When I was in college I built friendships with two fellow students. One was a Christian (Emily) and one was not (Kim). Emily and I often talked about how we could share Christ with Kim, but neither of us wanted to be obnoxious about it.

One year when Emily was in a Christmas play at her church, I asked Kim if she’d like to go and support Emily. The play had an impact on Kim’s life and in the car ride on the way home we talked about it more. She ended up accepting Christ that night!

Wow! I’m glad you didn’t miss that opportunity!

Yes. It wasn’t an easy thing to do because I didn’t want to come across like a pushy Christian. Still, it seemed the Lord was opening a door at that time. It was definitely one of those times God placed me in the right situation—and I (for once) obeyed.

That reminds me of a story in the Bible of a young girl who was in the right place at the right time—more like God placed her in the right place and the right time! Sound a little like Goldilocks and the habitability zone?

This is the story of Esther. If you’re not familiar with this story, we encourage you to read it sometime. It’s a fantastic tale that reads like a novel with plots of assassination, betrayal, dethronement, and an ordinary teenager becoming a queen.

Here’s a quick summary for the time being:

The king of Persia kicks out his wife (the queen) for disobeying his orders. The Jewish girl Esther is chosen from among many beautiful young women to be the new queen.

- Esther and her cousin Mordecai uncover a plot to assassinate the king.
- An evil prince of the area, Haman, tries to have Mordecai and the rest of the Jews eliminated.
- Encouraged by Mordecai, Esther risks death to expose this plot to the king, and Haman ends up being hanged for his actions (no, he wasn’t sent to the Island of Perpetual Tickling. That was the Veggie Tales version!).

In Esther 3, Mordecai finds out that Haman manipulated the king into declaring an edict to destroy all the Jews. In chapter 4, Mordecai tells Esther she should intercede for her people and tell the king the truth, but Esther

It’s hard to read the title of this lesson without laughing.

I know what my brothers and I said when we heard the term “gas giants!” But there’s a lot more to these planets than most people think.

A gas giant planet is made up mostly of gas (duh) and some of them, especially Neptune, could be quite—ummm—aromatic! There are four gas giants in our solar system: Jupiter, Saturn, Uranus, and Neptune. Jupiter is the largest planet in our solar system and is very important for us here on Earth. Jupiter is so big that its gravity affects everything in our solar system, even comets.
that come speeding through Earth’s atmosphere. With such gravitational force (power to pull other objects toward it), Jupiter provides a shield of protection to the planets that are between it and the Sun.

I remember seeing pictures of Comet Shoemaker-Levy 9. In 1992, Jupiter’s gravity tore the comet apart, and two years later as those pieces flew by Jupiter again they got sucked into the planet.

That’s right. In fact, the original comet was broken into more than 20 fragments. By the way, it may be somewhat misleading to use the word “fragments” because these pieces were very large. They ranged in size from a few football fields to nearly one mile across—and they unleashed enormous amounts of energy upon impact with Jupiter. The explosion from each collision released more energy than all the world’s nuclear bombs—combined! Check out the picture of Jupiter on page 5 (figure 1). The dark spots on the planet show the damage caused by these impact events.

So Jupiter could be seen like a (good) big brother for planets in the inner solar system, protecting its smaller brothers and sisters from dangerous things. Because it’s bigger and more massive than all the other planets in the solar system combined, it “eats” most of the comets, asteroids, and other things that would hit Earth and do some major damage.

Exactly. And believe it or not, the relatively small number of asteroids and comets that do impact Earth reflects another equally important role that Jupiter and Saturn played during the early years of the solar system. Roughly 500 million years after Earth formed, it experienced a huge bombardment of asteroids and comets. One likely cause of this bombardment was the migration of Jupiter and Saturn from their original orbital locations to their present ones. This migration would have hurtled the left-over planetary debris toward the inner solar system planets. Not only did this bombardment clear debris out of the solar system, but also it proved vital to early Earth. It supplied heavy elements to our planet, including iron, iridium, and osmium. Most critically, it brought water!

Although we tend to think of water as rare in the universe, it’s actually the third most abundant molecule in the cosmos. Comets and asteroids deposit their collection of water on Earth when they collide with our planet.

So how does Earth’s average surface temperature stay so stable and livable around 60°F when there are such hot and cold extremes throughout the universe?

Earth orbits in what can be called the “sweet spot” for liquid water to exist for an extended period of time. If you’ve ever gone camping and sat around a fire on a chilly night, you know about the “sweet spot.” If you sit too far away from the fire, you don’t benefit from the heat and end up cold. But if you sit too close to the fire, you start getting too toasty. (I’ve seen my share of melted shoes.) Venus orbits too close to the Sun and gets hot—beyond shoe-melting temperatures—while Mars orbits too far away to stay warm.

But what about the ice ages?

As we discussed in lesson 3, the Sun is very active, and just like fire, its supply of heat fluctuates at times. When it first formed, it started out roughly as bright as it is today, but then dimmed 15–30 percent over the first billion or so years. Then the Sun grew steadily brighter until it reached what it is today (and it will continue to grow brighter in the future). God has finely tuned our planet to deal with these fluctuations in order to keep its water around. Earth can’t just “move its chair” as we can when sitting around the campfire.

Throughout Earth’s history, its temperature has undergone moderate variations, but nothing like the changes on Venus or Mars. Earth has experienced periods where the mean global temperature dropped closer to 40°F, and possibly even below freezing (32°F) if glaciers covered the whole Earth. At other times, some changes conspired to raise the average temperature as high as 70–80°F.

This idea of habitability zones makes me think about the times I’ve felt placed in a certain situation at a certain time to do God’s work. Sometimes I run away from those opportunities, but other times I obey God’s leading and see great things happen.
Did you know scientists even use the word “Goldilocks” when referring to a planet like Earth that exists in the habitability zone? Following the analogy, scientists see our solar system like Baby Bear’s porridge (or chair or bed)—“just right” for Earth (a.k.a. Goldilocks). Earth is situated exactly where it meets a bunch of criteria essential for life support. Scientists refer to this just-right location as the habitability zone.

For example, liquid water is required for life to exist on any planet. The planet must not be too close to the star or it will get too hot and evaporate all the water. If it orbits too far away, the surface gets too cold and all the water freezes. Only in that just-right habitable zone can a planet possibly meet the requirements for life. Even in our own solar system liquid water is hard to find.

You keep saying “liquid” water. Why is liquid water more important than H₂O’s other states such as steam (vapor) and ice (solid)?

Only liquid water allows for the chemistry that life requires. Life chemistry can’t happen in steam or ice.

But I’ve heard that Mars and even Venus may have had liquid water at some point in the past. Does that mean these planets could have been home to life?

Probably not. And that’s the reason this habitability zone is so important. Not only is it important that liquid water be present, it is vital that it remains for an extended period of time. Mars may have once had liquid water, but it’s now at a frigid -81°F—so no liquid water for the Red Planet (remember water freezes at 32°F). Venus is a bit warmer—a mere 800°F! No water for our “sister” planet either.

So temperature really is a big factor in finding a planet that can maintain water?

Yes. And in space, it’s very difficult to find a location that’s not too cold (like Mars) and not too hot (like Venus). The temperature throughout most of space is the somewhat chilly -454°F! But then, in the heart of a star, supernova, or gamma-ray burst, the temperature rises anywhere from 10,000,000 to 100,000,000,000,000,000°F (that’s 100 million trillion or 100 quintillion degrees, in case you’re wondering).

I guess a conversion to Celsius really wouldn’t make much of a difference at that temperature!

So you’re saying that Jupiter and Saturn caused this bombardment which, I’m assuming, also cleared the rest of the debris out the solar system?

Well, the bombardment didn’t quite clear all of it. We still see evidence of relatively recent impact events. For example, one hundred years ago, a 10–20 meter object impacted Earth (it actually exploded 5–10 miles above the surface) in Russia knocking over 80 million trees covering 800 square miles. A similar sized meteor struck central Arizona 50,000 years ago and left a mile-wide crater.

Didn’t a huge meteor also wipe out the dinosaurs?

Most scientists believe that a meteor six miles wide hit Earth 65 million years ago and caused the last of the dinosaurs to go extinct.

But what about God’s protection?

Two things. First, as mentioned above, these impact events “protect” us (even if not the dinosaurs) by supplying Earth with important resources for our life and technology. Second, because of the early timing of this bombardment, the impact rate now is about 1,000 times less than it would have been, making Earth a much safer place to live.

God seems to have placed these gas giants in the just-right place in our solar system so that we don’t have to worry about being pulverized by all the stuff flying around.

INTERESTING FACT:

For the Sun and eight planets, the mass in each object is larger than all the smaller objects. For example, the Sun contains more mass than all the planets put together and Jupiter has more mass than the seven remaining planets combined. Continuing that trend, Earth has more mass than Mercury, Mars, and Venus combined.
And that’s a perfect example of what God does in our spiritual lives. There are many verses in the Bible that talk about God’s protection over His people. He has placed people, angels, and circumstances around us to protect us from danger. But it’s important that we follow His ways so we can actually benefit from that protection.

Very true. Think about this as an example: what if the Earth just changed its orbit and left the protection of the gas giants. You can probably guess what would happen. Wham!—more bombardments.

As a personal example, I remember a time when, because of my naivety, I easily could have ended up in serious trouble. As a five- or six-year-old, I visited a state fair with my parents, brothers, grandparents and other family. A few of us walked over to watch a car race. Amid the noise and excitement of the race, I lost track of the rest of my group. When I finally looked around, I was alone in a crowd of strangers.

I’ve had nightmares about this happening to one of my kids.

After realizing my predicament—and getting over the initial panic—I finally remembered something my parents told me when we arrived at the fair. We had agreed that if we got separated, we would meet at a specific building. I made my way to that building and my folks showed up shortly afterward. I was back under their protection.

The same thing happens in a spiritual sense. If we place ourselves under God’s authority, His protection is promised.

Psalm 5:11–12 says, “But let all who take refuge in You [God] be glad; let them ever sing for joy. Spread Your protection over them, that those who love Your name may rejoice in you. For surely, O LORD, You bless the righteous; You surround them with Your favor as with a shield.”

Read the verses on the following page and write down the things that God has given us for our protection and what we are protected from.

I’m happy to say this lesson on habitability zones should be the easiest to understand in this study.

Well, Ken, I’ve got some information on nucleosynthesis and high-energy symmetry breaking that can make this lesson “less easy” if you’d like.

Uh…no. I think we’re good.

This concept of habitability zones you talk about sounds something like the Goldilocks and the Three Bears fairy tale.

**PLEASE NOTE:** This diagram is NOT to scale! If it were, given the size of the sun in this image, Earth would be about 40 feet away from you. Neptune would be about four football fields away (1,200 feet)!
Finish this lesson by reading the following verses from Psalm 32 carefully. Here we read about the person who is blessed by God. Note that this person is not blessed because he is sinless, but because he is forgiven!

Blessed is the one whose transgressions are forgiven, whose sins are covered. Blessed is the one whose sin the LORD does not count against them and in whose spirit is no deceit. When I kept silent, my bones wasted away through my groaning all day long. For day and night your hand was heavy on me; my strength was sapped as in the heat of summer. Selah. Then I acknowledged my sin to you and did not cover up my iniquity. I said, “I will confess my transgressions to the LORD.” And you forgave the guilt of my sin. Selah.

1. Are there any sins you have not yet confessed to God and to someone you can trust?

2. Write down the name of the person with whom you can walk in the light.

*Note: We encourage you to read the entire chapter of 1 Corinthians 15 (it’s the gospel summed up in one chapter!) but here’s the punch line just in case you don’t get to it right away: Jesus Christ died for your sins and because He was raised from the dead, those who trust in Him are no longer guilty of their sin and have victory over death!
Jupiter plays a critical role in protecting Earth from destructive impacts. If we follow the Lord’s commands, we are promised protection from spiritual harm.

My son, if you accept my words and store up my commands within you, turning your ear to wisdom and applying your heart to understanding, and if you call out for insight and cry aloud for understanding, and if you look for it as for silver and search for it as for hidden treasure, then you will understand the fear of the LORD and find the knowledge of God. For the LORD gives wisdom, and from his mouth come knowledge and understanding. He holds victory in store for the upright, he is a shield to those whose walk is blameless, for he guards the course of the just and protects the way of his faithful ones. (Proverbs 2:1–8)

Look at your answers in the So What? section. What are two things you can do in order to place yourself under God’s protection?

1. 

2. 

BONUS QUESTION! Jupiter’s role in Earth’s safety usually goes unnoticed and unappreciated. Who has God placed in your life as a source of protection? Do you have the guts to thank that person for their protection and/or provision?

The point is, we need to allow God’s light to reveal our sin so we can receive forgiveness. If we hide our sin, we avoid the truth and don’t acknowledge God’s power to forgive. As Christians, we want to look like we have everything together, but the Bible tells us we don’t. In 1 John 1:10, we’re told “If we claim we have not sinned, we make him [God] out to be a liar and his word is not in us.” When we cover our sin (walk in darkness) we do not receive the grace that God offers.

When I was younger, I would quickly confess my sin and recite 1 John 1:9 to myself, “If we confess our sins, he is faithful and just and will forgive us our sins and purify us from all unrighteousness.” I can’t tell you how many times I quoted that verse. I knew God had forgiven me, but why wasn’t it helping me avoid that same sin later? I finally realized I was leaving something out. Earlier in that same chapter, John tells us to “walk in the light.” That means replacing wrong actions and attitudes with right ones.

So what about your sin? Yes, we know about it (well, not the specific sin, but just that you have sin). Do you struggle with lust, lying, stealing, swearing, pride, hate, selfishness, cheating, laziness, worrying about what people think of you, covering up wrongs you’ve done, not asking for forgiveness, things like that?

Are you walking in darkness and covering it up in the hopes it will just go away, or are you willing to step into the light and confess your sin to God and others?

These questions may come across as too direct or personal, but we want you to deal with the truth.

Proverbs 28:13 says, “Whoever conceals their sins does not prosper, but the one who confesses and renounces them finds mercy.”

Action Plan: If you’re serious about walking in the light, find an accountability partner, another Christian you trust and who can (and will) walk with you in the light. If there’s no one in your life to fill this role, talk to your parents or pastor about connecting with someone.