Science and Living in God's World

Grade 4

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continued

Introduction

This year's science text, *Science and Living in God's World 4*, will continue to remind you that the world in which we live is God's world. You will see, in an even more detailed way than before, that Almighty God made it for you to use wisely.

When you read and study this book, you will learn many facts about the things you see every day. You will learn about the earth and the plants and animals that live on it. You will learn about the sun, the moon, and the stars. Your mind will grow more alert from studying and thinking about these things. Your eyes and ears will become sharper in discovering what is going on in the world around you.

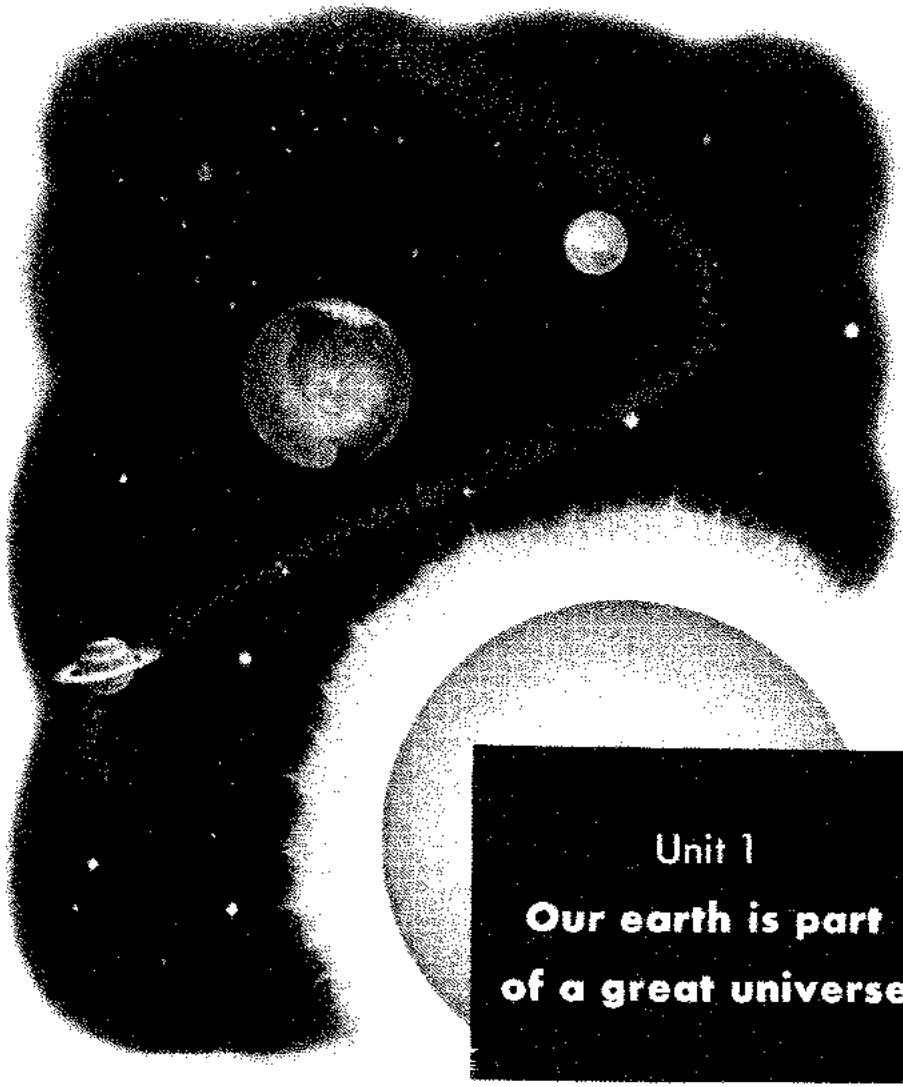
God made this wonderful world for you to use wisely. If you are going to use God's world wisely, you must learn all that you can about it. As you learn about the world, you will see a *plan* in everything that God created. Before a boy can make a model airplane, he has to have a plan or design. Before a girl can make a doll's dress, she must have a plan or design. God has a plan for His world. God's plan is shown in the sun and the planets, in day and night, the seasons, in your food, and in the wonderful way in which your body works.

If you did not know God, you would ask many questions about who planned all the things around you. You would wonder who made everything work just right. Who invented day and night, summer and winter, rain and snow? Who made such wonderful things as apples, pebbles, rivers, stars? Who thought of all the plants and animals? Who thought of men and women, boys and girls? Who made the grass, trees, and sky so beautiful? Who planned for your food and clothing to come from plants and animals? You know that the answer to all these questions is *God*.

Boys and girls ask many questions about the world. You, too, will ask many questions. As you learn the answers to your questions, you will realize that only a mind as wonderful as God's could make the plan of the world.

God can plan all the wonders and beauty of His world because He is wonderfully wise and powerful. You have learned about God in your religion class, in your home, and in the Church. As you study science, you will learn more and more about God and His world, and you will understand better how great God must be to plan it all.

St. Thomas Aquinas, who lived many years ago, wrote that man could find out that God really exists by studying the plan of the world. Since you already know that God exists and is all wise and all powerful, this science book will help you understand better the power, the goodness, and the beauty of God's mind. It will help you find God's plan in the bright moon, in a flower, in a friendly puppy, and best of all in YOU!



Unit 1
Our earth is part of a great universe

We learn from our catechism that God is perfect in His goodness. God created heaven and earth and all things. As we study this unit, we shall come to understand that everything that is good and beautiful comes from God. Because of His loving care for His creatures, God has given us a beautiful world to live in.

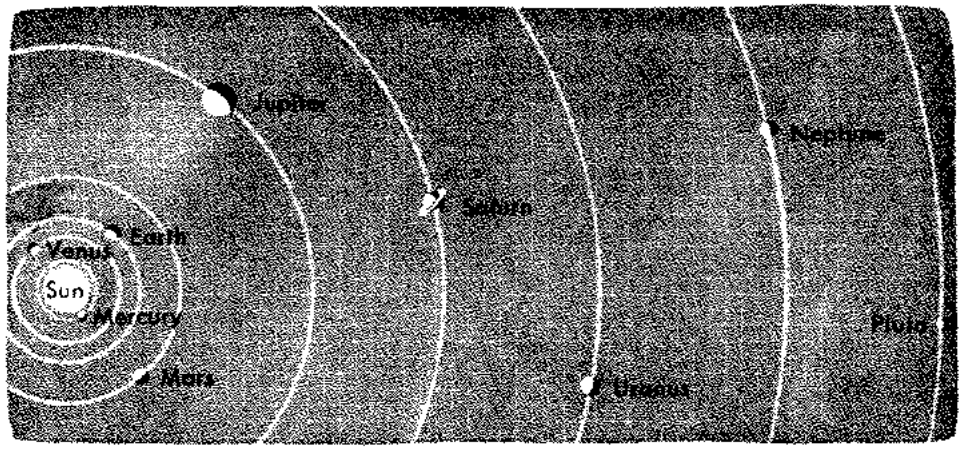
Our earth is part of the universe

God made the earth and everything on it—the rivers, the mountains, the oceans, the *planets*, the animals, the air. He made the sun, the moon, and the stars. We know all these things are around us because we can see them or feel them.

God also made things that we cannot see or feel. We cannot see angels, but we know they are real. They are just as real as things we can see or feel. God created them, too.

In this book we are going to study things we can see or feel. Some of the things God made are so far away that we cannot see them with just our eyes. We can see them only with a special kind of glass, which is called a *telescope*. A telescope makes a far-away thing look closer and clearer.

Some men and women spend all their working time in learning about the stars and planets. They use in their work telescopes like the one in the picture. They use telescopes to find out facts about the sun, the moon, the planets, and the stars.



Each planet has its own path around the sun. How many planets are nearer the sun than our earth?

When we look out from the earth, we see the moon, the sun, the planets, and many stars. And there are many more *stars* and *planets* that we cannot see because they are so far away. All of them together are called the *universe*.

The earth is one small part of this great universe. It is one of the nine planets that travel around the sun. The other planets are large bodies like our earth. Each of the planets travels around the sun in a path which is almost like a circle. Each planet has its own path around the sun. Our sun is one of many, many suns in the universe that have planets traveling around them.

When God made the universe, He also made a plan for it. Each planet always travels in its own path. It never gets in the way of the other planets. Each sun with its planets has its own place in the universe.

What would happen if God had not made a plan for the universe?

Stars light the earth at night

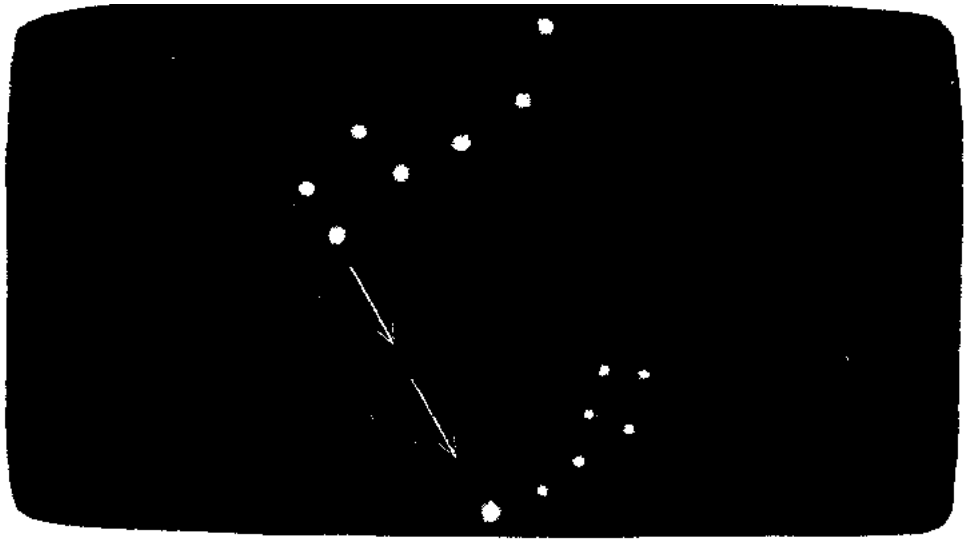
You know what the sky looks like on clear nights. Sometimes you can see the moon. Sometimes you cannot. If the sky is clear, you can always see thousands of tiny lights. A few of these lights are planets. The others are stars.

Did you know that every star is a sun? Some stars are much larger than our sun. All of them are many times as far away as our sun. That is why they look so small.

The stars shine day and night, but we do not see them in the daytime. Do you know why? Our sun is much nearer to us than the stars, and for us the light from it is much brighter. The sun's light is so bright that we do not see the stars during the day. At night the light from the sun does not reach us. Then we see the stars clearly.

All of the stars are very, very hot. This makes them seem to twinkle when we look at them. Some are even hotter than the sun. Yet we do not feel any heat from them because they are too far away. Some stars are so far away that it takes years and years for their light to reach the earth. Stars give us only a little light. They are our night lights.

Sailors can use the stars to help keep their directions at night. They can do this because God made a plan for the stars. Some of the stars are in groups that make beautiful patterns. These groups are known by names. One of these groups of stars looks very much like a big dipper in the sky. It is called the *Big Dipper*.



Sailors and travelers in our part of the earth use these groups of stars to help them find their way.

Look at the picture above and find the Big Dipper. Notice that the two stars in the bowl point toward a star called the *North Star*. If you can find the Big Dipper, these two stars, called pointers, will help you find the North Star. Now look at the North Star in the picture. It is part of another group of stars called the *Little Dipper*. Why is this group called the Little Dipper? What part of the Little Dipper is the North Star?

When you face the North Star, you are facing north. Your back is toward the south. To your left is the west. To your right is the east. Knowing this can help you find your way at night.

Why may we say that God put a compass in the sky for the sailors?

Why do the stars look so small?

Why do we not see the stars in daytime?

The earth has a neighbor in the sky

The moon is earth's nearest neighbor in space. You may remember from last year that when our astronauts landed on the moon in 1969, we found out many things we didn't know before. Later Apollo missions to the moon helped us to confirm that there is no water to speak of on the moon's surface. There is also no air.

Many of the planets have their own moons. Some planets have many moons. Some, like the earth, have only one. Others have no moon at all. A moon is not a planet. Planets revolve directly around the sun, but a moon revolves around a planet. A moon travels with its planet as the planet revolves around the sun

As you learned last year, our moon is much smaller than the earth. It looks as large as the sun, but it is not. The moon appears as large because it is hundreds of times closer to us than the sun.

The moon is not a star. It does not give off heat. It does not give off light of its own. Do you remember from your science studies in Third Grade why we can see the moon at night? Half of the moon is always lighted by the sun, and the moon *reflects* that sunlight. But we can only see part of the lighted half, which is how we see phases of the moon.

Do you remember from last year that for a couple of days each month, when the moon is between the earth and the sun, we see no moon at all? This is the "New Moon." Have you ever looked for the moon at night and not found it, even though there were no clouds to

hide it? Did you wonder why? You could not see the moon because the lighted part was turned away from the earth.

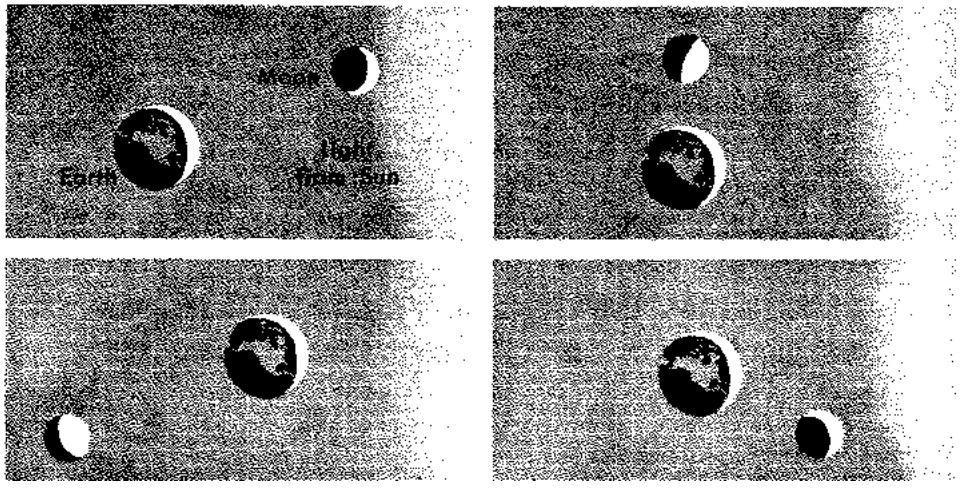
A few nights later you could see just a thin slice of the moon. Only that much of the lighted part was facing the earth. Then in a week or so you could see a much larger part of the moon.

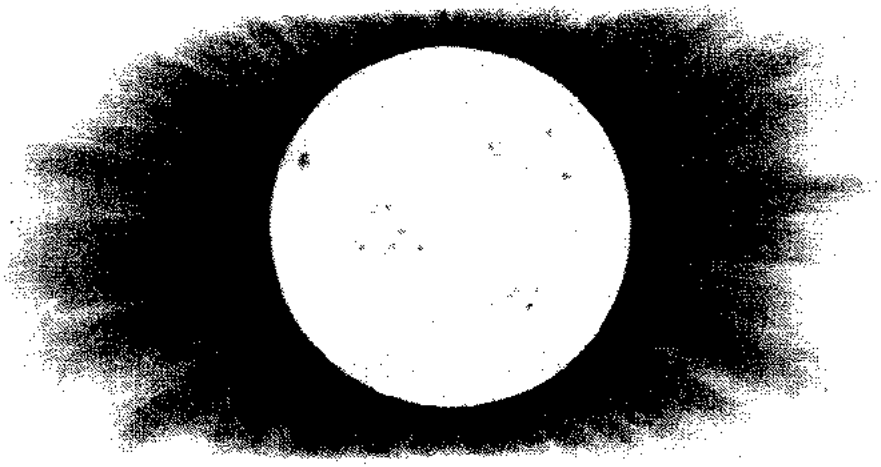
As the nights went by, you may have noticed that the lighted part of the moon was becoming smaller again. Soon there was no moon at all. It takes about four weeks, or twenty-eight days, for the moon to go through all these changes.

The moon is part of God's great universe. It is part of God's great plan. He caused the moon to move on its path around the earth. We have learned to depend on the moon and to use it in many ways.

What uses do we make of the moon?

The moon looks different to us at times because different amounts of its surface reflect light in our direction. How does the moon look to us in each of these pictures?





The sun is a glowing ball of very hot gases. It is a star.

The sun gives us heat and light

God made the sun as part of His great plan for the universe. The earth and the other planets travel around the sun. They receive warmth and light from it.

The sun is a round ball very much as the earth is round. The sun is really a ball of very hot gases. Steam as it comes from a teakettle is a hot gas. But the sun's gases are much hotter than steam. The gases are hotter than anything on earth.

The heat from the sun can burn things on the earth even though the sun is very far away. The air that is around the earth keeps part of the sun's great heat away. If there were no air, the sun's heat would burn everything on the earth.

The sun is a million times as large as our earth. This means that it is as large as a thousand thousand earths. This is hard to believe when we see the sun glowing in the evening sky like a big orange ball. The sun looks small because it is so far away. The sun is

ninety-three million miles away. It is hard for us to think of so great a distance. The sun's heat comes all that distance and still feels hot on our skin.

The sun's gases are so hot that they glow brighter than any light on earth. The sun is so bright that we should be careful not to look at it except through smoked glass. Such a bright light may injure our eyes.

Plants could not live without the sun's light and heat. The animals could not live without plants for food. And we could not live without the plants and animals. This is one of the many reasons why we could not live without the sun.

All parts of the earth do not receive the same amount of the sun's heat. Some parts have snow and ice all the year round. Other parts never have snow and ice. The picture shows scenes from two parts of the earth. Which receives more heat from the sun?

Things grow best where there is enough heat and light from the sun.

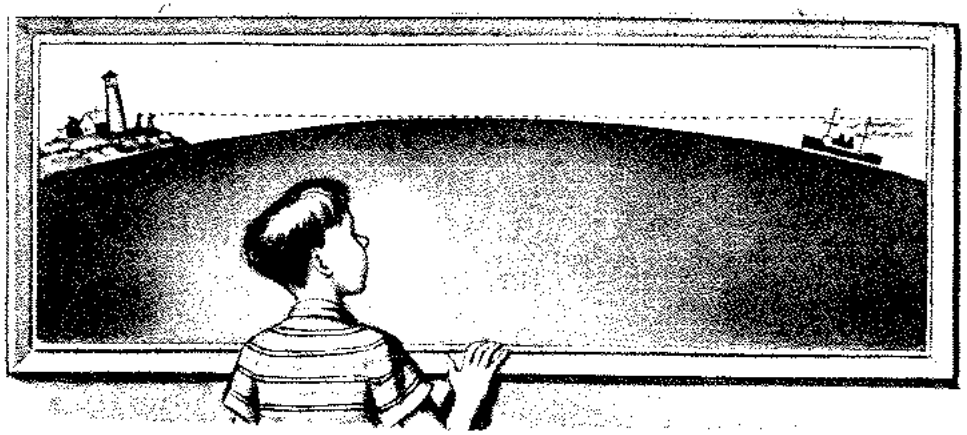
Both man and plants are helped by the sun.

The sun helps to keep us in good health. Sunshine kills germs that make us ill. It helps build strong bones so that we can have strong bodies. Yet, we must be careful how we use this aid to health. We must not stay out in the sunshine too long when the sun is high in the sky. The sun is high in the sky about noontime. At that time, the sun's rays can give us a very bad burn, especially during the summer.

To all living creatures on the earth the sun is very important. To them it is an important part of God's plan for the universe.

What do you think the earth would be like if there were no sun?

Which plant above did not have enough sunshine?



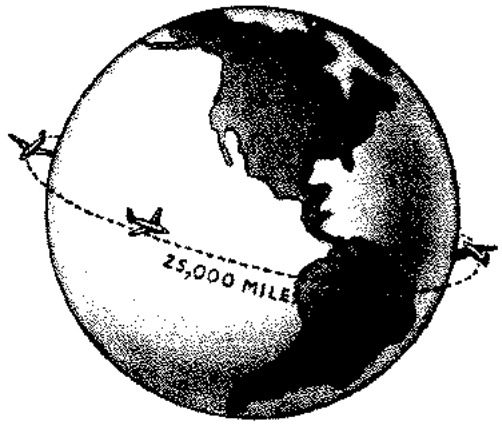
The ship disappears from your sight because the earth's surface curves.

Our earth is round like a ball

One day long, long ago some sailors were standing on a shore. They were watching a tiny speck in the distance. It was the top of the sail of a ship coming toward them. They kept watching and watching. The speck grew larger and larger. Then they began to see more and more of the ship.

This made the sailors think. They could understand why the ship seemed larger as it sailed toward them. Why did they not see the whole ship at once? Someone said this was because the earth must be round like a ball. More of the ship could not be seen until it came over the curved surface of the ocean.

Many men had always believed that the earth was flat and that ships could fall off the edge. But men began to lose their fear of falling off the edge of the earth. They began to travel farther and farther from land. Their travels taught them that our earth is round like a ball.



A journey all the way around the earth would be about 25,000 miles long.

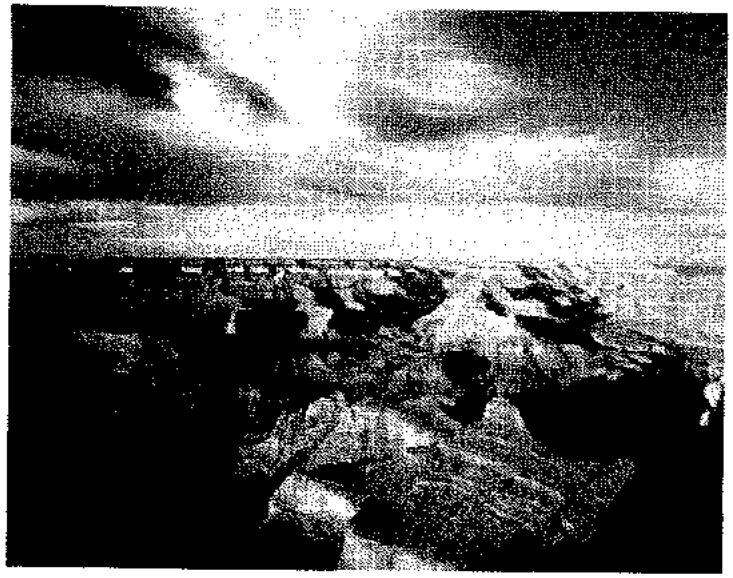
We know that the other planets are round like balls, because men and women have looked at them carefully through big telescopes. Pictures taken by scientists also show that the planets are not the same size. There are nine planets, and only two are smaller than the earth.

Do you know how large our earth is? Think of the biggest ball you have ever seen. Our earth is many, many thousands of times as large. You could travel 25,000 miles in going all the way around the earth. That would be a very long trip.

We think of the earth as a big place, but the sun and most of the planets are larger. If we could see the earth and our sun side by side, the earth would appear very small. And many of the stars are larger than our sun. The earth is like a tiny speck of sand compared to them.

Why did men once think the earth was flat?

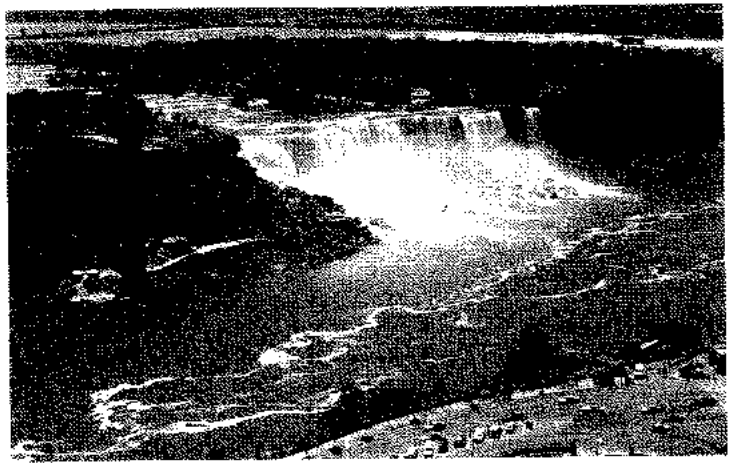
What famous men did much to make people know that the earth is round?



Our earth is very old

How old do you think our earth is? A part of the Grand Canyon is shown in the picture above. The canyon is at places a mile deep, several miles wide, and almost 300 miles long. Many scientists believe that it took a very long time for water to wear away the rocks to make the Grand Canyon. Perhaps you have seen Niagara Falls, shown in the photo at the top of page 21. Here, too, the water has been wearing away the rocks for a long, long time. Have you seen great mountains? How long do you suppose they have been standing?

Some of you live on the part of the earth that appears to have been covered by ice years and years ago. This ice may have been a mile thick in places. This great ice covering was known as a *glacier*. Glaciers are like large rivers of ice, moving slowly but steadily. Scientists tell us that as a glacier became larger, it carried huge rocks and whole hills with it as it moved.



It scraped out huge holes and valleys as it moved along. These holes and valleys became places for lakes and rivers when the ice melted. All this took a very long time, perhaps even thousands of years.

No one knows how old the earth is. Some scientists, called geologists, are working to learn about the earth and its age. Geologists try to learn more about the earth by studying the rocks. From rocks, they have seen that the earth may be very, very old. Because no one has yet found a way to tell the actual age of the earth, we can only make what is called an "educated guess." We can simply think of the earth as very old.

The earth was made by God. He made it as part of the universe and gave earth its place in the universe. The Incarnation took place here on earth. As Our Lord Jesus Christ, God walked the hills and valleys of this earth. This is truly God's world.

What parts of the earth near your home are very old? Did a great glacier help make them? In what other ways have some parts of the earth been made?

Part of the earth is solid

God made the earth. He made one part of it land, another part of it water, and the rest of it air. The land is the *solid* part of the earth. Mountains, valleys, deserts, plains, and hills are all parts of the land. Flowers and vegetables grow on the land.

We eat these plants. Most of the meat that we eat comes from animals that eat these plants. So nearly all of our food really comes from plants that grow on the solid part of the earth.

Our food is not the only thing that comes from the solid part of the earth. The coal and oil we use for heat and power also come from the solid earth. The minerals we use to make things come from the solid earth. Mines and wells go far down into the earth. Some go down as far as five miles. Yet this is just a short distance compared to the distance to the earth's *center.* It would take a well about 4,000 miles deep to reach the center of our earth. A tunnel from one side of the earth, passing through the center, would have to be about 8,000 miles long to come out on the other side.

Scientists have learned that the center of the earth is made up of heavy, hard rocks and minerals. These rocks and minerals are very hot. They have on them the weight of all the rocks above them. The rocks inside the earth are pressed together so hard that they become very hot.

While the rocks and minerals belong to the solid part of the earth, they are sometimes melted by the great heat. These melted rocks boil up through cracks in the great mountains and flow down the sides. Sometimes these hot, fiery, melted rocks explode in the mountain, burst into the sky, and fall to the earth as dust and cinders. A mountain that boils up or explodes in this way is called a *volcano.*

What volcano have you read about?

Why might we think of a volcano as a weak place in the earth's surface?

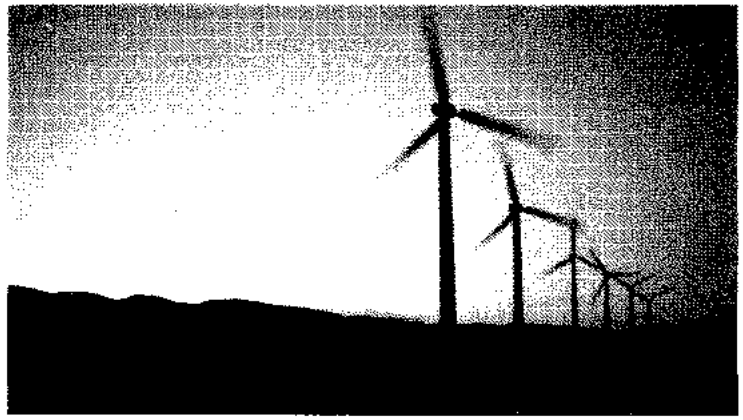
Part of our earth is liquid

Water is the *liquid* part of the earth. Water is found almost everywhere. It forms the oceans, lakes, rivers, ponds, springs, and wells. Three-fourths of the earth's surface is covered by water.

Large bodies of water keep the land cooler in summer and warmer in winter. This happens because water is slow in warming up in summer and slow in cooling off in winter. When a lake or ocean is cooler than the land near it, the air above the water moves toward the land and cools the land.

Plants die unless they have water. This is true even of plants that grow in the desert. Plants can store up water for future use. A man can live only a few days without water. He must drink water or eat plants that have stored up water. So we need water to live.

We use water to keep ourselves and our houses clean. We travel on water, and we turn machines with it. We play in it at the beach and seashore.



Wind generators use moving air to make electricity.

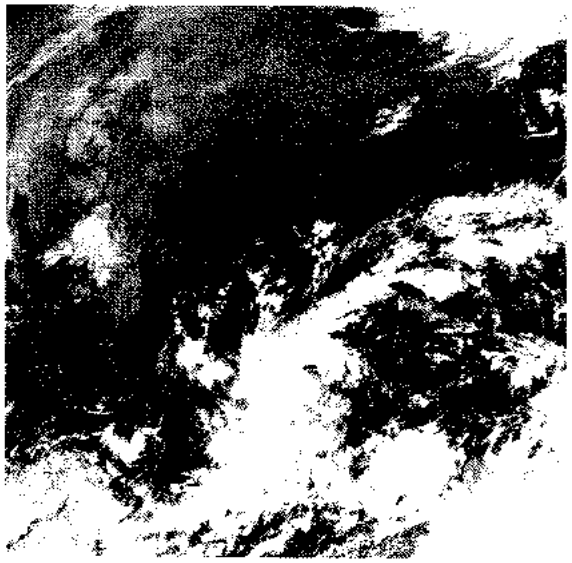
Part of the earth is gas

There is a part of the earth that is not solid like the rocks nor liquid like the water. This part is the air around and above us. Air is a *gas*. It has weight just as rocks and water have. Air moves. You can feel it when it moves.

Air is the gas that we blow into toy balloons, into tubes in our automobile tires, and into rubber cushions. Air is the gas that a fan causes to move. When a fan blows against a curtain, the fan does not move the curtain. The fan moves the air, and the air moves the curtain.

Air is not just one gas. It is a *mixture* of several gases. One of these gases is *oxygen*. Men, animals, and plants breathe air to get oxygen. Nothing can live without oxygen. Another of the gases in the air is *carbon dioxide*. Plants need carbon dioxide, and they get it from the air.

The air is around the whole earth. The air covers every bit of the earth, from the highest mountain to the deepest valley. There is air over the oceans. There



The part of the atmosphere close to the earth is heavier, thicker, and warmer than the part farther up. This is where the clouds, such as those which can be seen in this picture, are found.

is air over the land. There is no place on the earth that is not covered with a great blanket of air. This huge blanket is more than one hundred miles thick. It is called the earth's *atmosphere*.

Aircraft – planes, gliders, and helicopters – fly in the atmosphere. Control surfaces on the wings and stabilizers, called *ailerons* and *rudders*, help planes to turn using the pressure of the air against these surfaces. The space shuttle turns by using small rockets when it is in orbit in space. When it returns to the atmosphere, its control surfaces allow it to be landed like a glider.

Air has weight. The air next to the earth is pressed down by the weight of all the air above it. What happens to a piece of fluffy cotton when you press down on it with your hand? The fiber of the cotton is pushed together. It becomes *denser*. If we could pick up a piece of air close to the earth, it would weigh much more than a piece the same size high up in the atmosphere.

An astronaut "walks" in space.

As we go up from the earth, the air becomes lighter in weight and less dense. As we go up from the earth, the air becomes colder. This happens because the sun's heat passes through the air without warming it. Air next to the earth is warmed by touching the earth. This air warms the air just above it, and so on.

Nothing lives in the air all the time. Birds and insects fly in the air, but they always come back to the land. Airplanes and balloons carry us high into the air, but they also come back to earth. Do you know what holds the atmosphere to the earth? We will learn about the great force or pull of the earth that holds the atmosphere and all things to it.

The atmosphere will always remain close to the earth, and we will always have air to breathe. This is part of God's plan for the earth as a part of the universe.

Why can we not live without the solid part of the earth? The liquid part? The part that is gas?

When stones on a hill or cliff become loose, gravity pulls them down.

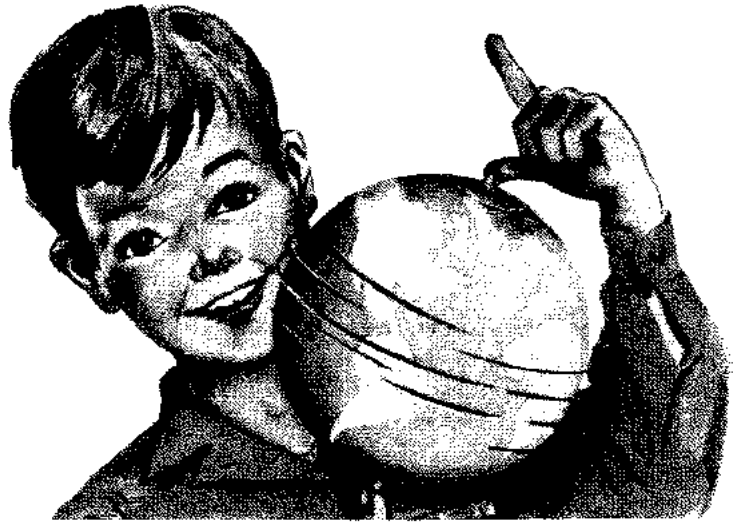
What is gravity?

Have you ever wondered why things fall? Have you ever wondered why a ball comes back to earth? There is a pull from the earth to things. There is a pull from the earth to the ball. The earth pulls on you, the rocks, the water, the air, and on everything. This pull of the earth on everything is called *gravity*.

The force of the earth's gravity pulls down on everything. We feel this pull when we lift anything. When we see something fall, we see gravity at work.

Gravity is very important to us. It keeps us from flying off into the atmosphere like a balloon. It keeps the atmosphere close to the earth. It keeps our houses on the ground. If there were no pull of gravity, everything would fly off into space, and the earth itself might fall apart.

The earth moves on a path in the universe, and the earth pulls on everything on it. All this motion and the force of gravity comes from God, Who created the universe.



The boy is spinning the globe from west to east just as our earth spins. He is holding it with one finger at the North Pole and one finger at the South Pole. A line that we imagine going down through the globe from one finger to the other is the axis of the globe. The globe spins on its axis. There are only two spots at which you can hold a spinning globe.

The earth moves on its axis

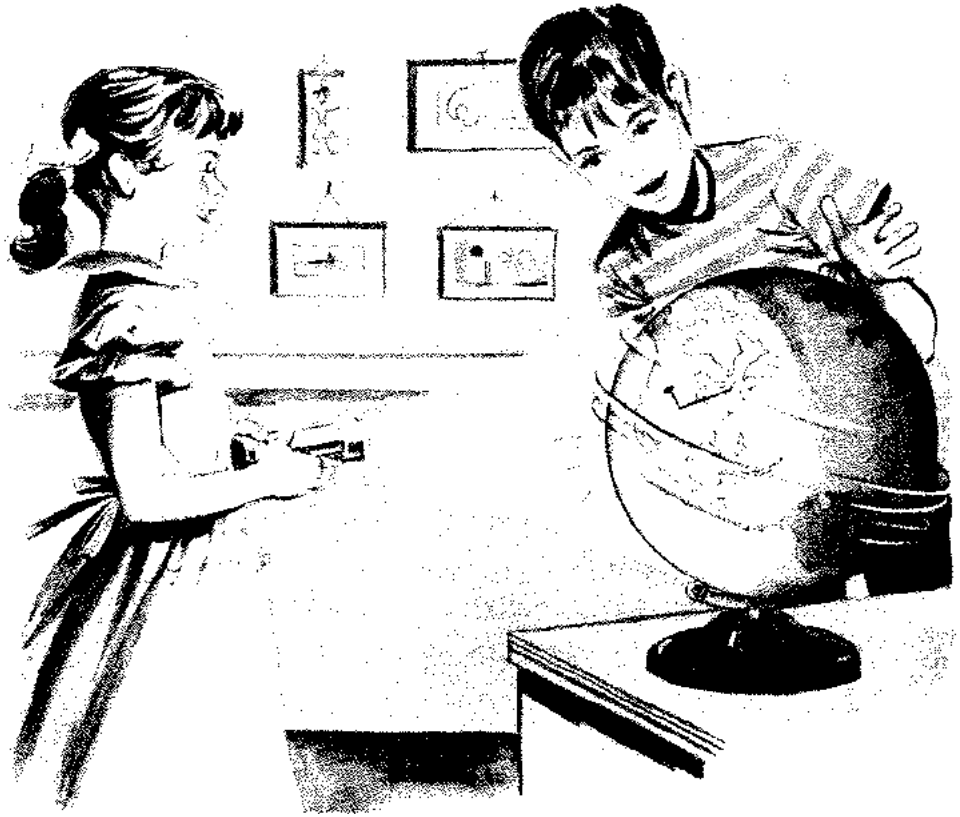
The earth spins around and around like a top all the time. It spins so fast that you are riding around and around on its surface at a thousand miles an hour. Do you wonder why you do not become dizzy riding around and around on the earth so fast? The earth is so big that it takes twenty-four hours for it to spin around once, even at such great speed. You cannot feel it spin. Instead of saying that the earth spins around and around, we say it *rotates*. The earth rotates from west to east.

The picture above shows what we mean when we say that the earth spins on an *imaginary line*. There

are two spots on the earth's surface that do not go around and around as you do when the earth rotates. One is at the North Pole, and the other is at the South Pole. Imagine a line *through* the earth from the North Pole to the South Pole. We can think of the earth as rotating on this line. This imaginary line is called the earth's *axis*. The earth *rotates* on its *axis*.

It takes the earth twenty-four hours to rotate on its axis. We know this because we face the sun every

Find the pin. Imagine you live there. Will the flashlight seem to disappear as you move away from it? When will your part of the globe be in darkness? When will your part of the globe be light?



twenty-four hours. The sun does not move away from the earth at night. It seems to move because the earth rotates. It is the earth that is moving.

The sun seems to *rise* in the east. In the morning we see the sun in the east as our part of the earth moves around to face the sun. As the morning passes, the sun seems to move higher in the sky. At noon the sun is directly overhead. The sun does not move. The earth spins around and makes the sun seem like it is moving.

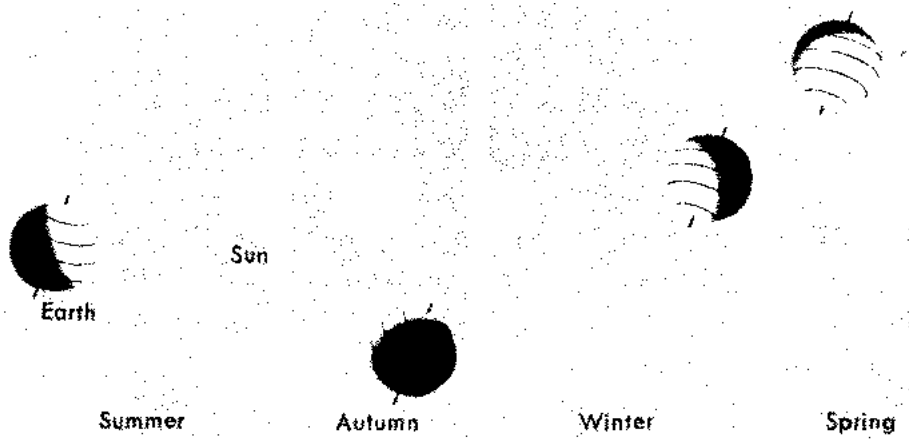
As our part of the earth moves during the day, the sun seems to go down in the sky. It finally disappears from our sight in the west. We say the sun *sets* in the west.

When our part of the earth has moved so that we can see the sun, we have *day*. When our part of the earth has moved so that we cannot see the sun, we have *night*. The rotation of the earth causes day and night. When our part of the earth has day, the other part has night.

Just think how wonderful God's plan for the universe is! Everything in the universe is in motion. The stars and their planets move through space at terrific speeds. The nine planets move on their paths around the sun. Each planet rotates on its axis. The moon moves around the earth. All this motion was given to the universe by God. The suns, the earth and the other planets, and the moon move as God planned.

What parts of a spinning top are like the North Pole and South Pole of the earth?

Why do we not fly off the earth as it rotates so fast?



Our part of the earth gets more light and heat from the sun during some seasons of the year than during others.

The earth moves around the sun

While the earth is spinning like a top, it is also traveling around the sun. The speed at which our earth travels around the sun is very great. The distance it travels in making the trip is very long. When we talk about the earth traveling around the sun, we say that it *revolves* around the sun. It always takes our earth 365¼ days to make this trip. We call the time of the trip around the sun a *year.*

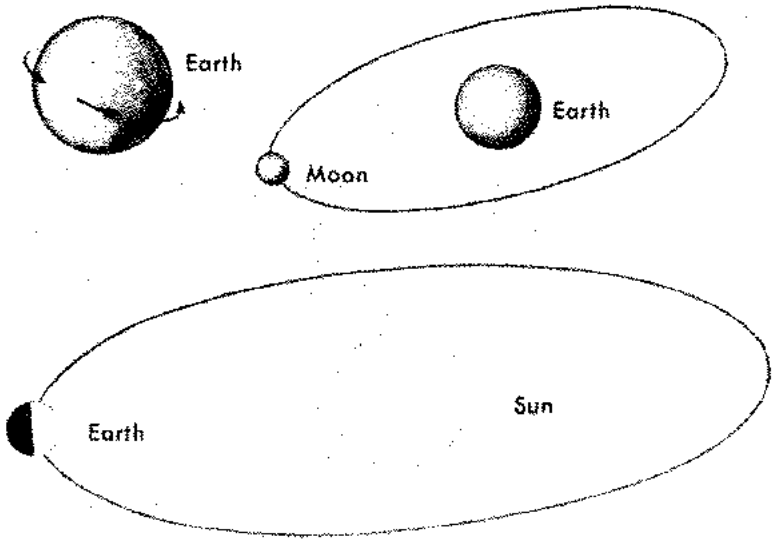
As the earth revolves, we have the four seasons of the year: *winter, spring, summer,* and *autumn.* The sun's heat and light strike the earth in different ways at different times of the year. In summer we get more light and heat from the sun than we do in winter. The amount of light and heat that we get from the sun changes slowly as the days go by. We get more and more, then less and less. These changes cause the four seasons of the year.

The seasons of the year are important to us. They cause many changes. The weather changes. Plants grow and die according to the seasons. Animals change their ways and places of living. We change our clothing and our kinds of work and play.

Eight other planets besides the earth revolve around the sun. Each of these planets has its own path around the sun and takes a different length of time to make the trip. Planets never bump into one another because they follow the plan that God made for them. Planets close to the sun revolve around it in less time than planets far from the sun. A year on a planet is measured by the time it takes the planet to revolve around the sun.

In what two ways did God cause the earth to move? How is each of these motions important to you?

For each picture be ready to tell what special things you do during that part of the year, what kind of clothes you wear, and what foods you eat.



When the earth rotates, it makes our day, which we divide into 24 hours. When the moon revolves around the earth, it makes almost a month. When the earth revolves around the sun, it makes our year.

The earth is our clock

Man has always used the motions of the earth to measure time. We measure our day by the time it takes the earth to rotate. We measure our year by the time it takes the earth to revolve around the sun. God's plan for the universe is so perfect that the motions of all stars and planets never change. Clocks that men make wear out and are not always correct. The universe goes on forever and never changes.

The rotation of the earth makes it possible for us to use the earth as a big clock. We know that it is noon when the sun appears directly overhead. At this time you cannot see your shadow because you are standing

on it. When it is noon on our part of the earth, it is before noon on some parts of the earth and after noon on other parts. When people in California are eating breakfast, people in New York are eating lunch.

When it is noon in Boston, it is eleven o'clock in Chicago. At the same time, it is ten o'clock in Denver, and it is nine o'clock in San Francisco.

If you travel across the United States from west to east, you will turn your watch ahead as you travel. If you are going from the east to the west, you will turn your watch back.

Of course you would not change your watch every few minutes. The government has decided which parts of the country are to have the same time. These parts are called *time zones.* There are four of them. Which ones do you hear about over your radio? When we travel, we move our watches ahead or back one hour as we enter a new time zone.

Scientists have a way of finding the exact time by measuring the earth's rotation and by watching the stars through big telescopes. Good clocks keep close to this exact time. The radio and television tell us the exact time every day.

Why is it important that we have a way of knowing the correct time?

In what time zone do you live? What time zone is east of yours? What time zone is west of yours?

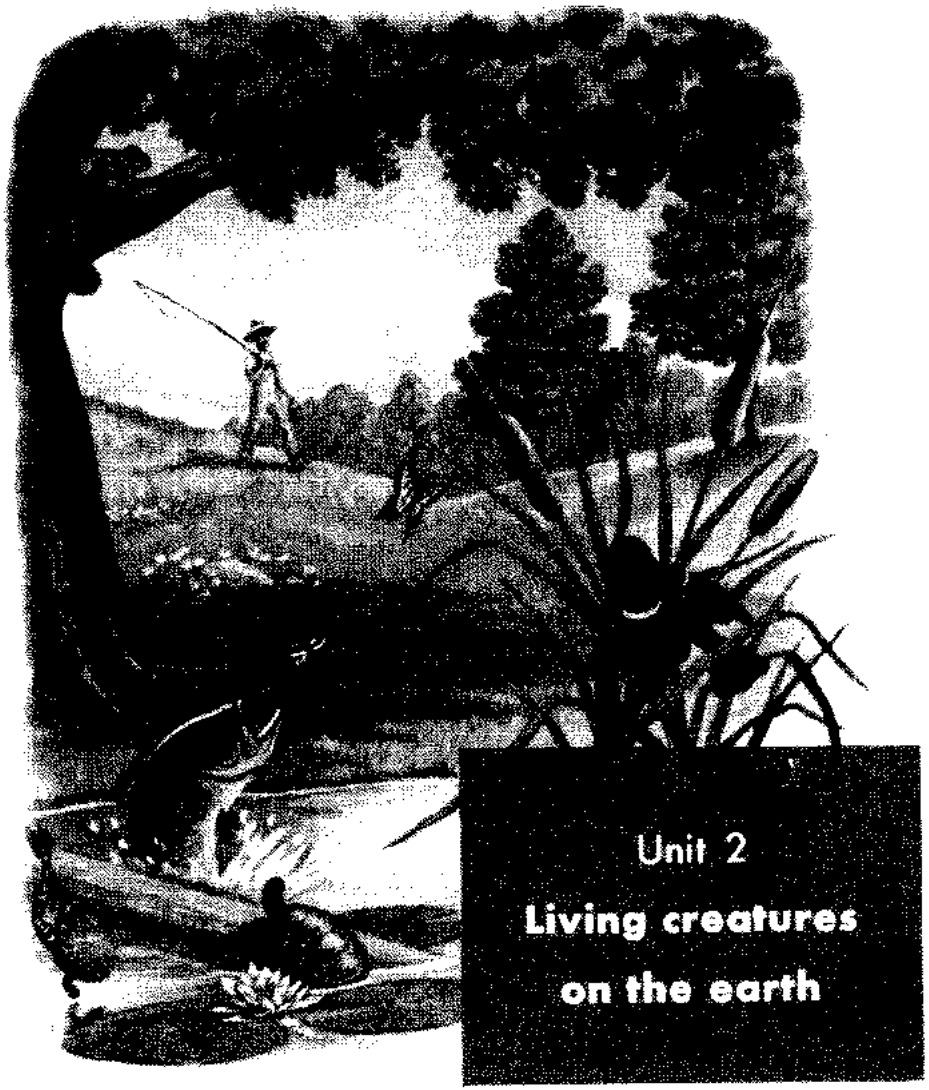
When it is nine o'clock in your time zone, what time is it in the time zone east of you?

When it is four o'clock in your time zone, what time is it in the time zone west of you?

What have you learned?

1. How do we know what the moon and stars are like?
2. Name some of the important parts of the universe.
3. What is the difference between a star and a planet?
4. Why can we not see the stars in daytime?
5. Where does the light of the moon come from?
6. In what way do the stars help us?
7. How does the moon help us?
8. In what way are the earth, sun, moon, and stars alike?
9. In what ways does the atmosphere help us?
10. Why would living things die without the sun?
11. How do we know that the earth is round?
12. How do we know the planets and the moon are round?
13. Is it possible to say which part of our earth is most important—land, water, or air? Why?
14. What part of the air do we use when we breathe?
15. Why does the sun seem to move?
16. What causes day and night?
17. Why do we have one extra day every four years?
18. What do we mean when we say that the atmosphere close to the earth's surface is denser than the atmosphere above?
19. Here are the new words you have learned in this unit. Be prepared to tell something about each.

atmosphere	oxygen	star
carbon dioxide	planet	sun
earth's axis	reflect	time zones
gravity	revolve	universe
moon	rotate	volcano



Unit 2
Living creatures on the earth

We learn in our catechism that man is made up of body and soul. God created man in His own image and likeness. In this unit we shall learn not only about man but also about the plants, the birds, and other creatures in God's world.