Contents

Welcome to Science 5!

Seeing and Not Just Looking

Eleven–year-old Ryleigh Taylor was walking near Douglas Lake in Tennessee. when it happened. She noticed one unusual rock among several along the banks. How many people had walked this way before and not noticed this rock? Her family contacted the University of Tennessee and found that the rock was a trilobite fossil. This one was special because it contained a whole fossil, and not just an exoskeleton.

"To find something like that, it's really really cool," Ryleigh says. "I looked down while I was walking and found it, I just saw it."

Trilobites were marine animals that scientists say became extinct before dinosaurs roamed the earth. They say that Ryleigh's fossil is 475 million years old! But they aren't using the Bible's story to really see the world.

What about you? Do you really see the world around you?

Ryleigh says, "I can show kids that are my age that they don't have to sit inside and play games. They can actually go outside and find different things." Use this *Science 5* textbook to explore the world and think about what you see based on what the Bible says.

You never know what amazing things you'll discover!

Let's Explore God's World

Do you know what the word *worldview* means? It means, basically, "a way of viewing the world." We use our worldview to answer questions such as the following:

How did the world begin?

Are people more important than animals?

Is science good or bad?

Answers to questions like these are important. A Christian worldview answers these kinds of questions based on the truth of the Bible. To begin our study, we will review some basics of a Christian worldview in science.

God is unlike anything or anyone.

As you read through this book you will see that God is far more powerful than anything you can imagine. He made the entire universe in just six days! Think of the vastness of outer space. Then think of the tiny parts that make up all the plants and animals and even your body. God made all these things and holds them all together (Genesis 1; Colossians 1:17). Studying science will give you a sense of how great God is.

God put us here to work.

Many adults and children in the world think life is about having fun and not having to work. But God's first command is that the job of all people is to take care of the earth and to make it useful (Genesis 1:28). People in each field of science study the world we live in so that we can use its resources to do better, faster work. Throughout this book you will see examples of machines, materials, and medicines that people have developed. Developing these things helps Christians obey God's first command as well as the command to "love your neighbor as yourself" (Leviticus 19:18; Mark 12:31).

People are important.

Many people in the world think others are important only when it benefits them. It is like a boy who thinks the other players on his soccer team are important only when they help him show off his skills. But the Bible says that other people are important because they are made in God's own image (Genesis 1:26). If you really love God, you will love people made to be like Him. What does this have to do with science? Science helps people care for others. Since people are important, so is science.

The Flood changed everything.

When Adam disobeyed God (Genesis 3), he brought sin and death into the world (Romans 5). God proved His attitude toward sin when He judged the whole earth with a flood (Genesis 6–9). Some people today do not want to think of God's judgment. But the evidence for the Flood is everywhere. Perhaps you wonder where fossils come from or where the dinosaurs went. The answers to all these questions include references to the Flood. This global disaster reshaped the earth's surface, changed the atmosphere, launched an ice age, and reduced all human and animal life to one boat. As you read through this book, remember that a catastrophe of huge proportions occurred during Noah's day.

God is working to redeem this world.

The Bible tells us that we were made to rule over God's creation. But man's sin put this world under a curse (Genesis 3:16–19). Because of His love, God sent His own Son, Jesus, into the world to redeem all who repent of their sin and believe in the gospel (Mark 1:14–15). One day God will make this world perfect again—the way it was before sin (Revelation 21:5). At that future time, God's people will rule over the world with God's Son (Revelation 22:5). Until then, God has called Christians to live lives of good works (Matthew 5:16). This is one reason Christians take science seriously. Science can give people the understanding and tools they need to help others.

Science is about making models.

A model helps explain, describe, or represent something in the world. A scientist often uses models that already exist, but he may make his own. He applies his worldview as he observes and interprets how the model works. The scientist then makes changes to the model as he gathers new information. A goal of scientists is to make existing models better and to create new models as new things are discovered. Because people do not know everything, science changes as the models and ideas of scientists change. But only God really knows and understands what is going on (Ecclesiastes 8:17). A good scientist knows that science is not about getting answers that never change. Science is about making models that work.

These six big ideas will help you think about the science you are learning. Keep these ideas in mind as you read.

From the Beginning

UNIT 2


God designed an efficient and portable cooling system for us. Chapter 4 tells us what this system is and why it is important to each of us.
Thunderstorms, molten rock under the earth's surface, and a pot of boiling water all have something in common. Chapter 4 explains about a characteristic these very different things share.
Melted chocolate chips can freeze without being in the freezer. Find out in Chapter 3 how this happens.
HMMM....
FREEZES EVERYTHING IN ICE
EXCEPT
THE CHOCOLATE CHIPS!

Matter 3

Andrea's neighbor broke her ankle recently. Wanting to be helpful, Andrea and her family have been doing yard work and running errands for her. Today Andrea decided to encourage her neighbor by making her brownies. Andrea needs to melt some chocolate for the frosting.

But what if all kinds of matter melted at the same temperature? How would that change things for Andrea? The pan, spatula, and chocolate would all melt at the same time. These types of problems would be unending. However, God created different kinds of matter to melt at different temperatures. Learning about matter and how it works is important for using it to glorify God. God's provision of matter offers many ways to serve others.

Consider

- What does Andrea need to know about matter in order to make brownies?
- Is it important how Andrea makes brownies for her neighbor?

Measuring Matter

Serving others often involves using objects. Andrea used ingredients and utensils to make her brownies. Although objects are different in many ways, they are all alike in at least one way. Each is made of matter. **Matter** is anything that has volume and has mass. Volume and mass are characteristics of matter that we can often measure. Sometimes we use the term *substance* to refer to matter.

Volume of a Liquid

The **volume** of a substance is the amount of space that it takes up. The standard unit of metric measurement for volume is the liter (L). Many soft drinks come in two-liter bottles. A smaller unit for volume is the milliliter (mL). Liquid medicine often uses this unit. A teaspoon of medicine is about 5 mL.

We measure the volume of a liquid by using a graduated container. *Graduated* means that the container is divided into equally marked parts. A graduated container has the units of measurement marked on its side. A liquid is poured into the container. The level of the liquid is then compared with the numbers on the side of the container. The numbers show the volume of the liquid. Scientists use containers called graduated cylinders, but even the measuring cups in a kitchen are a type of graduated container.

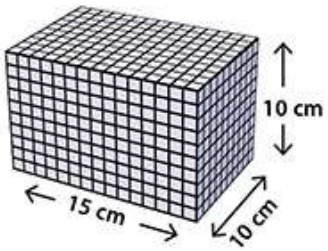
Graduated cylinders

SCIENCE & THE BIBLE

In 2 Kings 4 the Bible tells us about a widow who owed money. Her sons were going to be taken as slaves unless she could pay her debts. All that the widow had was a pot that held a small volume of oil. The prophet Elisha told the widow to borrow vessels, or large containers, from her neighbors. She started pouring her little bit of oil into the vessels and kept pouring until all of the vessels were filled. Elisha told her to sell the oil to pay her debts. God caused the small volume of oil to increase to fill many large pots. In this way, He miraculously provided for the widow's needs.

Volume of a Solid

There are two ways to measure the volume of solid objects. To measure the volume of regular shapes, such as cubes and rectangular solids, multiply the measurements of the length, width, and height of the object. The volume is written as a cubic measurement. An object that is 15 centimeters (cm) long, 10 cm wide, and 10 cm high has a volume of 1,500 cubic centimeters. A cubic centimeter is written as cm^3 or *cc*.



length × width × height = volume
15 cm × 10 cm × 10 cm = 1500 cm^3

However, we cannot always measure a solid object by using its length, width, and height. For instance, it would be difficult to measure a rock or a marble in this way. The volume of irregularly shaped objects can be measured using a method called *water displacement*.

You can see water displacement when you add marbles to the water in a graduated cylinder. The volume of the marbles is the difference between the beginning level of the water and the level after the marbles were added. The volume can be written in milliliters or liters. For example, suppose a cylinder contains 250 mL of water. After the marbles are added, the level of the water is at 300 mL. The volume of the marbles is 50 mL.

300 mL – 250 mL = 50 mL

250 mL **300 mL**

In the metric system one cubic centimeter is equal to one milliliter. Scientists usually use milliliters to describe the volume of a liquid. They use cubic centimeters to describe the volume of a solid. So the volume of the marbles in the example is also equal to 50 cm^3.

Mass and Weight

Mass is another way that matter is measured. **Mass** is the amount of material in a substance. It is usually measured by comparing an unknown mass with a known mass. For example, a student with an unknown mass can sit on one end of a seesaw. A substance with a known mass, such as a sack of sand, can be placed on the other end. If the seesaw balances, we know that the mass of the student is the same as the mass of the sand.

We usually measure mass with an instrument called a balance. The substance to be measured is placed on the instrument. Standard masses, objects of known masses, are used to balance the unknown mass of the substance. The mass of the substance to be measured is equal to the sum of the standard masses.

Some metric units of mass are the gram (g) and the kilogram (kg). The mass of a paper clip is about 1 g. A one-liter bottle of water has a mass of about 1 kg.

It is usually easy to determine which of two objects has the greater mass. A large dog has more matter than a small cat does and, therefore, has more mass. The dog also weighs more than the cat does. But the dog's mass and the dog's weight are not actually the same.

Mass and weight are related, but they measure different things. Mass measures the amount of matter. **Weight** measures the amount of force gravity exerts on the matter. If we measure two items at the same location, the object with greater mass weighs more.

Mass can change only as the amount of matter changes, but weight can vary based on the gravity at a location. A student whose mass is 40 kg would weigh 88 pounds (lb) on the earth. But that student would weigh about 220 lb on Jupiter and only 15 lb on the moon. The difference occurs because the gravity of the moon and the gravity of Jupiter are different from the gravity of the earth.

Balance