How to Use the GILBERT MICROSCOPE

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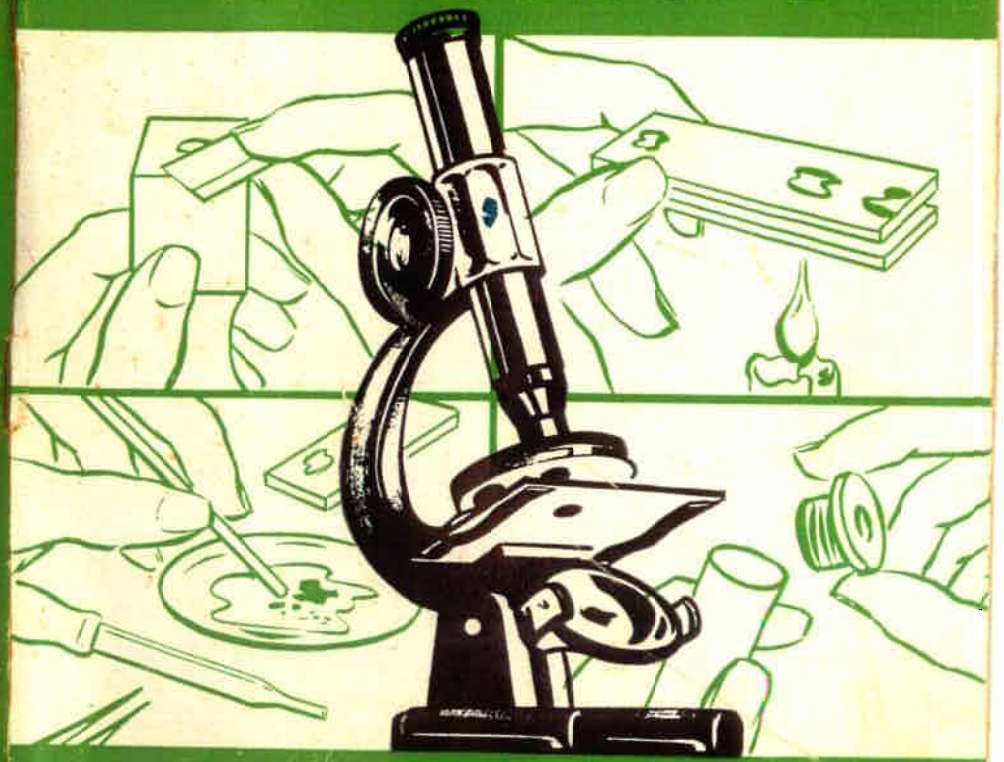
HOW TO USE THE Gilbert MICROSCOPE



ANOTHER GILBERT HALL OF SCIENCE PRODUCT

EXPLORING THE WORLD WITH THE MICROSCOPE

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LIST OF EXPERIMENTS THAT CAN BE DONE WITH THE No. 8 SET

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ALL EXPERIMENTS IN THIS MANUAL
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INTRODUCTION

Now that you own a Microscope you are equipped to undertake a journey of exploration such as you probably have never before enjoyed, for touring the world with your microscope for hidden sights is one of the most exciting pleasures that you can imagine.

Just think of the thrills there are in store for you.

Hidden mysteries and secrets of nature and science are brought to your clear vision through powerful, searching lenses and one after another amazing and unbelievable secrets are revealed.

You will see hundreds of new things — too small to find with just your eyes and you will marvel at intricate details of how things are made and put together.

You'll not only explore new and fascinating worlds but learn how to make tests, know about plants, animals, furs, textiles, paper, crystals, and do detective work as well.

The microscope, especially in this modern age is recognized as indispensable and few industries can get along without its aid.

Physicians and their assistants use it for blood counts and in examining bacteria which causes disease, scientists in making new and startling discoveries and you too can find no end of interesting objects by exploring your home and the things you and your folks use each day.

Each season of the year offers exciting experiments of its own and many of the experiments described in this manual may be performed anytime, even in mid-winter.

You will find some things which show nicely under the microscope with little care, but to really use the microscope you will wish to know how it works and how to prepare objects for examination. Even if you have used a microscope before, you will enjoy reading the first chapters of the manual and remember to make discoveries properly you should follow the directions given. Very few objects can be looked at with the microscope without some special treatment and this manual is written to tell you how to have the most fun with your new equipment. No manual, however long, could tell you of all the interesting things to see, but you will find thousands of objects all about you, at all times of the year, wherever you may be. Many people find that the microscope becomes a pleasant companion and make microscopy a delightful hobby. Years ago men either had to make their microscopes or had to pay a great deal for them, but now any boy may have a good microscope and can explore with it. Some of you may find that the microscope is necessary to your life work

WARNING!!

This set is not intended for children who cannot read and understand the accompanying Instruction Books.

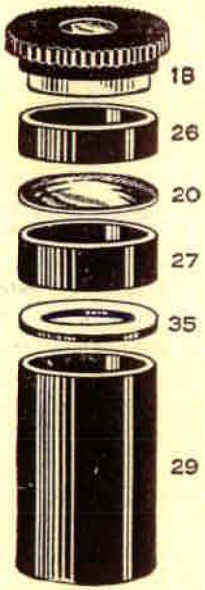
This set does not contain dangerous poisons and the chemicals mentioned in this manual are not embraced under the term "poisons." They are perfectly safe to use if handled carefully and intelligently. They are not intended to be taken by mouth or swallowed, and no intelligent person would be expected to use them for such purposes. It is necessary, however, to emphasize the fact that carelessness on the part of the experimenter can always lead to trouble. The author suggests, therefore, that all experimentation be carried out cautiously and according to the directions, especially when manipulations like heating is involved, or when gases are evolved in the reactions.

Before performing any experiments outlined in the manual, the following instructions should be read carefully and observed.

Before performing experiments, be sure to spread a thick layer of newspapers or other protective material over the table, so that hot liquids, candle grease, etc., will not injure the table.

Always read an experiment entirely through before starting to perform it. By following this rule many mistakes may be avoided.

Never point the open end of a test tube, while heating, at yourself or anyone nearby, as it may suddenly boil over, causing burns or injuring clothing. For the same reason never smell at the open end of a test tube while heating, or put your face near it.



INSTRUCTIONS FOR CLEANING AND CORRECTLY REPLACING LENSES IN YOUR MICROSCOPE

Microscope S6 has a collective lens and diaphragm located in main barrel and spaced as shown in diagram. After cleaning lenses it is important that spacing tubes, etc. be replaced exactly as shown.

Microscope S15 lenses are mounted in a short metal tube which can be taken from the large tube. Remove the eye lens in its mount, push long spacing tube up with finger and remove short spacing tubes and lens as you push them up. Clean lenses and replace in the order shown in diagram. For further information on the care of microscope lenses see Experiment 22 on Page 27, entitled, "Locating Dirt on the Microscope Lenses."

The Simple Microscope

Any round piece of transparent material may be used to make a simple microscope or hand magnifying glass. No one knows who discovered the first one, but we do know that many years ago clear pebbles were used to make objects look larger. The clearer the stone the better one can see through it. Glass is used now to make magnifying glasses. The glass may be round, or one side may be flat and the other side round. All that is necessary is that the center of the glass be thicker than the edge.

EXPERIMENT 1. Using the Hand Lens

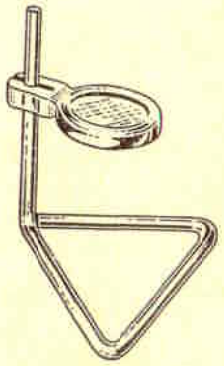


FIG. 1

Pull the simple lens from the support rod of the dissecting microscope of your set, fig. 1, and hold it near a piece of newspaper or other object. Bring the lens toward your eye until you find the position that gives the best view. Are the letters, or is the object right side up? Move the object while you look at it with the lens and note whether it appears to move in the same direction.

EXPERIMENT 2. Magnifying Power

Look at a hair or a small bit of wire. Compare the size of it as seen through the lens with the actual size. About how many times larger do you think it makes the hair?

EXPERIMENT 3. Magnifying Power of a Lens

A more accurate method of measuring the magnifying power is to determine the focal length of the lens. Hold a piece of white paper so that it faces a window or a light. Place the lens in front of the paper and move it slowly toward the window or light until you see a picture of the window or light on the paper. Then measure the distance from the center of the lens to the paper and this distance is the focal length. Divide 10 by the number of inches focal length and the result is the magnifying power. The lens that I have, has a focal length of 1 and ½ inches. Therefore its magnifying power is 10 ÷ 1.5 which is just a little over six and one-half times. Everything that I look at with it appears to be nearly seven times larger.

The magnifying power depends on how curved the lens is. The greater the curvature the larger appears the object seen through the lens. Smaller lenses have greater curvature. Tiny glass beads or round drops of water make high powered lenses. Leeuwenhoek (pronounced Lay' wen huk) made many simple microscopes by grinding very small glass beads and mounting them in a hole between two pieces of metal (fig. 2). Because it was hard to hold such a microscope steady he added an arm to hold the object and arranged screws to move the object and to hold it in place. Then the microscope could be passed around and his friends could see the interesting things. He saw bacteria, small plants and animals and his discoveries were

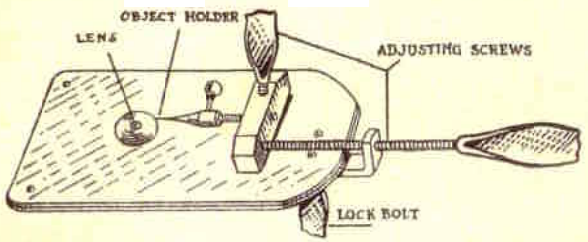


FIG. 2

so important that he used to send them from his home town, Delft, Holland, to the Royal Society in London. A great many of these little microscopes were made by him during the latter part of the seventeenth century. The one in the figure was drawn from a model made by the Bausch and Lomb Optical Co. in 1932 to celebrate the three hundredth anniversary of his birth.

EXPERIMENT 4. Making a Leeuwenhoek Microscope

Take a piece of cardboard and make a small hole through it with a nail. The hole should be less than 1/8 inch in diameter. If the cardboard is soft rub a little warm candle grease or paraffine into it to make it water proof. With a medicine dropper place a small drop of water in the hole. This is the lens. The drop should be small enough to round up. Place a fly on a pin and hold it close to the drop and look at it through the drop. You will find that the fly has to be held closer to the drop than it did to the hand lens. About how much does this simple microscope magnify? When the water evaporates it will have to be replaced. By using different sized holes and drops of water you can make similar microscopes with different powers.

The simple microscope, or hand lens, is used for preliminary examination of objects. The following experiments describe some of the observations you may make and you will think of many others.

EXPERIMENT 5. Cloth

Examine some cloth, such as a handkerchief and see how it was woven. How many threads are used to one-quarter inch? Do cloths which feel finer have more or less threads to the quarter inch?

EXPERIMENT 6. Finger Tip Patterns

Examine the ridges on your finger tips with the hand lens. Do they all have the same pattern? Are they the same on your friend's fingers?

EXPERIMENT 7. Finger Prints

If you have a stamp pad place a finger on it to cover it with ink and then place it on a piece of paper to give a finger print. If you do not have a stamp pad rub off some lead from a pencil and use it instead of the pad. Compare different finger prints using your lens.

EXPERIMENT 8. Lace

Look at some lace and see if it is woven the same as cloth.

To see the object clearly it must be held so that it is in the light and not shaded by the lens. Take your object to a window or to a light and you will soon learn how to hold the lens and object for best vision. Sometimes one can see better when the lens is held close to the eye.

EXPERIMENT 9. How Printing Appears

Look at different kinds of printing to see if the letters are equally clear. Look at a bit of colored "funny" paper and see how the colors are printed. Some will be plain color and others made by printing dots of a different color over the first color. The dots seem to blend with the plain color when seen by the unaided eye.

EXPERIMENT 10. Printed Pictures

Compare pictures made on good paper in a magazine with those printed in a newspaper. You will see that the picture is actually printed as dots and the coarser the paper, like newspapers, the coarser are the dots and the less clear the picture details become.

EXPERIMENT 11. Some Interesting Experiments

Minerals, frost on the window pane, crystals, dust, etc. will be interesting subjects when seen under your hand lens. In fact any object that can be brought into the light becomes more interesting under the magnifying glass. Be sure to look at plants, flowers, insects, etc.

EXPERIMENT 12. How to Use the Dissecting Microscope

If you wish to look at part of an insect it is convenient to have a stand and a rod for holding the lens so that your hands are free. For this work one puts the lens back onto the support rod of the dissecting microscope (fig. 1). The insect is put on one of the glass slides placed under the lens. The lens is slid up or down on the rod until the insect is seen clearly, or as we say, the lens is focused on the insect. The rod will hold it so you can move the insect around with the dissecting needles (fig. 3B) or take it apart with the forceps (sometimes called tweezers, fig. 3C). This dissection microscope will be used to prepare material for examination with the compound microscope as will be described later.

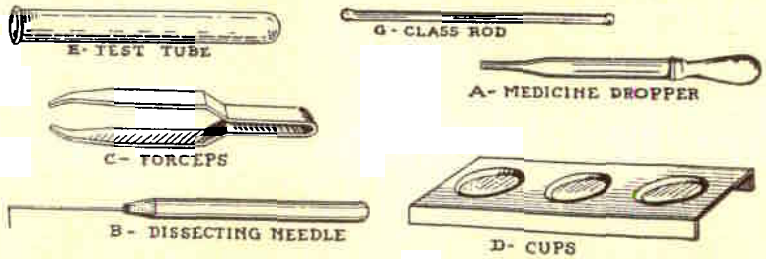


FIG. 3