Helps and Hints for Science in the Beginning

by

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All Scripture verses are taken from the New American Standard translation.

Introduction

Thank you for using *Science in the Beginning*, a multigrade elementary science course. I have designed the course so that elementary students of all ages (K-6) can work through it together. The details of how that is accomplished are contained in the introduction to the main book. In this companion book, you will find the answers to the student review exercises, helpful hints about some of the lessons, tests, and answers to the tests. I pray that these contents will make the course easier for you to cover.

As I mention in the introduction to *Science in the Beginning*, while I do provide tests in this book, I personally don't think they are very important for the elementary years. However, I realize that there are many parents who do. In addition, I understand that some students need practice taking tests in science before they are thrust into the more academically challenging science courses found in junior high and high school. As a result, I ask that you use your own discretion when it comes to administering the tests. Do so if you think it is the best thing for your children. If you decide to use the tests, please note that you are free to photocopy them straight from the book. There is a note to that effect on the relevant pages.

If you are just looking for an evaluation tool, I would strongly recommend that you emphasize the student notebook. Each lesson has a notebooking exercise for all but the youngest students. These students should have a single notebook that is devoted solely to this course, and they should use the notebooking exercises as a guide for what belongs there. Of course, the notebook should be the student's own account of what he or she learned in the course, so the student is free to add things to the notebook. The notebooking exercises simply indicate the minimum content that should be found there.

How will you evaluate your student's notebook? Obviously, the student's completion of the notebooking exercises should contain scientifically correct information, which is why you will find answers to all of the exercises in this companion book. If the student ends up putting incorrect information in the notebook, have him correct it. That will offer a chance for the student to learn from his mistakes.

However, the notebook should be more than just a repository for information related to the course. You should also use it as a tool to help the student master his strengths and improve on his weaknesses. For example, does your student struggle with writing? The writing assignments in most of the notebooking exercises are fairly short, so you can view them not only as science work, but also as English and grammar work, perhaps going so far as to grade him on how well he writes. If writing is a real struggle at first, consider having your student orally answer the exercises, with you writing down what he is saying. As time goes on, you can transition from him doing none of the writing to him doing more and more of the writing. If your student is good at writing, then view the notebook as a chance to encourage him to be creative with his words,

Is your student good at drawing? There are several drawing assignments in the notebooking exercises. Make part of the student's grade based on how good the drawings are. Alternatively, if your student is not very good at drawing, there are options in most of the assignments to cut pictures out of magazines or print them off the internet instead. Allow your student to do that *most* of the time, but force him to draw in a few assignments, just so he has a chance to work on that weakness. Of course, if drawing is a weakness, any grade you give based on his drawings should take that into account.

For some of the lessons, there are hints given, usually regarding the experiment. It is always best to look at a lesson's entry in this book before starting the lesson with your students so that you are aware of any hints that might make the lesson a bit easier. Also, if the student is asked a question during the reading, such as to identify something in a picture, the answer will be found in this book's entry on that lesson.

As discussed in the introduction to *Science in the Beginning*, there is a way for you to ask questions about the material. Feel free to use that service as often as you need. My goal is to make science more enjoyable for both you and your students!

Table of Contents

Lesson Review Helps and Hints

If your children are having trouble completing a lesson review, check here for help. You should do the checking, not your students.

Lesson 1

1. Light reflects when it bounces off something, changing direction.
2. In order to see something, light must reflect off it and hit your eyes. If there is no light, that can't happen.

Older students: See #1 above.

Oldest students: The drawing should show an arrow coming down from the light and hitting the object on the table. Where that arrow hits the object, another arrow should start, and it should end up hitting the person's eye. This allows the person's eye to detect the light and send information to the person's brain so the brain can form the image. If the light were turned off, the person would see nothing.

Lesson 2

1. They came from the (mostly) white light made by the candle flame.
2. Red, orange, yellow, green, blue, indigo, violet

Older students: See the pictures on page 5. Mr. White Light's name helps you remember the colors of the rainbow because each letter stands for a color, and the letters are in the same order that the colors appear in the rainbow.

Oldest students: You would not see the rainbow. Only white light has all the colors of the rainbow.

Lesson 3

Note for the experiment: The black paper will reflect some light, because it cannot absorb all the light from the flashlight. As a result, you will see some of your helper's paper when you shine the flashlight on black paper.

1. It reflects red light.
2. They are absorbed by the object.

Older students: In the drawing, the only arrow that should reflect off the rose and hit the person's eye is the red arrow. The seven arrows represent white light, which has all the colors of the rainbow. The red arrow represents the only color of light that is reflected – red.

Oldest students: See the "older student" explanation. The other colors are absorbed.

Lesson 4

Note for the experiment: If the two pieces of plastic aren't at noticeably different temperatures when your students touch them, just let them sit in the sun longer.

1. Light is a form of <u>energy</u>.
2. When an object absorbs light, the object gets <u>warmer</u> because the light's radiant energy is changed to thermal energy.

Older students: The lesson discussed radiant energy, chemical energy, mechanical energy, and thermal energy. The picture for radiant energy should use light, chemical energy should use food, wood, or something else that contains chemicals, mechanical energy should have something in motion, and thermal energy should have something hot.

Oldest students: A black shirt converts the radiant energy of the sunlight into thermal energy, which warms you up. The white shirt reflects most of the radiant energy, so it is not converted into thermal energy.

Lesson 5

1. A white object reflects most of the light that hits it.
2. The white shirt still absorbs *some* light, and that light gets changed into *some* thermal energy.

Older students: When the magnifying glass was held over the paper, it concentrated a lot of sunlight into a small space. That means there was a lot of radiant energy there. Even though the white paper reflected *most* of that radiant energy, some of it got absorbed and got changed into thermal energy, which was enough to catch the paper on fire. If the paper had been black, it would have caught fire sooner, since it would have absorbed more light.

Oldest students: The one on the left is a mirror. It reflects almost all the light that hits it, and all the light reflects in the same direction. The middle one is black paper, since almost all of the light is absorbed. The one on the right is a white piece of paper, since almost all the light is reflected, but it is scattered all over the place.

Lesson 6

Note for the experiment: If you can't see the light bulb light up, see if the balloon has enough charge by touching the top of the balloon to the wall. If the balloon sticks to the wall, it has enough charge. If not, you need to use cleaner hair or a wool blanket.

1. Energy cannot be created or destroyed. It can only be converted from one form to another.
2. In order for you to have fun, your body needs to make a lot of mechanical energy. The only way you can do that is if you have chemical energy, which you get from food. If you don't have a lot of chemical energy in your body, it won't be able to make a lot of mechanical energy.

Older students: Energy cannot be created or destroyed. It can only be converted from one form to another. In the experiment, the mechanical energy in the balloon's motion was converted into radiant energy. Since you could only put a little bit of energy into the motion of the balloon, it got converted into just a little bit of radiant energy, which is why the bulb was dim.

Oldest students: Moving the balloon quickly would give you a brighter glow, because there is more mechanical energy in a quickly-moving balloon than in a slowly-moving one.

Lesson 7

1. A battery stores chemical energy.
2. There are only so many chemicals in the battery, so there is only so much chemical energy. When the chemicals get used up, there is nothing more that can be converted to electrical energy.

Older students: The batteries convert chemical energy to electrical energy, and the motor in the toy car then converts electrical energy into mechanical energy.

Oldest students: The car will not run as fast with two good batteries instead of three, because there isn't as much chemical energy to convert to electrical energy. With one battery, it will run even more slowly.

Lesson 8

Note for the experiment: The key is that the digital camera needs to be of low quality. High-quality digital cameras filter out infrared light.

1. We call it visible light.
2. You cannot see infrared light or ultraviolet light. The students need to name only one.

Older students: The drawing should show an arrow coming from the remote, hitting the paper, and reflecting off the paper and to the television, which is behind the remote. If someone stood in front of the remote, it wouldn't work, because that person would be blocking the light.

Oldest students: The proper order is infrared light (lowest energy), visible light (medium energy), and ultraviolet light (high energy).

Lesson 9

1. It focuses the light on the retina.
2. They detect light.

Older students: The drawing should look very similar to what is on page 25. The rods and cones are on the retina, and the blind spot is that brown area where the optic nerve comes out on the retina.
Oldest students: The green circle will disappear when the book gets close to your face. When the light coming from the green circle hits your blind spot, your brain has to "fill in" the missing information with what it sees around the green circle, which is just white paper. So the green dot is replaced with white paper.

Lesson 10

1. The light can reflect off the object, be absorbed by the object, or pass through the object.
2. It means that light can pass through it.

Older students: The first drawing should show light hitting the fork, reflecting off the fork, traveling through the water and then the air, and then hitting a person's eye. In the second drawing, the arrows should show light hitting the fork, reflecting off the fork, passing through the water, reflecting off the surface of the water, passing back through the water, passing through the bowl, and hitting a person's eye.
Oldest students: The students should have an explanation like what is written above.

Lesson 11

Note for the experiment: If you know that you can yell at each other and be heard through the window, there is no reason to work out signals.

1. You will see your reflection.
2. When a large amount of light is doing one thing and a small amount of light is doing another, we tend to see what the <u>large</u> amount of light is doing.

Older students: If your little brother has his lights on, the small amount of light coming from the flashlight outside will be overwhelmed by the reflection of light inside. As a result, either your little brother won't see anything, or it will not be nearly as ghostly looking.
Oldest students: For a one-way mirror to work, the side on which the suspect is being questioned needs to be brightly lit. The side from which the other officers are observing needs to be dimly lit. That way, the amount of light being reflected on the suspect's side is large, and all you see on that side is the reflected light. As a result, the window looks like a mirror. On the other officers' side, very little light is reflected, because there is little light to begin with. That means the majority of light comes from the room where the suspect is, so the officers see the suspect very clearly.

Lesson 12

1. It reflected off the air.
2. It is called a fiber optic cable.

Older students: The assignment explains what the drawing should look like.
Oldest students: The doctor can put a tiny camera on a flexible tube. She can push it in the patient's mouth, down the esophagus, and into the stomach. The camera will need light, though, which is where fiber optic cable comes in. A fiber optic cable can be pushed right along with the camera, and light will shine wherever it goes. This is often done in diagnostic medicine.

Lesson 13

1. Morse code converts every letter in the English language into <u>dots</u> and <u>dashes</u>.
2. You need the chart to convert your written message into flashes of light, but your helper needs it to convert those flashes of light back into a written message.