discovered by reasoning.

Some men make better use of their power of reasoning than others do. Scientists use their power of reasoning to add to our knowledge of God's world and its creatures. They are not satisfied just to know facts. They try to find out *why*. Let us see how some great scientists worked. Let us find out how they gathered facts, how they reasoned them through, how they arrived at conclusions, and how they proved their conclusions.

Hippocrates

Hippocrates

Hippocrates lived about 2400 years ago in Greece. Because he came from a family of doctors, he was able to study all that was then known about medicine. He traveled a great deal, and everywhere he went, he observed how diseases were treated.

Back in those early days most people thought that disease could be cured with charms. All those patients who recovered from sickness would make an offering to the medicine god. In the god's temple they would place a clay tablet, telling the story of their illness. Hippocrates saw that these records contained information about disease. By comparing many records of the same disease, he learned much about the disease.

Hippocrates was not superstitious about disease. He examined patients carefully to discover the causes of their illnesses. He kept careful records of his observations.

Hippocrates became a famous doctor. He taught his followers that the human body carries out the laws of nature. Hippocrates

believed all disease has a natural cause that can be discovered by careful study. In his time this was a new idea. He also advised other doctors that cleanliness, light, air, diet, and exercise are important. He taught that people should not eat, sleep, or exercise too much. To be healthy, people should be moderate in all things.

The ideas of Hippocrates are preserved now in a famous collection of writings. His most important ideas have to do with the high ideals of doctors. Today medical students make these promises, which are based on Hippocrates' ideals, when they become doctors:

"I will be loyal to the profession of medicine, and just and generous to its members. I will give directions for the good of my patients according to my ability and my judgment, and never do harm to anyone. To please no one will I prescribe a deadly drug, nor give advice which may cause his death.

"I will preserve the purity of my life and art. Into every house which I enter I will go for the good of those suffering, being above all wrongdoing. All that comes to my knowledge in the exercise of my profession in connection with the lives of human beings which ought not to be spread abroad, I will keep secret."

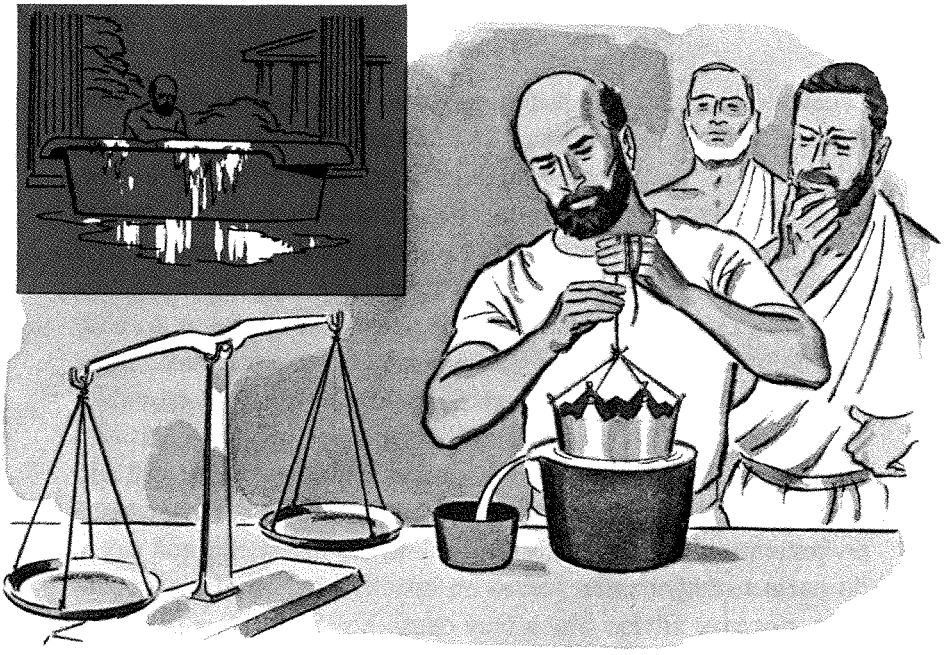
We call these promises the oath of Hippocrates.

Archimedes

Archimedes lived about 2200 years ago in the Greek city of Syracuse on the island of Sicily. He spent his whole life puzzling out problems that had to do with mathematics. He advised the people about balances and levers, and about weights and measures. He told them how to make various kinds of machines.

Archimedes

We are told that the king of Syracuse once asked Archimedes for advice. The king was anxious to find out whether his new crown was made of solid gold. He suspected that it was made of a cheaper material covered with gold. Archimedes reasoned that the weight



of the crown would depend on the material in it. He knew that gold has a different weight than silver or any other material. But he did not know how much gold was supposed to be in the crown. The shape of the crown made it hard to measure.

Archimedes thought about this problem without success for some time. One day, as he got into his bath, he noticed that some of the bath water overflowed. Perhaps because he had formed a habit of wondering about causes, Archimedes suddenly saw how he could measure the king's crown.

Archimedes reasoned that his body made the bath water overflow because it took up space in the tub. If he filled the tub to the brim and then lowered his body into the water, the amount of water that overflowed would take up exactly the same amount of space as his body. Now he realized how he could measure the size of the crown. He lowered it into a container brimful of water and measured the amount of water that ran over the top.

Archimedes then found out how much that amount of pure gold would weigh. Next he weighed the crown and found that it was of a different weight than pure gold. The king had indeed been cheated. Can you tell why?

Then Archimedes thought of another use for his discovery that is even more important. He thought of the reason why some things float while others sink.

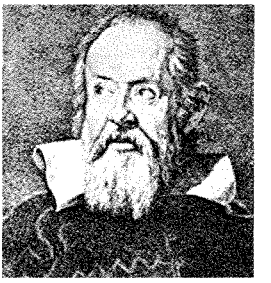
Archimedes had noticed that any object seems lighter under water than it does out of the water. He reasoned that the amount of weight lost by the object would be equal to the weight of the water that it displaced. Archimedes then tested this theory. He weighed the water that was displaced by an object. He also weighed the object before it was placed in the water and while it was under water. He repeated the experiment with different objects. Archimedes proved that his theory was correct. An object that is lighter than the water that it displaces will float. An object that is heavier than the water that it displaces will sink. Any object is lighter under water than it is out of the water.

Archimedes announced this discovery as a law of nature, which we now call the *principle of Archimedes:* A body in a fluid is lighter in weight by an amount equal to the weight of the fluid that it displaces. Thus his discovery became a scientific fact that helps us to understand God's world.

Galileo and Copernicus

Galileo Galilei has been called the father of modern science. He was born almost four hundred years ago in Pisa, Italy. His life was devoted to the search for the truth about the world and the laws of nature. Whenever possible, Galileo accepted a fact only after he could test it and prove it for himself. He was very successful in this kind of thinking because he was clever at thinking up ways to prove facts.

Galileo



While he was a medical student at the University of Pisa, Galileo noticed a hanging lamp that was swinging back and forth. Knowing that his own heart beats were regular, Galileo timed the swinging of the lamp by holding the fingers of one hand on his other wrist to feel the beat of his pulse. He