

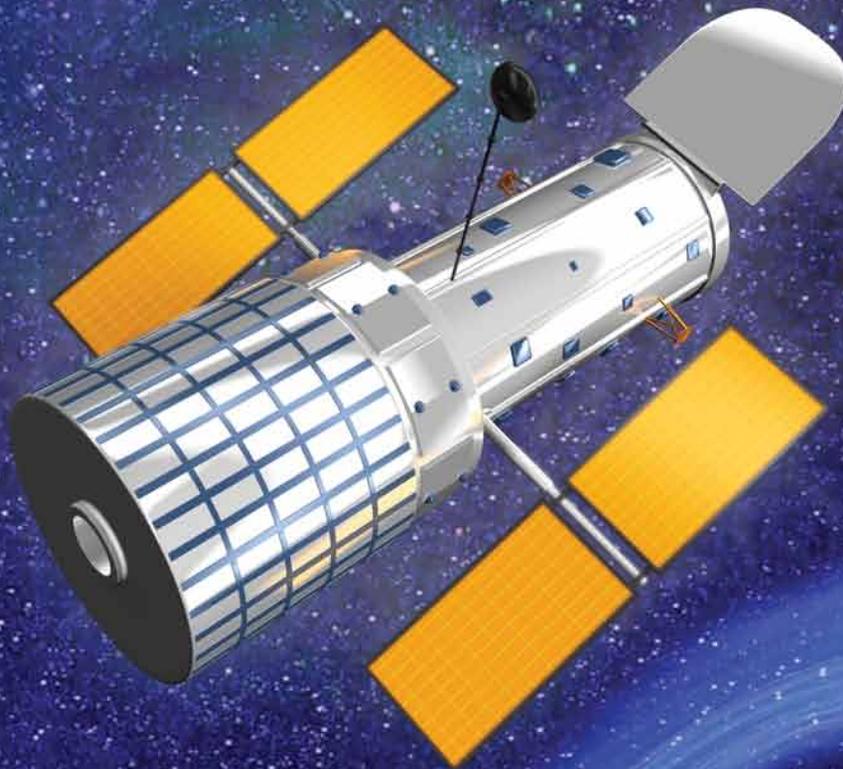
Grades K-4

FOCUS ON

ELEMENTARY

A R O N O M Y

Teacher's Manual



Rebecca W. Keller, PhD



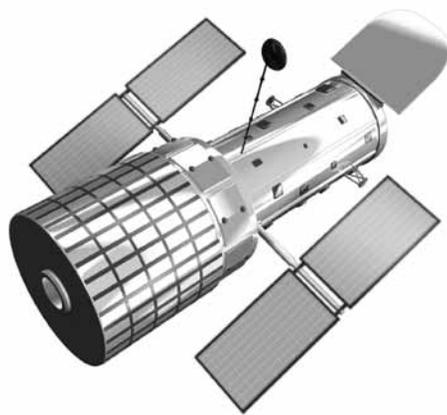
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Illustrations: Janet Moneymaker
Marjie Bassler

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A Note From the Author

This curriculum is designed to provide an introduction to astronomy for students in kindergarten through fourth grade. The *Focus On Elementary Astronomy Laboratory Workbook* is intended to be the first step in developing a framework for real science. This teacher's manual will help you guide the students through the laboratory experiments. The series of experiments in the laboratory workbook will help the students develop the skills needed for the first step in the scientific method—making good observations.

There are different sections in each chapter. The section called *Observe It* helps students explore how to make good observations. In the *Think About It* section questions are provided for students to think about and to use to make further observations. In every chapter there is a *What Did You Discover?* section that gives the students an opportunity to summarize the observations they have made. A section called *Why?* provides a short explanation of what students may or may not have observed. And finally, in each chapter there is a *Just For Fun* section that contains an additional activity. Students may enjoy using a notebook to record observations from the *Just For Fun* sections as well as any additional observations from other parts of the experiments.

The experiments take up to 1 hour. The materials needed for each experiment are listed on the next two pages as well as at the beginning of each experiment.

Enjoy!

Rebecca W. Keller, PhD

Materials at a Glance

| Experiment 1 | Experiment 2 | Experiment 3 | Experiment 4 | Experiment 5 |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| pencil or pen colored pencils clear night sky | pencil or pen colored pencils clear night sky basketball or other large object(s) Telescope Kit from Home Sci- ence Tools Item# AS- TELEKIT (see below for website) | pencil or pen basketball ping-pong ball flashlight empty toilet pa- per tube glue or tape scissors a dark room | pencil or pen colored pencils night sky | pencil or pen 8 styrofoam craft balls: (1) 10 cm (4 in) (1) 7.5 cm (3 in) (2) 5 cm (2 in) (2) 4 cm (1.5 in) (2) 2.5 cm (1 in) water-based craft paint: red blue green orange brown miscellaneous objects to use as planets |

| Experiment 6 | Experiment 7 | Experiment 8 | Experiment 9 | Experiment 10 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| pencil or pen styrofoam ball pick or other thin, sharp object nylon string scissors 2 or more marbles - different sizes cups - different sizes | pencil or pen flashlight with new batteries glow sticks, assorted colors (from places such as Walmart, toy store, or online) | pencil or pen colored pencils clear night sky optional: pictures of cities computer with internet access | pencil or pen 2 bar magnets iron filings (Home Science Tools: see below) shallow, flat- bottomed plastic container or box lid cardboard box (optional) corn syrup plastic wrap Jell-O or other gelatin assorted fruit cut in small pieces | pencil or pen small plastic pail water dirt small stones dry ice (from grocery store) mallet or hammer cloth or paper bag heavy gloves or oven mitts freezer |

<http://www.hometrainingtools.com>
Telescope Kit: Item #AS-TELEKIT
Iron Filings: Item #CH-IRON

Materials at a Glance

By type and quantity

| Equipment | Materials | Materials (cont.) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| computer with internet access container, plastic (shallow, flat-bottomed) or plastic box lid flashlight with new batteries freezer magnets, bar (2) mallet or hammer pail, small plastic pick or other thin, sharp object scissors Telescope Kit from Home Science Tools Item# AS-TELEKIT (see below for website) | bag, cloth or paper box, cardboard (optional) dirt and small stones dry ice, 1 pkg (from grocery store—crushed if available) pen pencil pencils, colored basketball (1) basketball or other large object(s) with textured surface cups (2 or more of different sizes) gloves (heavy) or oven mitts glow sticks, assorted colors (from places such as Walmart, toy store, or online) glue or tape iron filings (Home Science Tools: see below) | ping-pong ball (1) string, nylon (approx. 2 meters [6 ft]) styrofoam craft ball (1) styrofoam craft balls (8): (1) 10 cm (4 in) (1) 7.5 cm (3 in) (2) 5 cm (2 in) (2) 4 cm (1.5 in) (2) 2.5 cm (1 in) toilet paper tube, empty |
| Food Items | marbles (2 or more of different sizes) objects (miscellaneous) to use as planets paint, water-based craft: red blue green orange brown pictures of cities (optional) plastic wrap water | Locations |
| corn syrup fruit, assorted, cut in small pieces and/or berries Jell-O or other gelatin (1 pkg) | | outdoors with clear night sky room, dark |

<http://www.hometrainingtools.com>
 Telescope Kit: Item #AS-TELEKIT
 Iron Filings: Item #CH-IRON

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Experiment 1

Twinkle, Twinkle Little Star

Materials needed:

- pencil or pen
- colored pencils
- clear night sky

Objectives

In this unit students will observe the stars in the sky.

The objectives of this lesson are:

- *To help students learn how to make good observations and ask questions.*
- *To understand that even without the use of technology, scientific inquiry can still occur. Using the senses is important for science.*

Experiment

I. Observe It

Allow adequate time for the students to observe the night sky. It is better if you can go to an area away from city lights where the stars will be easier to observe. Allow the students to simply “take in” the enormity of the night sky and the abundant number of stars. More stars can be observed if it is possible to locate the Milky Way from where you are.

Encourage the students to draw as many stars as they can see. They can use colored pencils if they are able to observe stars of different colors. Use questions to help them make good observations:

- *How many stars do you see? Can you count them?*
- *Where do you see the largest star?*
- *Where is the smallest star?*
- *Are there any areas that have no stars?*
- *Where is the brightest star? Is it the same as the largest star?*
- *Can you see any stars that are twinkling?*

II. Think About It

Help the students think about and answer the following questions. There are no “right” answers, and it is important that you allow your students to answer the questions in their own words.

- Do you think the largest star is also the brightest star? Why or why not?

(Often with the naked eye, the brightest stars also look like the largest stars. However, this may not literally be true. A close planet, which is much smaller physically than a star, can appear to be larger and brighter than a faraway sun-like star.)

- Do you think all of the “stars” are stars? Could some of them be planets? Why or why not?

(Planets look like stars in the night sky, and it can be very difficult with the naked eye to tell the difference. If you can find the planet Venus and the North Star Polaris, see if your students can observe any differences between the planet and the star.)

- Do you think the brightest star is the closest star? Why or why not?

(Brightness and closeness are not the same thing. Some of the brightest stars are very far away, and some of the closest stars can appear dim. The luminosity of stars varies. Compare the difference in luminosity between the light of a flashlight and that of a car headlight.)

III. What Did You Discover?

The questions can be answered verbally or in writing depending on the writing ability of the student. With these questions, help the students think about their observations. There are no “right” answers to these questions, and it is important for the students to write or discuss what they actually observed.

IV. Why?

The most important part of astronomy is observing. Learning to make good observations takes patience and practice. Simply looking at things is an essential element of astronomical observation—things such as where the stars are located, which ones appear bright, which appear dull, if there are any colored stars, and whether stars twinkle. Even when technology is added to the investigation, these observational skills are still needed. Looking through a telescope makes the stars appear larger, but observing the details is what makes the difference between a skilled astronomer and a novice. By observing the stars, students will begin to understand that there are both stars and planets in the night sky, that some stars are brighter than others and some are closer than others, and that stars may be different colors.

V. Just For Fun

Help the students find stars that are twinkling. Explain that tiny particles moving in the air can cause light to bounce around making stars appear to twinkle.

A nova is a star that has used up all of its own fuel. It increases and decreases in brightness as it takes hydrogen gas from a neighboring star, burns it, and then repeats the cycle. A supernova is a star that suddenly becomes very bright as it explodes. Then it slowly fades from view.