

Introduction to Foundations of Science: Science and Creation (Year 1)

Using the Bible to Teach Science:

Our curriculum combines grades 4-12 together for science each day. Our plan covers the six days of creation over the entire school year and is designed to be done together as a whole family, with additional independent reading and research assignments for high-school students. Our plan is to offer this as a 4-year sequence, giving students the opportunity to visit each topic repeatedly and in greater depth.

All the science we will study over our 4-year curriculum is firmly based upon the creation of the world by YHWH.

- We believe that Scripture teaches **YHWH created the world** in six literal, consecutive 24-hour days.
- We believe that **the Flood of Noah's day** was a worldwide, literal flood. It was a significant geological event and much (but not all) fossil sediment originated at that time.
- We believe that the **gap theory has no basis** in Scripture.
- We believe that no apparent, perceived or claimed **evidence in science** can be valid if it contradicts the scriptural record. Of primary importance is the fact that evidence is always subject to interpretation by fallible people who do not possess all information.

We also attempt to emphasize some things in our curriculum:

- We seek to teach our students to **think logically and carefully** about the created world. We emphasize the scientific method, which consists of observing (gathering facts), hypothesizing (suggesting explanations), and experimenting (testing explanations).
- We teach that **science is inseparable from mathematics**, which we call the "language of science." We teach our students to be precise, exact, and careful when interacting with God's world.
- We acknowledge that **we are made in the image of a Creator**, and we hope to cultivate creativity in our children and constant appreciation of the created world. (We try to avoid the use of the word "nature," choosing to use the word "creation" instead.) While teaching responsibility and stewardship of God's creation (Genesis 1:28), we also seek to worship the Creator, rather than created things, in all that we do (Romans 1:18-32).

Homeschooling Torah's science curriculum is different from most other publishers. It is typical to study science by topics, spending up to a year at a time studying biology, chemistry, physics, geology, anatomy, etc.

However, because we want to use the Bible as our primary textbook, we use a more holistic approach to studying science. Because we view Scripture as absolute truth, we want to see YHWH's creation from His perspective.

For instance, why did He create light before creating plants? How can studying things in the order in which they happened help us understand their properties better? In later years, how does the Flood affect the created world we see around us? When we study science found in Job, the Psalms, the Prophets, or the New Testament, how does the context of the passage help us understand why that particular scientific principle is being discussed?

We believe that seeing science from a biblical perspective, rather than a man-made, evolutionary perspective, can help us see things from the Creator's viewpoint. We were first inspired to use this unique order when studying the writings of Sir Isaac Newton. He is credited with many scientific discoveries and even laws of science, which is amazing because even Einstein only has theories. Newton credits his success in science to studying the Scriptures verse by verse, then asking questions of the text, taking it very literally. Our hypothesis is that students will be able to think MORE scientifically if they read the Scriptures FIRST, even though it's not the way the public schools do it.

**“I have more understanding than all my teachers,
For Your testimonies are my meditation” (Psalm 119:99).**

Topics Covered in Year 1

- **Light, Energy, and Matter (Creation Day 1)** – Topics include magnetism, electricity and currents, motion, force, light and sound waves, color, gravity, radiation, electronics.
- **Water and Atmosphere (Creation Day 2)** – Topics include water, oceanography, molecules, atmosphere, weather.
- **Land and Plants (Creation Day 3)** – Topics include rocks, minerals, elements, chemical reactions, earthquakes, plants, flowers, seeds, trees, fungi, mold, bacteria.
- **Sun, Moon, and Stars (Creation Day 4)** – Topics include the moon and moon phases, planets, constellations, eclipses, galaxies, meteors, star clusters, comets, asteroids, calendars, and the study of space.
- **Birds and Sea Life (Creation Day 5)** – Topics include birds, fish, amphibians, environmental science.
- **Land Animals and Man (Creation Day 6)** – Topics include fossils, reptiles, mammals, insects, invertebrates, classification systems, microbiology, human anatomy and physiology, disease.
- **Sabbath and the Importance of Rest in Creation (Creation Day 7)**

Topics Covered in Year 2

Year 2 covers the account of the global flood of Genesis (Genesis 2-11), examining the changes made to our earth and to the way we understand science. Topics include **biology** (cellular

biology, genetics, microbiology, botany, zoology), **chemistry** (chemical composition and reactions, stoichiometry, gases, thermodynamics), and **physics** (magnetism, motion and wave theory).

Topics Covered in Year 3

Year 3 covers scientific topics addressed in the Torah, the Tanakh, and the Apostolic Scriptures. Topics include **biology** (cellular biology, taxonomy, human anatomy and physiology), **chemistry** (atomic theory, kinetics), and **physics** (classical mechanics, work and energy, electricity, optics, nuclear physics). The scientific method and historical applications of Scripture are emphasized.

Topics Covered in Year 4

Year 4 covers the life, studies, discoveries, and inventions of famous scientists in world history, examining how closely their views aligned with Scripture and how Scripture helped them understand YHWH's world. Scientists include the following:

- Aristotle
- Babbage
- Bacon
- Bohr
- Boyle
- von Braun
- Carnot
- Carver
- Copernicus
- Damadian
- Darwin
- Einstein
- Enoch
- Faraday
- Galileo
- Gilbert
- Goodyear
- Grosseteste
- Haber
- Harvey
- Herschel
- Howell
- Huygens
- Irwin
- Job
- Joule
- Kelvin
- Kepler
- Leavitt
- Leeuwenhoek
- Linnaeus
- Lumsden
- Maury
- Maxwell
- Morris
- Morse
- Newton
- Pascal
- Pasteur
- Planck
- Pottenger
- Price
- Riemann
- Rumford
- Solomon
- da Vinci
- Wilder-Smith
- Young

Hear, Learn, Keep, Do

When God wants to teach mankind something, He follows a very specific method that I can copy in my homeschooling. For instance, let's look at how God teaches all mankind about His "invisible qualities, his eternal power, and divine nature":

*"The wrath of God is being revealed from heaven against all the godlessness and wickedness of men who suppress the truth by their wickedness, since what may be known about God is plain to them, because **God has made it plain to them**. For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that men are without excuse" (Romans 1:18-20).*

First, **God clearly presents information**. In this case, He used the things He had created, which can be seen by every person no matter where he lives, to make Himself plain to all people.¹ The sun, moon, and stars are visible to all. The amazing capabilities of the human body are visible to all. The metamorphosis of a caterpillar into a butterfly... the water cycle... the fossil record — these are visible to all.

Once God has presented information, **He expects that I'll have the help of a human teacher** to explain what I'm seeing and hearing.

"How, then, can they call on the one they have not believed in? And how can they believe in the one of whom they have not heard? And how can they hear without someone preaching to them?" (Romans 10:14).

He then expects me, the "student," to do a few things, which I'm calling the "Hear, Learn, Keep, Do" method (from Deuteronomy 5:1).

"And Moses called all Israel, and said unto them, Hear, O Israel, the statutes and judgments which I speak in your ears this day, that ye may learn them, and keep, and do them" (KJV).

1. The student is to "hear."

To hear doesn't mean to let sound come into my eardrums; rather, it means to "**listen with intelligence**." I can look up into the night sky and "see" the stars, but unless I "listen with intelligence," I won't relate those stars to a Creator God, to His eternal power and divine nature.

When I was a little girl, my parents would wake us in the middle of the night and take us out into the backyard, where they had laid a blanket on the ground. We would lie on our backs and

¹ Psalm 8

look at a meteor shower, an eclipse, or an especially bright planet. My dad would pass around the binoculars and telescopes, and he would show us where the constellations were. All the while, he would remind us that **God created these things**. He helped us “listen with intelligence” to the “words” God had put into the stars.

Today I can go to my bookshelf and read *The Witness of the Stars*, by E. W. Bullinger, to learn how the different constellations point to God as creator and to His promised Redeemer.

All of these things can help me “listen with intelligence” to the God who is trying to teach me about Himself.

2. The student is to “learn.”

The word “to learn” means “**to goad**.” My human teacher helps me learn by “goad” me. A goad is a long stick with a sharp end, used to herd animals like cattle. With me, my human teacher pokes me along, but this isn’t a negative thing. My teacher spurs me into action, reminds me where the path is, and even gives me confidence as I step by encouraging me. In the New Testament, we see the word “exhort” used in a similar way.

If I were a child learning about the constellations, this would be a review lesson, where maybe I would draw maps of the constellations, with overlays of the symbolism of Jesus the Messiah, filing them away in a notebook. Maybe my father would take me outside on another night and ask me to point to the specific constellations and tell him a little about each one. Maybe I would be required to memorize Scripture verses about each one and recite them at supper. All along, my “teacher” would be goading me, poking me, reminding me that God was the creator of the constellations and that they were placed in the sky by Him so that I would learn about His eternal power and divine nature.

3. The student is to “keep.”

The word “keep” used here means “**to guard**.” My husband and sons love to study about medieval castles, which often had a “keep” inside the walls, where the soldiers could fall back during a siege. It was a place of refuge, heavily guarded and fortified, and filled with ample provisions. Often this was a strong tower. Sometimes the “keep” was a dungeon, where prisoners would be “kept” and guarded.

When God gives us a body of information, He wants us to guard it carefully. All of Scripture contains information about God, but we should not guard it physically so that no one is able to read it, such as often happened during the Middle Ages as Bibles were chained to tables inside cathedrals, to keep thieves from stealing these rare books. In this case, He’s referring to a *mental* guarding of this information, where we replay it over and over so that it doesn’t get lost or misplaced among all the other pieces of information that compete.

For instance, the word “keep” is used 22 times in Psalm 119 alone, as we are instructed to “keep” God’s commands and instructions.

In my illustration of learning the constellations, I would “keep” or guard what I had learned by reviewing it, over and over and over again, so that I would not forget it. God uses the method of writing things down so that mankind doesn’t forget it. In addition, He “schedules” times into His calendar so that we remember to review what He has taught us (Leviticus 23). He has His people “recite” and “repeat” what He has taught them. Finally, He “tests” them on what He has taught, to be sure that they understand and know it well.

4. The student is to “do.”

James 1:22-25 says that when we learn God’s Word, even when we listen to it, our human hearts are very prone to walking away and “immediately forgetting” what we saw. God’s “perfect law” gives freedom, though, to the one who “looks intently” into it and “continues to do” it, “not forgetting what he has heard, but doing it.” God says that man will be “blessed in what he does.”

Learning information is never the end goal. When God placed the stars in the sky, they were there to point us to the Messiah and to bring us to faith in Him. Yeshua is always the reason for everything God has revealed to us.

“Wherefore the law was our schoolmaster to bring us unto Messiah, that we might be justified by faith. But after that faith is come, we are no longer under a schoolmaster. For ye are all the children of God by faith in Messiah Yeshua” (Galatians 3:24-26, KJV).

“For Messiah is the end [“result, purpose, goal”] of the law for righteousness to everyone that believeth” (Romans 10:4, KJV).

“We have much to say about this, but it is hard to explain because you are slow to learn. In fact, though by this time you ought to be teachers, you need someone to teach you the elementary truths of God’s word all over again. You need milk, not solid food! Anyone who lives on milk, being still an infant, is not acquainted with the teaching about righteousness. But solid food is for the mature, who by constant use have trained themselves to distinguish good from evil” (Hebrews 5:11-14, NIV).

Going to school isn’t the point. Learning facts isn’t the goal. Learning should bring about a change in behavior.

We would be disappointed if we had to homeschool our children for the rest of their lives. No way! We expect them to graduate someday. When they graduate, they will continue to add, subtract, multiply, and divide — but they won’t be doing it on math worksheets. They’ll be applying math to their everyday lives.

God revealed Yeshua throughout all His Word, not so we could master facts, rules, or commands. He revealed Himself so that, as we continue to obey His instructions each day of our lives, we will be able to hear intelligently that we need a redeemer, we'll be goaded each day by the keeping of His commands, we'll have plenty of review as we continue to walk in His commands, and we'll see our need of a Messiah and turn to Him in faith, so that His righteousness can be given to us. Then we can *grow up*, teaching God's commands to others and helping others come to faith in Him also.

Sounds like what parents do, doesn't it? We learn, we grow up, we have children of our own, and we pass on truth to them.

*For a more thorough look at our philosophy of education, we suggest **Biblical Home Education**, by Anne Elliott (Foundations Press, 2011). This book is included in your Homeschooling Torah membership, under the free e-books in the Parent Resource section of the website.*

Features of Our Science Curriculum:

- Each “week” of lesson plans is set up so that **3 days will be spent discussing science topics with the Parent**, then **2 more days of study, projects, and review can be done relatively independently**. In a typical homeschool, the parent and children spend three days a week studying science together. Expect this to take about an hour per day. However, two days a week are planned where the children can do science mostly independent of the parent. This can help you have time to accomplish housework, errands, and other responsibilities. You are always welcome to do *more* than the curriculum suggests.
- **Memorization** is an important part of our curriculum, so that students will have a mental “handle” on which they can hang all of the other things they learn. We strongly emphasize the days of Creation on which God made things, and we learn the history of scientific inventions and discoveries. We emphasize especially the Latin and Greek roots of scientific words, to promote literacy and the ability to interact with scientists and academic literature in the sciences. For this reason, you will begin each week by learning science vocabulary words. A dictionary will be needed. Online dictionaries will work just fine! Try to help your children put definitions into their own words, simplifying things as much as possible. Understanding is the most important thing!
- We have utilized online resources extensively in our curriculum, to save you the added expense of purchasing additional books and materials. ***You will need Internet access for many of the lessons.***
- We have scheduled topics of **discussion** to go with each topic. However, don’t feel that you must limit the discussion to only these things! Mom should feel free to discuss things that she knows are important to her family. Allow the Holy Spirit to guide you as you learn together.
- We provide at least weekly opportunities for science to be “**hands on.**” However, out of respect for your budget and energy levels, we try to use supplies that are readily available around your home.
- We do suggest ways to spend time outside **observing Creation**, but because we ourselves live in a cold climate where we can’t always watch things grow or stay outside too long, we offer other options for families who also have difficulty getting outside at all times of the year or might live in an urban environment.
- Throughout the year, we will be constructing a **science notebook**. At least once each week, we schedule a “notebooking” activity that your children can mostly do independently. Provide them with supplies, such as colored pencils, markers, pretty papers, glue, and special scissors. Younger children might want to dictate a paragraph to

Mom, which she could then type and print out, to be included in their notebooks. Some families like to have their children notebook several times a day. Other families skip notebooking altogether, just having their children “tell back” (narrate) to them what they have learned.

- Some activities are simply listed as **research projects**, such as, “Visit a public library or do research online on the migration of birds.” These could be used as notebooking activities, as writing assignments, or as parts of larger reports or projects. Do what works best for your family!
- **High school students** are ready to discuss and interact with many of these topics on a much deeper level than younger students. We recommend that you take many of the weekly notebooking topics and require 2-3 pages of essays from your high school students. You may wish to pose controversial questions of your students and ask them to defend their positions. We have also included additional reading assignments, research projects, and application activities for high school students. Some of these are more difficult than others, so use your discretion in what you require of your own students. Resources and e-books are available for free online but if your budget allows, consider purchasing hard-copy books, since it will be easier for your student to read, to highlight, and to take notes.

A Further Word About High School:

As already mentioned, we use a holistic approach to studying the Bible and what it says about science. This will not match the typical high-school sequence for science, which is typically earth science, biology, chemistry, and physics.

If your student already started high school, and if he is on a certain “track” and wants to maintain that, you might not want to use our science curriculum.

Ours uses more of a spiral approach over 4 years, covering biology, chemistry, earth science, and physics for a short time each year, then returning to do more the next year. It works best for students just beginning 9th grade, unless your older student is not intending to need a typical high-school study schedule for college or a future career.

However, a student just beginning 9th grade *will* cover the normal subjects covered in any high school and can expect to learn what is needed for a regular high-school science education.

We like Science for High School, mixed with some videos and lab demonstrations from Khan Academy, although neither is Torah observant, of course.

- <http://www.scienceforhighschool.com/how-to-use>
- <https://www.khanacademy.org>

Internet Studies:

Throughout this curriculum, we recommend various websites to study topics in further depth. If you do not have access to the Internet, a local library should be able to provide you with many similar resources.

Please use discretion when using any website, including the ones we recommend, and always supervise your children when using the Internet.

Please contact us if any link does not work so that we may update it.

About Foundations of Science

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Scripture taken from the King James Version of the Bible, unless otherwise noted.

“Therefore all things whatsoever ye would that men should do to you, do ye even so to them” (Matthew 7:12).

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FOUNDATIONS OF SCIENCE – YEAR 1

SUPPLY LIST

WEEK 1

- cotton swabs
- unsweetened baking cocoa
- lemon juice
- salt
- honey

WEEK 2

- rope or heavy string
- 1 large flat pan, 4-5 inches deep
- electric or paper fan
- bucket or jug
- food coloring (optional)
- 5 large marbles or ball bearings

WEEK 3

- balloons

WEEK 4

- flashlight
- aluminum foil

WEEK 5

- mirror
- aluminum foil
- a piece of colored paper (red, green, or blue)
- a piece of black paper

WEEK 6

- toothpicks
- playdough or modeling clay
 - make your own play dough in 4 minutes: <http://theimaginationtree.com/2012/04/best-ever-no-cook-play-dough-recipe.html>

WEEK 7

- large balloons
- string
- yard stick
- skewer or something sharp to pop the balloons

WEEK 8

- 2-liter clear plastic pop bottle
- matches

WEEK 9

- food coloring (different colors)
- table salt
- large baking dish

WEEK 10

- 2-liter clear plastic pop bottle
- drill (to make holes in the bottle)
- scotch tape

WEEK 11

- none

WEEK 12

- seeds for sprouting

WEEK 13

- celery
- red food coloring
- broccoli

WEEK 14

- one flower per child
- sketch pad
- magnifying glass (optional)

WEEK 15

- 1 round piece of cardboard about 1 foot across (the cardboard from a frozen pizza works well)
- colored construction paper
- scissors
- tape
- string
- pencil, crayons, markers
- a geometry compass (for making circles)

WEEK 16

- none

WEEK 17

- none

WEEK 18

- yarn or string
- modeling clay
- notebook-sized piece of cardboard
- compass

WEEK 19

- large piece of cardboard (about 1m squared)
- black spray paint
- 8 (or more) ping-pong balls (or other same-sized balls)
- black permanent marker
- very strong glue (such as Duco cement)
- flat piece of glass, such as from a picture frame

WEEK 20

- cylindrical oatmeal container with plastic lid
- a nail
- black tape
- flashlight

WEEK 21

- piece of cardboard
- string
- 2 thumbtacks
- pencil

WEEK 22

- none

WEEK 23

- none

WEEK 24

- none

WEEK 25

- perch dissection kit: <http://www.hometrainingtools.com/perch-dissection-kit> (optional)

WEEK 26

- none

WEEK 27

- none

WEEK 28

- crayfish dissection kit: <http://www.hometrainingtools.com/crayfish-dissection-kit> (optional)

WEEK 29

- eggs

WEEK 30

- grasshopper dissection kit: <http://www.hometrainingtools.com/grasshopper-dissection-kit> (optional)

WEEK 31

- earthworm dissection kit: <http://www.hometrainingtools.com/worm-dissection-kit> (optional)

WEEK 32

- play dough or modeling clay (see recipe Week 6)

WEEK 33

- microscope (optional but highly recommended)

WEEK 34

- frog dissection kit: hometrainingtools.com/frog-dissection-kit (optional)

WEEK 35

- coffee filter
- clear glass container
- sugar
- cocoa
- old t-shirt or apron
- craft supplies (paint, markers, glitter, iron-ons, fabric, etc.)

WEEK 36

- none



WEEK 1. The Scientific Method

INTRODUCTION

The Bible says that “in the beginning, God created the heavens and the earth” (Genesis 1:1).

We’re going to spend an entire year learning about the creation of the world. We’re going to look at it from a scientific perspective, so that we can learn how it works and how His creation affects our everyday lives.

SUPPLIES NEEDED

- *Science Notebook*
- *Cotton swabs*
- *Water*
- *Small cups or glasses*
- *Unsweetened baking cocoa*
- *Lemon juice*
- *Salt*
- *Honey*

WEEK 1. The Scientific Method

DAY 1.

HEAR

What does the word science mean? The word science comes from the Latin word **scientia**, which is pronounced see-en-she-a. The root of this word is **scio**, pronounced see-oh, and it means to know. In other words, science is a collection of facts or truths that we know.

The Scriptures tell us that “the fear of Yehovah is the beginning of knowledge, but fools despise wisdom and instruction” (Proverbs 1:7). In other words, true knowledge only begins when we fear Yehovah, but many foolish people despise His wisdom and instruction.

Psalms 119:130 says, “The entrance of Your words gives light; it gives understanding to the simple.” Many scientists, or men and women who are seeking knowledge about our world, have read these words of Scripture and decided to use the Bible to direct them as they studied.

However, many people reject the Scriptures as a source of knowledge or science. They reject the idea that Yehovah created the world, and without that foundation, they have to come up with other causes for the world we see around us. Even though they might appear to be wise, the Bible calls them fools for despising the wisdom and instruction found in God’s Word.

Here is one problem we encounter often in science: “The first one to plead his cause seems right, until his neighbor comes and examines him” (Proverbs 18:17). The first person who tells us about something in our world seems correct, but without some sort of standard, we have no way to know if the person is telling the truth or not.

“The fear of Yehovah is the beginning of knowledge, but fools despise wisdom and instruction” (Proverbs 1:7)





Scientific Method:

The process of the investigation of knowledge about creation. It is composed of observing, hypothesizing, and experimenting.

We are going to use the Bible as our foundation for science. We are going to start out with the rule that the Bible is true in everything it says about our world. However, we are also going to show you that the evidence surrounding you constantly agrees with the Scriptures.

What Is the Scientific Method?

Have you ever been curious about something you saw while walking outside? Maybe it was a strange flower, some animal tracks in the mud, or a bird's call that you had never heard before. Did your curiosity make you want to leave the trail and go find out more? Maybe you took a picture and went home to look it up on the Internet.

All scientific investigation starts with curiosity. Since mankind was not present for most of the first week of Creation, we did not see firsthand how Yehovah made the world. We are very curious about everything that we see around us! Adam and Eve must have felt the same way.

When we are curious, we begin to investigate to learn more. Maybe we leave the trail and find that the animal tracks we saw in the mud lead to a large hole in the ground. Maybe we sit next to the hole for a few minutes and hear scratching noises from the darkness. Our investigation is already leading us to make some conclusions about what kind of creature could be down in the hole.

A wise scientist writes down his discoveries so that others can follow in his footsteps or even discover more than he did. Let's assume that you took a spiral notebook and pencil out of your pocket and drew a picture of the tracks you saw in the mud, as well as a quick drawing of the hole in the ground. Using your arm, you roughly measured the size of the hole, and you also drew a picture of the plants surrounding the hole. You tried to write down the sounds you heard, to the best of your ability, so that you'd be able to make those same sounds for your family at dinner this evening. Maybe your older brother will use your drawings tomorrow to find the hole again, even though rain is in the forecast this evening and the tracks will be washed away. Maybe you use your notes to find an audio file of animal sounds online. Your notes would be invaluable in helping you identify the animal you discovered today!

If every scientist in the world were to use a similar method to write down what he learns, then other scientists could come behind him and use his notes to learn and discover more.



In fact, we have just such a method for recording information. **The process of investigation of knowledge about creation is called the “scientific method.”** It is composed of three steps:

1. Observing
2. Hypothesizing
3. Experimenting

Observing

To observe means to gather facts using our five senses. Usually observation begins with what we see, but not always. Sometimes we pay attention to things that we hear, smell, taste, or touch. A good scientist tries to observe with all of his senses at once.

While we observe, it is important that we write our observations down. Our senses notice many things, but we do not always remember them clearly. If we are to gather facts, we must be careful to also collect those facts to share with others.

Hypothesizing

A hypothesis (pronounced high-poth-eh-sis) is an “educated guess.” It comes from two Latin roots:

Hypo (pronounced high-poe) means “under.”

Thesis (pronounced thee-sis) means “a set.”

So a thesis would be a set of knowledge that has been set down, but a hypothesis is “under” that, or not quite up to that standard. We are not sure of it. It is only a set of knowledge that we have a good guess about.

When we observe something in the created world, even though our Creator knows and understands everything about it, we are not quite up to His standard. We don’t know everything He knows, nor we were around to observe His creation of the world. We are only able to make educated guesses, or hypotheses.

However, just because we are guessing doesn’t mean that we can’t make “educated” guesses. We can use the

information gathered by scientists who have gone before us and build upon that information to learn even more.

For instance, if we are trying to guess what animal lives in the hole we saw, we can use stores of information available to us in books and online to start to narrow down what kind of animal lives in a hole of that size, with tracks that match what we drew in our sketchbook. If the animals we find in the reference materials also make sounds similar to the ones we observed, then we can certainly begin to make an educated guess about what sort of animal’s hole we discovered.

Like our observations, we should write down our hypotheses.

(Note: the word *hypotheses* is plural for hypothesis; it is pronounced high-poth-eh-sees.)

In your notebook, you would use a complete sentence to write down as much detail about your guess as you can. You would also be wise to include notes about any reference materials you used, in case you wanted to look at them again in the future. (Maybe your brother will also want to look at that book or website tomorrow as well.)

Experimenting

Now it is time to test your hypothesis, to see if it is correct. **Testing a hypothesis is called experimentation.** Maybe you could set up a camera next to the hole in the ground, to record a video of any animals that enter or leave the hole in the next hour. Possibly your younger sister would be willing to sit a safe distance away, to watch with a camera and snap a picture of anything she sees, in exchange for your willingness to wash the dishes for her after supper this evening.

As you can probably guess, you should write down the steps of your experiment in your notebook. First, **write down your best prediction of what you think will happen.** In the case of the mystery animal, write down what you think will happen in the next hour or so. Your sister may wish to look at this to see if she is paying attention to the right things.



Keep a journal, a pen, and possibly a camera with you when you explore Creation, so that you are ready to record whatever you see.

A primary source is the recorded testimony of a firsthand witness to an event. The witness was actually at the event and experienced it personally.

A good prediction can be accurately tested. As we will discover in the coming lessons, we can accurately test things by measuring them with precision. We'll learn more about this soon, but in our backyard example, a camera will help your sister capture what she sees in a way that can be accurately shared with others later.

Are Observations Necessary?

What would happen if a scientist could not observe something himself? How would he be able to prove something actually happened?

In Deuteronomy 19:15, we read that "by the mouth of two or three witnesses the matter shall be established."

According to the 1828 Webster's Dictionary, someone can be included as a witness if one of the following statements is true:

- Someone was personally present at an event and was an eye-witness to what happened.
- Someone can furnish evidence or proof.

So if two or three such witnesses were personally present at an event so that they could tell what they saw, or if they can furnish evidence or proof from others, then a scientist can include that

information in what he is studying.

A good scientist would write down the names of the witnesses and, if possible, what they observed, using their own words.

Sometimes this "evidence" is found already written down. **These recorded testimonies of firsthand witnesses are called primary sources.**

However, if a scientist acts on information that he didn't see himself, and for which he has no primary sources or first-hand witnesses or evidence, then he is making an **assumption**. This often happens without anyone's realizing that they're assuming things, but it can cause large problems and make it difficult for new scientific discoveries to happen.

Cause and Effect

Many times we observe things that happen in our world, but we might not observe what caused them to happen.

For instance, you might observe that something caused a hole in the ground, but you didn't observe what caused the hole to be there.

You might make the assumption that a rabbit made the hole in order to build its burrow or nest. However, unless you directly observed the rabbit making the hole, or unless you had other direct evidence, you would only be assuming the cause of the hole.

Suppose you were a farmer that had been living on a piece of land for over 50 years, during which time you had directly observed many rabbits coming out of their holes in the grounds and had other direct evidence of how rabbits make their burrows.

You would likely be very safe making an assumption that a new hole you found yesterday was made by a rabbit. You would make a hypothesis based on credible evidence, and your hypothesis would likely be correct.

Your theory would have been tested many times, over 50 years. We might call it a scientific theory or even a law of nature.



LEARN

Have a discussion with your students about each of the following questions:

- What does the Latin root *scio* mean?
- What does the word *science* mean?
- What is a scientist?
- What rule will we use as we study science?
- As we discuss questions each day, how could we discover the answers? One way is to sit by a computer or use our phones or tablets, looking things up as we discuss. We could also look at books that we have obtained at the library. Are there any other ways?
- We will use our Bibles each week as we are introduced to a new scientific topic. Let's start by reading Proverbs 18:17. What do you think this verse has to do with science?
- All scientific investigation starts with curiosity. What do you think this means? Have you ever been curious about something YHWH made?
- The process of investigation is called the "scientific method." What does each word mean?
 1. Observing
 2. Hypothesizing
 3. Experimenting
- What would happen if a scientist could not observe something? How can he prove that what he is observing is true? Look up Deuteronomy 19:15.
- What is an experiment?
- What is a prediction? The ability to be accurately tested is a sign of a good prediction. What does this mean?
- What is "cause and effect"?
- What is a theory? What is a theory that has successfully been tested repeatedly?

We have scheduled topics of discussion to go with each topic. However, don't feel that you must limit the discussion to only these things! You should feel free to discuss things that you know are important to your family. Allow the Holy Spirit to guide you as you learn together.

KEEP

- Complete the activities for Day 1 in your Science Notebook.



DAY 2.

HEAR



Watch this 5-minute video about Newton's First Law of Motion:

- <https://homeschoolingtorah.com/links/newtons-first-law-of-motion>
- You can also scan the QR code to watch the video.

Discuss the following together:

- There were three scientists mentioned in the video. Why did they become curious?
- How did they use the **observation** step of the scientific method?
- How did they use the **hypothesis** step of the scientific method?
- How did they use the **experimentation** step of the scientific method?
- In the illustration given in the video, how can you see cause and effect? Are there any causes or effects you might not be thinking of?
- Why do you think this is called a **law** of motion, rather than just a **theory** of motion?

DAY 3.

HEAR

Discuss the following together:

- What does it mean to be accurate?
- What does it mean to be precise?
- We call mathematics the "language of science." Why do you think this is?
- What is an equation?
- What is trial and error?
- What is a measurement? Can you name some things that can be measured? (Length, volume, mass, time, temperature. Define as needed.)

The students will be adding definitions for "accurate" and "precise" to their Student Notebook.



KEEP

- Complete the activities for Day 3 in your Science Notebook.



HIGH SCHOOL

Watch this 12-minute video about Scientific Notation:

- <https://homeschoolingtorah.com/links/scientific-notation/>
- You can also scan the QR code to watch the video.



Discuss the following together:

- What are significant figures?
- What is scientific notation?
- What is the metric system?

DAY 4.

DO

You've probably noticed that your tongue can taste many different flavors. Do you think you know why?

- Complete the activities for Day 4 in your Science Notebook.



DAY 5.

KEEP

- Complete the activities for Day 5 in your Science Notebook.



HIGH SCHOOL

- Check out a library book on the life of Sir Isaac Newton or Galileo Galilei. Try to have it read within a week.
- Make a list of 3-5 character qualities in their lives that helped them become excellent scientists.
- Plan to share the list with your family next week.

WEEK 1. The Scientific Method

DAY 1

Write out a short definition for each word:

Observation _____

Hypothesis _____

Experiment _____

Prediction _____

Theory _____

Assumption _____

Causality _____

Copy Proverbs 18:17 from your Bible.

Make a chart illustrating the scientific method. Be sure to use each of these steps:

1. Observing (gathering facts)
2. Hypothesizing (suggesting explanations)
3. Experimenting (testing explanations)

THE SCIENTIFIC METHOD



DAY 3

Write out a short definition for each word:

Accurate _____

Precise _____

DAY 4

You've probably noticed that your tongue can taste many different flavors. (Can you name some? Draw pictures to illustrate them.) Do you think you know why?

Suggest a hypothesis as to why your tongue can taste different flavors. Write your hypothesis down in a complete sentence. A complete sentence is a group of words that includes a subject and a verb and expresses a complete thought. For instance,

My tongue can taste different flavors because (state your hypothesis here).

Before doing the following experiment, predict what you think will happen. Write your prediction down in a complete sentence.

- ❑ Experiment: <https://homeschoolingtorah.com/links/science-experiment-tongue-map/>



Analyze your results. Was your hypothesis correct? Did your prediction come true? Were the results repeatable? Why or why not? (Use a complete sentence.)

Could you design a better experiment? What would make it better?

DAY 5

Draw a picture that illustrates something you learned this week about the scientific method. Write a summary paragraph at the bottom of the page.
