NATIONAL GEOGRAPHIC™

1200X Microscope Manual

SET INCLUDES...

Microscope
Prepared Slides
Blank Slides
Slide Covers
Labels
Collection Vials
Petri Dish
Macro Viewer
Tweezers
Scissors
Needle
Stiring Rod
Scalpel
Magnifying Glass
Graduated Cylinders
Specimen Slicer
Shrimp Hatchery
Textile Vial
Yeast Vial
Sea Salt Vial
Blue Dye Vial
Light Bulb

Not Included

AA x2

AGE 8+

WARNING:
Not suitable for children under 3 years of age. Contains functional sharp points and edges.

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Supervision by Adults

Read and follow the instructions, safety rules, and first aid information.

This microscope set is intended for children older than age 8. Children should only use this device under adult supervision. Never leave a child unsupervised with this device.

Accessories in this experimental kit may have sharp edges and tips. Please store the device and all of its accessories and aids out of the reach of young children when not being used due to a risk of injury. Warning! Not suitable for children under 3 years of age. Contains functional sharp points and edges.

This device contains electronic components that are powered by batteries. Never leave a child unsupervised with this device. Batteries should be kept out of children's reach. When inserting batteries, please ensure the polarity is correct. Insert the batteries according to the displayed +/- information.

Danger of Fires and Explosions!
Do not expose the device to high temperatures. Use only battery types recommended. Never mix old and new batteries. Replace all batteries at the same time. Never mix Alkaline, standard Carbon-Zinc, and rechargable Nickel-Cadmium batteries. Never short circuit the device or batteries or throw either into a fire. Exposure to high temperatures or misuse of the device can lead to short circuits, fires, or even explosions. Leaking or damaged batteries can cause injury if they come into contact with the skin. If you need to handle such batteries, please wear suitable safety gloves.

Chemicals
Any chemicals and liquids used in conjunction with the device should be kept out of reach of children. Do not drink any of the chemicals contained in this set. Hands should be washed thoroughly under running water after working with these chemicals. In case of accidental contact with the eyes or mouth, rinse the affected area with water. Seek medical treatment for ailments arising from contact with the chemical substances, and take the chemicals with you to the doctor.

Risk of Material Damage
Never take the device apart. Please consult our service center and send the device in for repair if needed.

Do not subject the device to temperatures exceeding 140°F.

Tips on Cleaning
Remove batteries from device before cleaning.

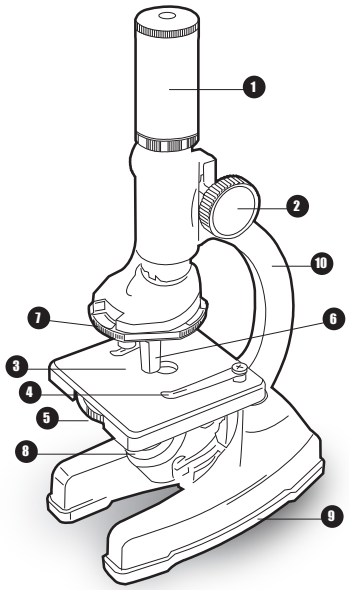
Microscope Care
Clean the exterior of device with a dry cloth. Do not use cleaning fluids to avoid causing damage to electronic components. Clean the lens (objective and eyepiece) with only a soft, lint-free cloth, like a microfiber cloth. Do not use excessive pressure—this may scratch the lens. Protect the device from dust and moisture. Store the device in the in its original packaging. Batteries should be removed from the device if it will not be used for a long period of time.

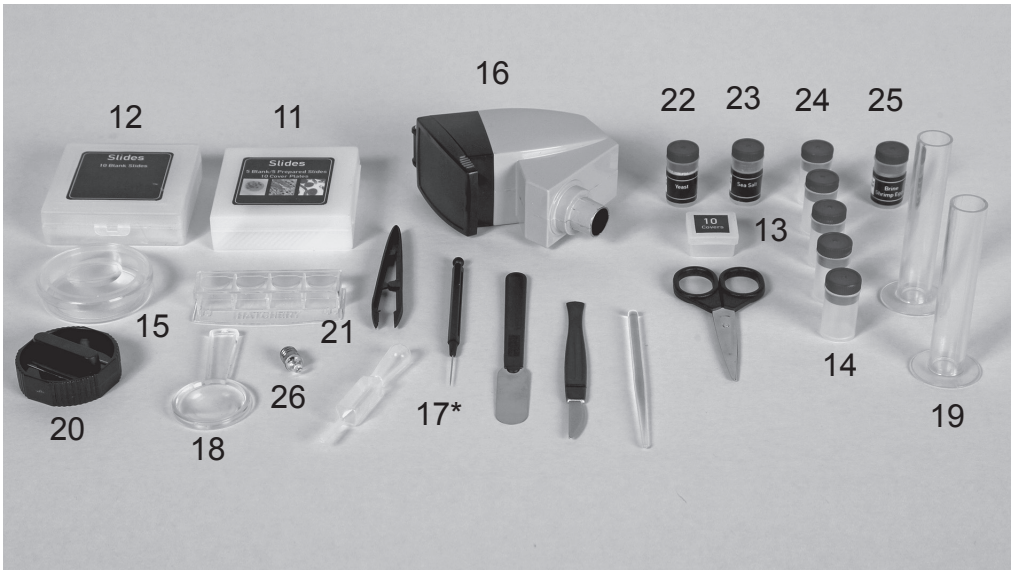
DISPOSAL
Keep packaging materials, like plastic bags and rubber bands, away from children, as they pose a risk of suffocation.

Dispose of packaging materials as legally required. Consult the local authority on the matter if necessary.

DISPOSAL
Dispose of the packaging materials properly, according to their type, such as paper or cardboard. Contact your local waste-disposal service or environmental authority for information on the proper disposal.

Please take the current legal regulations into account when disposing of your device. You can get more information on the proper disposal from your local waste-disposal service or environmental authority.





Microscope Parts:

1 Eyepiece
2 Focus Knob
3 Stage
4 Metal Stage Clips
5 Color Filter Wheel
6 Objective
7 Objective Turret (15X, 30X, 60X)
8 Illumination On/Off Switch and Mirror
9 Rubber Base and Battery Case
10 Microscope Arm

Additional Contents:
11 (5) Prepared Slides (10) Blank Slides
12 (10) Blank Slides
13 (10) Slide Covers/Labels
14 (4) Collection Vials
15 Petri Dish
16 Macro Viewer
17* Tweezers/Scissors/Needle/ Stiring Rod/Scalpel
18 Magnifying Glass
19 Graduated Cylinders
20 Specimen Slicer
21 Shrimp Hatchery
22 Textile Vial
23 Yeast Vial
24 Sea Salt Vial
25 Blue Dye Vial
26 Light Bulb
*Warning! Not suitable for children under 3 years of age. Contains functional sharp points.

Congratulations! You've chosen one of the highest quality microscopes available for young explorers. Read the following instructions carefully to get the greatest benefit from your precision instrument. Then try out the experiments to begin your investigation of the fascinating world around you.

How do I use my microscope?

Before you use your microscope, make sure that the table, desk, or surface that you place it on is stable and is not subject to vibration. If the microscope needs to be moved, hold it by the arm and base while carefully transferring it.

Install two "AA" batteries (not included) in the battery box, located in the base of the microscope. Remove the rubber base with a screwdriver, and insert the batteries according to the displayed +/- information. Reattach the rubber base with the screw.

Once the microscope is in a suitable location and the batteries are installed, check the light source to make sure that it illuminates. Use a microfiber cleaning cloth to gently wipe the lenses off. If the stage is dirty with dust or oil, carefully clean it off. Make sure that you only raise and lower the stage using the focus adjustment knob.

How do I operate the illumination?

Locate the mirror/light on the base of the microscope. Flip the mirror/light to the on position (with the light facing up) and the light will illuminate. This microscope is equipped with an incandescent light that illuminates the specimen from below. The color filter wheel (Fig. 5) is located in the middle of the microscope stage (Fig. 3). The filters help you when you are observing very bright or clear specimens. Using these filters, you can choose various brightness levels and colors. This helps you better recognize the components of colorless or transparent objects (e.g. grains of starch, or protozoa).

How do I adjust my microscope correctly?

Place the microscope in a suitable location as described above, and sit in a comfortable viewing position. Always start each observation with the lowest magnification. Adjust the distance of the microscope stage (Fig. 3) so that the stage is in the lowest position, farthest away from turret head. Turn the objective turret (Fig. 7) until it clicks into place at the lowest magnification (Objective 15X/300X). Note: Before you change the objective setting, always make sure the microscope stage (Fig. 3) is farthest away from turret by rotating the focus knob (Fig. 2). Separating the stage and turret by rotating the focus knob will avoid causing damage to the specimen slide or microscope. When starting an observation, always start with the 15X/300X objective (Fig. 7) in the rotating head (Fig. 3).

***Quick Fact** — The highest magnification is not always the best for every specimen!*

Magnification Guide		
Eyepiece	**Objective**	**Power**
20X	**15X**	**300X**
20X	**30X**	**600X**
20X	**60X**	**1200X**

How do I observe the specimen?

Sitting in your location with adequate illumination chosen from the color filter wheel, the following basic rules should be observed: Start with a simple observation at the lowest magnification. Position the object or specimen in the middle of the stage under the stage clips (Fig. 4), centered over the lower light (Fig. 8). Focus the image by rotating the focus knob (Fig. 2) until a clear image appears in the eyepiece.

NOTE: The higher the magnification, the more light you will require for a good image quality.

***Quick Fact** - The item you want to observe with the microscope is known as the object or specimen.*

Place the prepared slide directly under the objective on the microscope stage (Fig. 3) securing with the stage clips (Fig. 4). The prepared slide should be located directly over the lower illumination (Fig. 8). Look through the eyepiece and carefully turn the focus knob (Fig. 2) until the image appears clear and sharp. Now you can select a higher magnification by rotating the 30X/600X objective turret (Fig. 7). Higher levels of magnification can be achieved by turning the objective turret (Fig. 7) to a higher setting (600x or 1200x). Following this procedure creates a steady increase of magnification without overpowering the view of the object. The following magnifications should be considered: 300x, 600x, then 1200x.

Each time the magnification changes (due to the objective change), the image sharpness must be readjusted with the focus knob (Fig. 2). When doing this, be careful because if you move the microscope stage too quickly, the objective and the slide could come into contact and cause damage to the slide or microscope.

For transparent objects (e.g. protozoa), light is projected by the lower light, traveling from below the stage, through the objective and eyepiece, and finally into your eye. This process of light transmission is known as microscopy. Many microorganisms found in water, plant components, and the smallest animal parts are transparent in nature. Opaque specimens, on the other hand, will need to be prepared for viewing. Opaque specimens can be made transparent by a process of treatment and penetration with the correct materials (media), or by slicing. You can read more about creating specimens in the following experiment sections.

Troubleshooting Table

Problem	Solution
No recognizable image	• Turn on light • Readjust focus • Start with the lowest power objective (15X)
No image	• Center object on slide under lowest power objective (15X)
No light	• Replace batteries • Check on/off position

Cleaning Tips

To ensure your microscope has a long service life. Clean the lens (objective and eyepiece) with only a soft, lint-free cloth, like a microfiber cloth. Do not press down too hard while cleaning, as this might scratch the lens. Ask your parents to help if your microscope is really dirty. The cleaning cloth should be moistened with cleaning fluid and the lens wiped clean using very little pressure. Make sure your microscope is always protected against dust and dirt. After use, leave it in a warm room to dry off.

This microscope can be the gateway to a fun, creative learning process and will open the door to advanced knowledge of the world around you. It will allow you to explore the various fields of science, from biology to botany to chemistry and beyond, so have fun exploring the exciting world of science.

Experiment Instructions

WARNING!
• Keep chemicals and corrosive liquids out of the reach of children.
• Do not ingest any chemicals.
• Wash your hands thoroughly with soap under running water after use.

Introduction

Here are a few tips about how to take a better look at the wonderful world of microorganisms and crystals. You will learn how to prepare your object so that you can look at it with the microscope. The numerous experiments described should make you curious and want to use your microscope more.

Objects to Observe

With a magnifying glass, you can look at non-transparent (i.e. opaque) objects like small animals, parts of plants and tissues. When you use a magnifying glass, light falls onto the object and is reflected back through the magnifying lens and into your eye. With your microscope, however, you can observe transparent objects. The light from the lamp goes through the opening on the stage and through your prepared specimen. Then, it passes through the objective, the body of the microscope, and the eyepiece , and travels into your eye. In this way, the microscope is only meant for observing transparent objects. Many microorganisms in water, parts of plants, and the tiniest animal parts are naturally transparent. To observe opaque objects under the microscope, we must make them transparent. We may make them transparent through a treatment or penetration with the right materials (media), or by taking the thinnest slices from them (using our hand or a specimen slicer), and then examine them. Below you'll find out how to do this.

How to Produce Thin Specimen Slices

WARNING:

Only do this with an adult's supervision.Ask your parents to help you. As already mentioned, you need to get the thinnest slices possible from an object so that they are transparent and can be looked at under the microscope. First, get a candle and place it in an old pot, then heat it on the stovetop until the wax becomes liquid. Now, use tweezers to dip the object in the liquid wax a few times. Be careful, the wax is very hot! After each dip, allow the wax to harden before you dip the object into the wax again. When the wax around the object has hardened completely, you can use the specimen slicer to cut it into thin slices. Place these slices on a slide and cover them with a cover slip.

The Production of Specimens

There are two basic types of specimens: permanent specimens and short-term specimens.

Short-term Specimens

Short-term specimens are produced from objects that you want to look at, but don't want to keep in your specimen collection. These specimens are only meant to be observed for a short period of time, after which they are disposed of. For short-term specimens, place the object on the slide and place a cover slip on top of it. After looking at the

object, clean the slide and cover slip, disposing of the specimens.. One of the secrets of successful observation with a microscope is the use of clean slides and cover slips. Spots or stains will distract you when looking at an object.

Permanent Prepared Specimens

Permanent prepared specimens are produced from objects that you would like to look at again and again. The preparation of dry objects (e. g. pollen or the wings of a fly) can only be done with special glue. You'll find such glue at a local hobby store or online, identified as "gum media." Objects that contain liquid must first have the liquid taken out of them before they can be prepared as permanent specimens.

How to Prepare a Dry Object

First, place the object in the middle of a clean slide and cover it with a drop of glue (gum media). Then place a cover slip on top of the object and glue. Lightly press the cover slip, so that the glue spreads to the edges. Let the specimen harden for 2-3 days before observing it.

How to Prepare a Smear Specimen

For a smear specimen, place a drop of the liquid to be observed (e.g. water from a puddle in the forest) on the end of the slide using a pipette. Then smear the liquid across the slide with the help of a second slide. Before observing, let the slides dry together for a few minutes.

Experiments

Experiment 1:
Black - and - White Print
Objects:
1. A small piece of paper from a newspaper with a black and white picture and some text.
2. A similar piece of paper from a magazine with color pictures and text.
In order to observe the letters and the pictures, produce a short-term slide from each object. Now, set your microscope to the lowest magnification to look at the specimen from the newspaper. The letters on the newspaper look frayed and broken, since they are printed on raw, low-quality paper. Now look at the specimen from the magazine. The letters on the magazine specimen look smoother and more complete. The pictures in the newspaper are made up of many tiny dots, which appear slightly smudgy. The halftone dots of the magazine picture are clearly defined.

Experiment 2:
Color Print
Objects:
1. A small piece of color - printed newspaper
2. A similar piece of paper from a magazine
Make short-term specimens from the objects and observe them with the lowest magnification. The colored halftone dots of the newspaper often overlap. Sometimes, you'll even notice two colors in one dot. In the magazine, the dots appear clear and rich in contrast. Look at the different sizes of the dots.

Experiment 3:
Textile Fibers
Objects and accessories:
1. Threads from various fabrics (e.g. cotton, linen, wool, silk, rayon, and nylon)
2. Two needles
Place each thread on a separate slide and fray the samples using the two needles. Next, wet the threads and cover them each with a cover slip. Set the microscope to one of the lower magnifications. Observe each slide in turn. Cotton fibers come from a plant and look like a flat, twisted ribbon under the microscope. The fibers are thicker and rounder at the edges than in the middle. Cotton fibers are basically long, collapsed tubes.
Linen fibers also come from a plant, and they are round and run in one direction. The fibers shine like silk and exhibit many bulges along the length of the thread.
Silk comes from an animal and is made up of solid fibers that are small in diameter, in contrast to the hollow plant-based fibers. Each fiber is smooth and even and looks like a tiny glass tube.
The fibers of the wool also come from an animal. The surface is made of overlapping sleeves that look broken and wavy. If possible, compare wool from different weaving mills. In doing so, take a look at the different appearance of the fibers. Experts can determine which country the wool came from by doing this.
Rayon is a synthetic material that is produced by a long chemical process. All the fibers have solid, dark lines on the smooth, shiny surface. After drying, the fibers curl into the same position. Observe the differences and the similarities between the different types of fibers.

Experiment 4:
Table Salt
Object: Common table salt
Place a few grains of salt on a slide, and observe the salt crystals with the lowest setting of your microscope. The crystals are tiny cubes and are all the same shape.

Experiment 5:
Production of Salt Crystals
Objects and accessories:
1. Table salt
2. A graduated cylinder filled halfway with warm water to dissolve the salt
3. Cotton thread
4. Paper clips
5. A matchstick or pencil
Add salt to the water until the salt will no longer dissolve. You now have a saturated salt solution. Wait until the water has cooled. Attach a paper clip to the end of the cotton thread. The paper clip serves as a weight. Tie the other end of the cotton thread into a knot around the match, and dip the end with the paper clip in the salt solution. Place the match horizontally on top of the test tube, which prevents the cotton thread from slipping all the way down into the test tube. Now, place the tube in a warm place for 3-4 days. If you take a look at the glass after a few days under the microscope, you can see that a little colony of salt crystals has formed on the cotton thread.

Experiment 6:
Raising Brine Shrimp
Accessories:
1. Shrimp eggs (at your local hobby store)
2. Sea salt
3. Hatchery
4. Yeast
Artemia salina are a species of shrimp typically found in salt lakes, bodies of water with a higher salinity than even the ocean. During a drought, a salt lake can become a hostile habitat for organisms, and entire populations of Artemia salina sometimes die off. During drought conditions, to ensure that the species will repopulate the salt lake when the drought ends, Artemia salina lay thick-shelled eggs called winter eggs that can survive for up to ten years in a dormant state. Winter eggs can withstand heat, cold and chemicals. These eggs hatch when favorable conditions return to their ambient environment. The eggs provided (23d) are of this type.

Incubate Your Brine Shrimp
To hatch the shrimp, create a solution with an appropriate salinity and temperature. First, fill two containers with a half litre of freshwater, and let them both stand for

about thirty hours. Next, pour half of the provided salt into one container and stir the solution until the salt dissolves. Pour some of this solution into the prawn hatchery. Place a few eggs close to the lid. Position the hatchery somewhere with plenty of light but not in direct sunlight. The ambient temperature should ideally hover around 77°F. As water in the hatchery evaporates, gradually add fresh water from the second container. After two to three days, the eggs will hatch prawn larvae, called nauplii.

Observe Your Brine Shrimp
The animal that hatches from the egg is known as a nauplius larva. With the help of a pipette, you can place a few of these larvae on a glass slide and observe them. The larvae will move around in the salt water by using their hair-like appendages. Take a few larvae from the container each day and observe them under the microscope. Remember to return them to their container when you're done observing them. In case you've hatched the larvae in a hatchery, simply take off the cover of the tank and place the tank on the stage. Depending on the room temperature, the larvae will be mature in 6-10 weeks. Soon, you will have raised a whole generation of brine shrimp, which will constantly grow in numbers.

Feed Your Brine Shrimp
Feed your brine shrimp often to keep them alive. The best food is dry-powdered yeast. Give the some every other day. Be careful not to overfeed them, as doing so can cause the water to stagnate and poison the shrimp. If the water does begin to stagnate (you'll see it darkening), transfer the shrimp to a freshwater solution.

Warning! The shrimp eggs and the shrimp are not meant to be eaten!
Experiment 7:
Developing Bread Mold
Object: An old piece of bread
Put the bread on a slide and lightly moisten it with water. Place the bread into a sealed container, and keep it warm and out of harsh light. Within a short time, black bread mold will form. When the mold takes on a white, shiny appearance, remove the slide from the container and observe it with your microscope. It will look like a complicated mass of thread, forming the fungus body, which is called the mycelium. Each thread is known as a hypha. These threads, or hyphae, grow like long, slim stacks, ending in a small, white ball, called a sporcap. Inside the sporcap is a spore that will eventually be released to start new colonies of mold. With your microscope you can watch this amazing transformation unfold.

Experiment 8:
Observing Stem and Root Sections
Objects:
1. A celery stalk
2. A carrot
Cut several very thin slices from the middle of the celery (a stem) and from the middle of the carrot (a root). Make a wet mount by placing a drop of water on the slide. Then put the specimen on the water-covered slide, and top it with a cover slip. The water will help support the sample. It also fills in the space between the cover slip and the slide. Start by viewing the specimens at the lowest magnification and then increase the magnification, for more detailed observation. What differences are there between the stem and the root?

Experiment 9:
Observing Cork Cells
Object: A small cork
With an adult's supervision, cut a very thin slice from the cork. The thinner you cut the slice, the better you'll be able to observe it.. Prepare a wet mount of this cork slice as you did with the celery and carrot in Experiment 8. When applying the cover slip over the slide, the water, and the cork, make sure no air bubbles are trapped beneath it. Begin observing the specimen with the lowest power, and increase the magnification as desired. The cells you see, called lenticels, are actually the air pockets that are left after the plant material inside has died.

Experiment 10:
Observing Leaf Cells
Objects: A fresh leaf, clean and dry, without holes or blemishes
With an adult's supervision, cut a one-inch -wide cross section out of the center of the leaf, from one side of the leaf to the other. Tightly roll that section up, starting from one uncut edge of the leaf. The central vein of the leaf will be in the center of the roll and not be visible. Then cut several very thin slices off of one end of the roll. The central vein will be in the middle of this almost transparent slice. You'll be observing the cells around that central vein. Using a droplet of water, make a wet mount (as in Experiments 8 and 9), placing the leaf segment so that the inner part faces up. Start with the lowest power and gradually increase the magnification for more detail. What do you observe about the leaf cells?

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