NEWTON'S RINGS

TOPIC:

Light

SCIENTIST:

Isaac Newton 1642–1727

INTRODUCTION:

One of Isaac Newton's great interests was the study of optics. He spent much time being involved with the production of telescopes. An important part of their production was ensuring that the lenses were ground correctly so that they had a perfect shape. Newton noticed that if a slightly convex lens were pressed onto a glass plate and if light were reflected onto the lens, a series of colored concentric rings could be seen where the lens touched the sheet of glass. These rings became closer together as the distance from the center of the lens increased. Newton also found that where the lens was not perfect, neither were the rings. He used this principle to test whether a lens was faulty.

TIME NEEDED:

15 minutes

MATERIALS:

Note: This experiment must be performed in a room that can be darkened.

2 pieces of glass 15 cm x 15 cm x 2 mm thick
slightly convex lens, such as lens from an old pair of reading glasses
ring stand and clamp
protractor
magnifying glass
powerful flashlight
piece of cardboard approximately 10 cm x 10 cm
scissors
masking tape
pencil
3 or 4 books (to rest flashlight on)

Original Materials:

Newton used materials very similar to those you are using in this experiment. He would have used sunlight as his light source.

Safety Precautions

Please read and copy the safety precautions at the beginning of this book.

PROCEDURE:

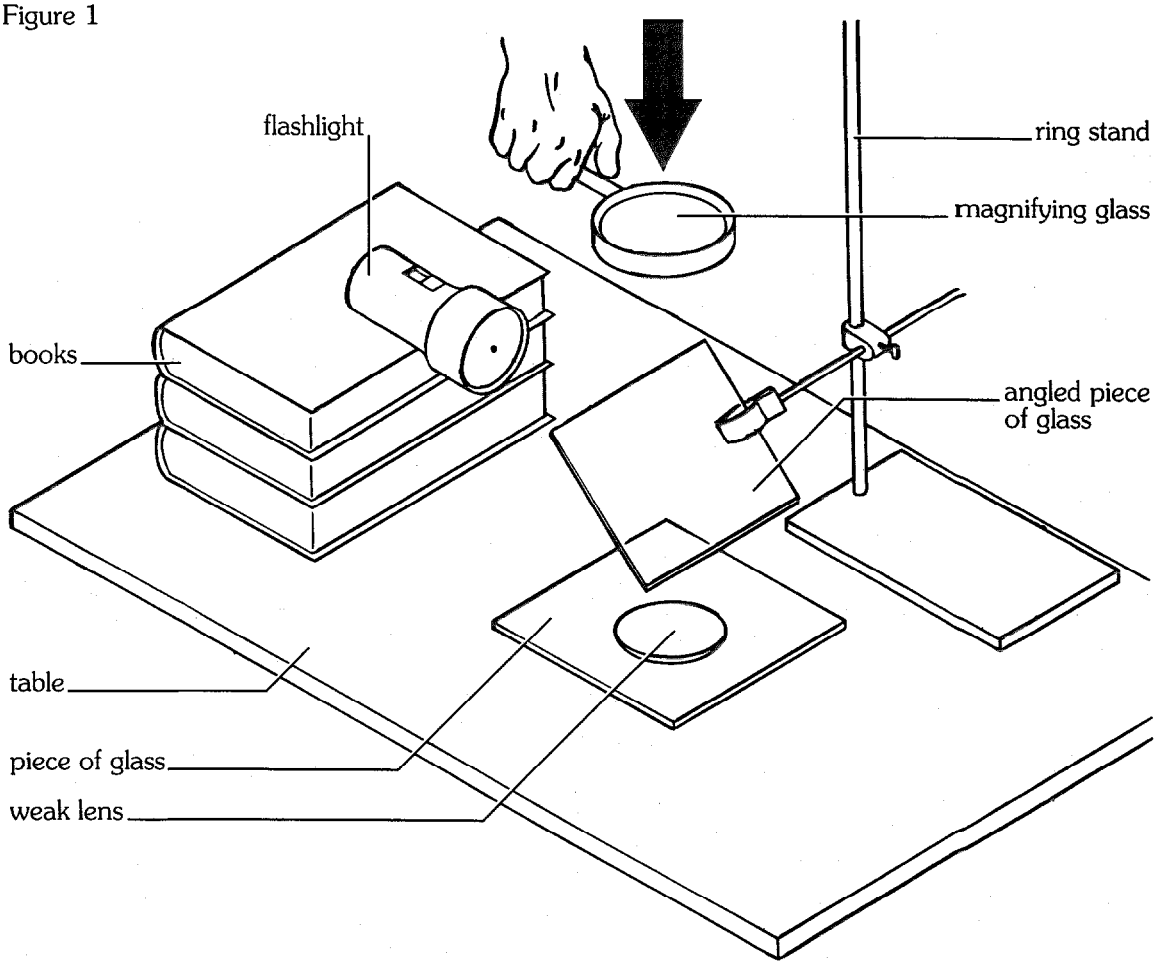
1. Put one piece of glass flat on the table.
2. Put the lens in the middle of the piece of glass.
3. Make a pile of books about 30 cm from the piece of glass.
4. Put the flashlight, lens downward, on the piece of cardboard. Trace the outside of the lens on the cardboard.
5. Cut out the cardboard outline. Make a small hole in the center with the scissors. Secure the cardboard shape over the lens of the flashlight with masking tape.
6. Put the flashlight onto the pile of books, pointing in the direction of the piece of glass.

7. Clamp the second piece of glass in a vertical position using the clamp attached to the ring stand. Adjust the position of the clamp so that the glass is at 45° to the vertical. Use the protractor to check this.

8. Position the angled piece of glass directly over the lens (see figure 1).

9. Darken the room so that there is no direct light coming into it. Switch on the flashlight. Adjust the height of the angled piece of glass so that it is in front of the light beam and so that it reflects the light beam down through the lens (see figure 1).

Figure 1



10. Stand so that you can look straight down through the angled piece of glass to the center of the lens. Use the magnifying glass to see if any patterns have appeared on the lens. You may need to move the magnifying glass up and down to achieve this.

ANALYSIS:

1. What did you see when you looked down on the lens?
2. From what you saw, what could you tell about the quality of the lens?

OUR FINDINGS:

Click on above link to see what we found.

SPECIAL SAFETY NOTE TO EXPERIMENTERS

Each experiment includes any special safety precautions that are relevant to that particular project. These do not include all of the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely necessary that you read, copy, and remain mindful of the General Safety Precautions that follow this note.

Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly while you are performing an experiment. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Always prepare for unexpected dangers by following basic safety guidelines the *entire* time you are performing the experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note: The book assumes that you will read the safety precautions that follow, as well as those in the box within each experiment you are preparing to perform, and that you will *remember* them. Except in rare instances, these precautions will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE does not mean that you should be careless when simmering water or stripping an electrical wire. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it.

If you ever have a question about whether a procedure or material is dangerous, wait to perform it until you find out for sure that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the experiments in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARING:
—Clear all surfaces before beginning experiments
—Read the instructions before you start
—Know the hazards of the experiments and anticipate dangers

PROTECTING YOURSELF:
—Follow the directions step-by-step; do only one experiment at a time
—Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eye wash, and first-aid kit
—Make sure there is adequate ventilation
—Do not horseplay
—Wear an apron and goggles
—Do not wear contact lenses, open shoes, loose clothing, or loose hair
—Keep floor and work space neat, clean, and dry
—Clean up spills immediately
—Never eat, drink, or smoke in laboratory or work space
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USING EQUIPMENT WITH CARE:
—Set up apparatus far from the edge of the desk
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs
—Don't use your mouth to pipette; use a suction bulb
—Clean glassware before and after use
—Check glassware for scratches, cracks, and sharp edges
—Clean up broken glassware immediately
—Do not use reflected sunlight to illuminate your microscope
—Do not touch metal conductors
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders

USING CHEMICALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly

HEATING SUBSTANCES:
—Use goggles, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—Turn off hot plates, bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Have fire extinguisher on hand

FINISHING UP:
—Thoroughly clean your work area and glassware
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residue and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws

BE SAFETY CONSCIOUS AT ALL TIMES