

POCKET MICROSCOPE

NATURE DISCOVERY KIT



What's inside your experiment kit:





Kosmos Quality and Safety

More than one hundred years of expertise in publishing science experiment kits stand behind every product that bears the Kosmos name. Kosmos experiment kits are designed by an experienced team of specialists and tested with the utmost care during development and production. With regard to product safety, these experiment kits follow European and US safety standards, as well as our own refined proprietary safety guidelines. By working closely with our manufacturing partners and safety testing labs, we are able to control all stages of production. While the majority of our products are made in Germany, all of our products, regardless of origin, follow the same rigid quality standards.

1st Edition 2016
© 2016 Franckh-Kosmos Verlags-GmbH & Co. KG,
Pflzerstr. 5-7, D-70184 Stuttgart, Tel. +49 (0) 711 2191-343

This work, including all its parts, is copyright protected. Any use outside the specific limits of the copyright law without the consent of the publisher is prohibited and punishable by law. This applies specifically to reproductions, translations, microfilming, and storage and processing in electronic systems and networks. We do not guarantee that all material in this work is free from copyright or other protection.

Project management: Dr. Mark Bachofer
Technical product development: Steffen Rothweiler
Manual design concept: Atelier Bea Klenk, Berlin
Layout typesetting: Südgrafik, Stuttgart
Technical conception for assembly: rotor-design, Stuttgart
Illustrations: Aannazakharchenko ©fotolia.com p. 3 bottom left, p. 17 top + middle; Alhovic @shutterstock.com p. 19 bottom left; Friedrich Werth, Horb/N. 11 top, 17 bottom left, 18, 19 middle right, 20 bottom left; Markus Hirche, rotor-design, Stuttgart front cover; all other illustrations Andreas Resch, St. Ulrich am Waasen, Austria
Manual photos: picsfive (all pushpins); askaja (all paper clips); Jaimie Duplass (all strips of tape); contrastwerkstatt p. 14 bottom right, 2 top, 4 middle left; goir p. 4 middle right; gorilaze p. 3 middle left, 14 middle; Henrik Larsson p. 16 bottom right; mates p. 15 top right, p. 16 bottom left, 21 middle upper right; pit24 p. 20 top right; Stocksnapper p. 20 top left; Thorben Wengert p. 16 middle right; Tim UR p. 15 middle right; vicu9 p. 4 bottom right; Vladyslav Siaber p. 15 bottom right; uomoe p. 15 bottom left (all ©fotolia.com); arlindo71 ©istockphoto.de p. 14 middle right, p. 16 bottom middle; Marek Velechovsky @shutterstock.com p. 19 top left; M. Bachofer, Stuttgart p. 3 bottom middle, p. 17 top + bottom middle, 20 bottom middle; MEV/CreativCollection p. 3 bottom right, p. 16 top right, p. 20 bottom right

Packaging layout: Südgrafik, Stuttgart
Packaging design concept: Peter Schmidt Group GmbH, Hamburg
Packaging illustrations: rotor-design, Stuttgart (illustrations on front side); Andreas Resch, St. Ulrich am Waasen, Austria (material illustrations on back side); constantincornel (compound eye); gnmira (wasp); both ©fotolia.com

The publisher has made every effort to locate the holders of image rights for all of the photos used. If in any individual cases any holders of image rights have not been acknowledged, they are asked to provide evidence to the publisher of their image rights so that they may be paid an image fee in line with the industry standard.

1st English Edition © 2017 Thames & Kosmos, LLC, Providence, RI, USA
Thames & Kosmos® is a registered trademark of Thames & Kosmos, LLC.

Translation: David Gamon; Editing: Ted McGuire; Additional Graphics and Layout: Dan Freitas

Distributed in North America by Thames & Kosmos, LLC.
Providence, RI 02903
Phone: 800-587-2872; Web: www.thamesandkosmos.com

Distributed in United Kingdom by Thames & Kosmos UK, LP.
Goudhurst, Kent TN17 2QZ
Phone: 01580 212000; Web: www.thamesandkosmos.co.uk

We reserve the right to make technical changes.

Printed in China / Imprimé en Chine

>>> KIT CONTENTS

Checklist: Find – Inspect – Check off

✓	No.	Description	Qty.	Item No.
<input type="radio"/>	1	Left housing	1	718 024
<input type="radio"/>	2	Right housing	1	718 026
<input type="radio"/>	3	Housing cover portion	1	718 027
<input type="radio"/>	4	Microscope stand	1	718 176
<input type="radio"/>	5	Transparent bottom housing attachment	1	718 029
<input type="radio"/>	6	Zoom adjustment wheel	1	718 030
<input type="radio"/>	7	Focus adjustment wheel	1	718 031
<input type="radio"/>	8	Eyepiece ring	1	718 033
<input type="radio"/>	9	Battery compartment cover	1	718 038
<input type="radio"/>	10	Eyecup	1	718 177
<input type="radio"/>	11	Eyepiece sleeve ring	1	718 178
<input type="radio"/>	12	Jacket sleeve	1	718 180
<input type="radio"/>	13	Middle sleeve with relay lens	1	718 181
<input type="radio"/>	14	Inner sleeve with objective lens	1	718 182
<input type="radio"/>	15	Button cell battery 1.5-volt, type LR 44	3	718 183
<input type="radio"/>	16	Prepared slide: <ul style="list-style-type: none"> · Fish scale · Snakeskin scale · Bird's feather 	1	718 043
<input type="radio"/>	17	Slide for your own specimens	1	718 044

✓	No.	Description	Qty.	Item No.
<input type="radio"/>	18	Illumination knob with large spring	1	718 032
<input type="radio"/>	19	Battery compartment closure knob with small spring	1	718 184
<input type="radio"/>	20	Eyepiece lens	1	718 185
<input type="radio"/>	21	Carrying strap	1	718 186
<input type="radio"/>	22	Electronic unit with switch, LED bracket, and wires	1	718 028
<input type="radio"/>	23	Screws for housing pieces	2	718 188
<input type="radio"/>	24	Screw for bottom housing attachment	1	718 187
<input type="radio"/>	25	Holding pin for carrying strap	1	718 189

Parts that are not included in the kit are indicated in *italic script* under the “YOU WILL NEED” heading in the experiments.

You will also need:

Small Phillips-head screwdriver, pen, tape, scissors (optional), interesting objects from around the house or from nature to study under the microscope

Dear Parents and Supervising Adults,

This experiment kit will help your child discover a world of small and fascinating things from a microscopic or macroscopic perspective. And not only that — by assembling the microscope from its individual parts, he or she will learn how its lenses, electrical elements, and mechanical parts work. Please be ready to help your child with the microscope assembly and be sure to check its electrical components and verify that the batteries are inserted in the correct polarity direction. We wish you and your child a lot of fun with the experiments!



- ▶ **WARNING!** Only for use by children aged 8 years and older. Instructions for parents or other supervising adults are included and have to be observed. Keep the packaging and instructions as they contain important information.

Never look directly into the sun, whether with the lenses, the pocket microscope, or the naked eye. You could blind yourself!

- ▶ **WARNING!** Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.



- ▶ **WARNING!** This product contains a Button or Coin Cell Battery. A swallowed Button or Coin Cell Battery can cause serious internal chemical burns in as little as two hours and lead to death.

- ▶ **WARNING!** Dispose of used batteries immediately. Keep new and used batteries away from children. If you think batteries might have been swallowed or placed inside any part of the body, seek immediate medical attention.

Safety for Experiments with Batteries

- ▶ The microscope requires three 1.5-volt button cell batteries, which are included in the kit.
- ▶ Batteries are only to be handled, inserted, and replaced by an adult.
- ▶ Batteries are to be kept away from children.
- ▶ The assembly of the microscope should be checked by an adult.
- ▶ Avoid short-circuiting the batteries. A short circuit can cause the wires to overheat and the batteries to explode.
- ▶ Different types of batteries (rechargeable and non-rechargeable) or new and used batteries are not to be mixed.
- ▶ Do not mix old and new batteries.
- ▶ Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- ▶ Batteries are to be inserted with the correct polarity orientation. Press them gently into the battery compartment.
- ▶ Non-rechargeable batteries are not to be recharged. They could explode!
- ▶ Rechargeable batteries are only to be charged under adult supervision.
- ▶ Rechargeable batteries are to be removed from the toy before being charged.
- ▶ Exhausted batteries are to be removed from the toy.
- ▶ The supply terminals are not to be short-circuited.

WARNING! Used batteries do not belong in the household trash! In some states and countries, it is required by law to deliver batteries and rechargeable batteries to a local collection location or to a store. This will ensure that they will be disposed of in an environmentally responsible manner. Batteries containing hazardous substances are identified by this image or by chemical symbols (Cd = cadmium, Hg = mercury, Pb = lead).



Notes on Environmental Protection

This product's electronic components are reusable, and for the sake of environmental protection they should not be disposed of in the household trash at the end of their lifespan. Instead, they must be delivered to a collection location for electronic waste. This is indicated by the following symbol:



Please consult your local authorities for the appropriate disposal location.

>>> TABLE OF CONTENTS

Kit Contents 1
Safety Information/A Word to Parents and Adults 2
Table of Contents 3

Your Pocket Microscope 4
 Assemble the microscope, insert the batteries, and off you go!

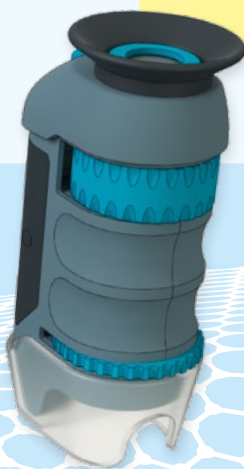
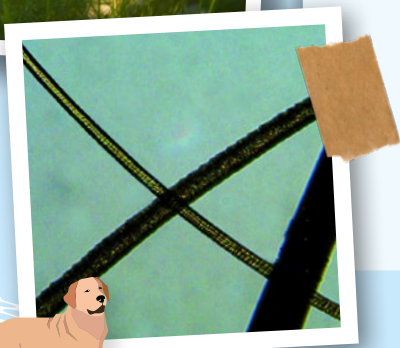
Assembly 5
First look 12

Exploring the World with your Microscope 14
 Here's where you will find suggestions for all the things you can study under your microscope.

Studying plants 15
Exciting bugs 16
Crime scene clues 17

TIP!

You will find additional information under "Check It Out" on pages 11, 18, 19, and 20.



Your Handy Pocket Microscope

Assemble the microscope, insert the batteries,
and off you go!



ASSEMBLY

1



Start by attaching the two black sleeves with the lenses and the jacket sleeve.

Pay attention to the alignment notches as you do this.

2



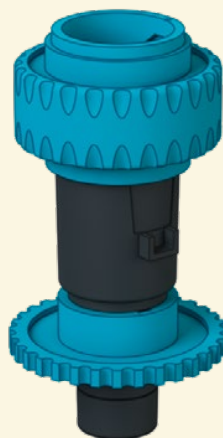
3

The zoom adjustment wheel is mounted on the top. This will be used to move the relay lens and adjust the zoom setting between 20-fold and 40-fold magnification.

The focus adjustment wheel goes on the bottom. This will move the objective lens.

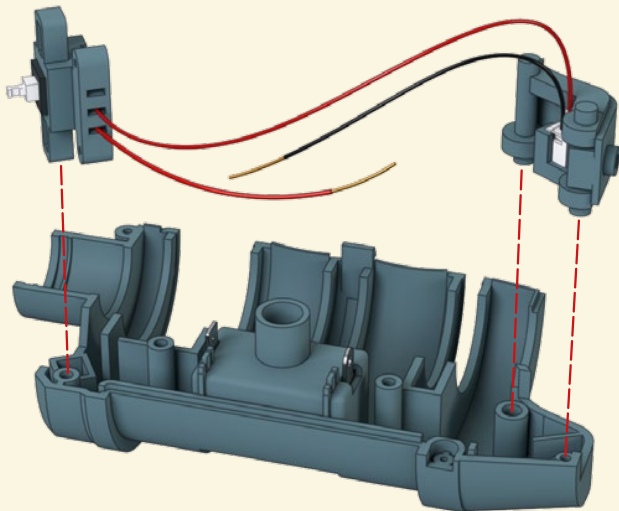


4



ASSEMBLY

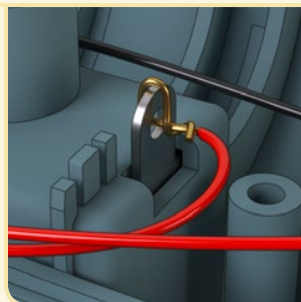
5



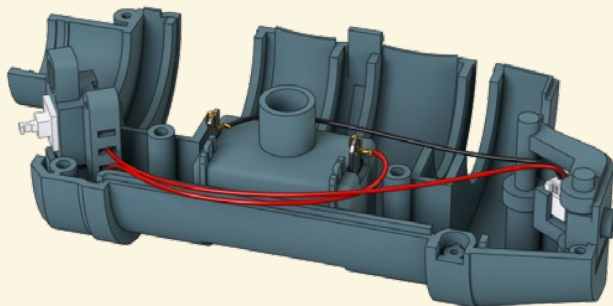
Take the electronic unit and attach the switch and the LED lighting bracket to the proper locations in the housing.

6

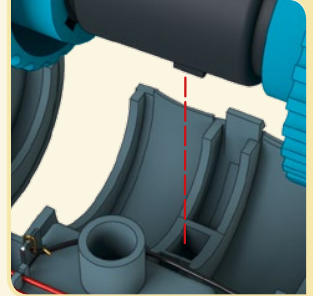
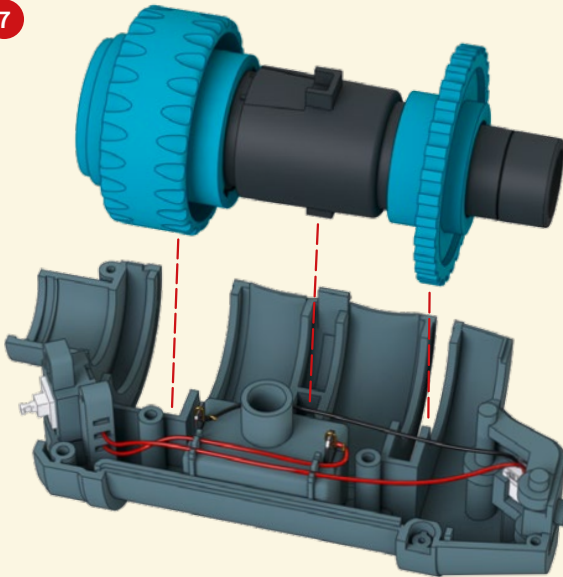
Twist the end of the red wire onto the proper contact of the battery compartment. Secure the end of the black wire in the same manner to the other battery compartment contact.



Then, clamp the wire into the brackets.

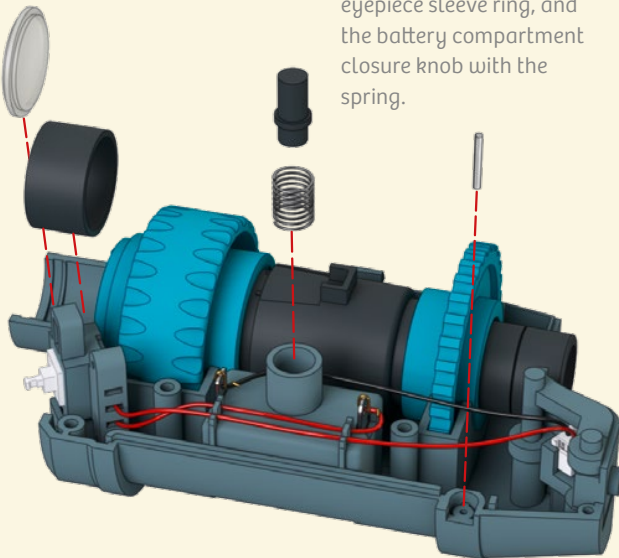


7

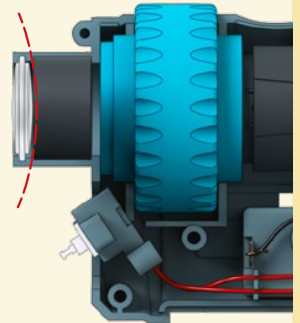


Insert the optical unit into the housing. Make sure that the center portion's notch fits into the groove in the housing.

8



Insert the eyepiece lens, the eyepiece sleeve ring, and the battery compartment closure knob with the spring.

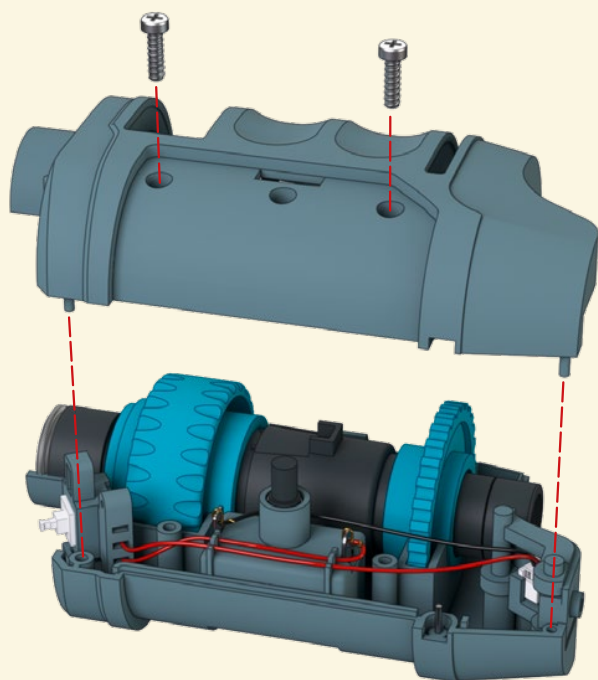


Insert the lens with its more curved side on the inside.

Don't forget to insert the little carrying strap pin!

ASSEMBLY

9



Now attach the second housing section. First re-check the positions of all the components.

Use the two larger screws to close the housing, using a small Phillips-head screwdriver.

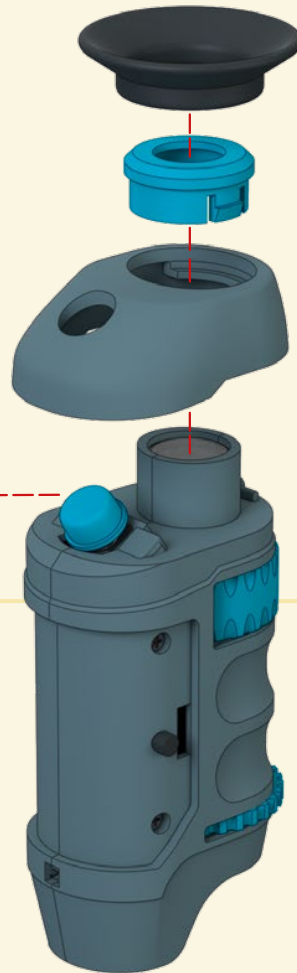
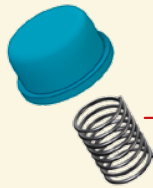
10



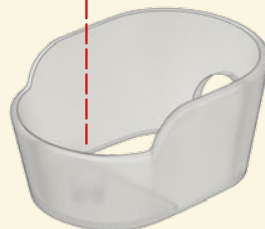
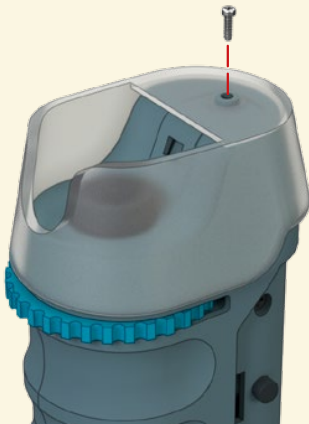
The basic assembly is now complete. Check the functioning of the zoom and focus adjustment wheels.

- 11** Assemble the three upper components of the microscope (eyecup, eyepiece ring, and upper housing cover). Before mounting the parts on the microscope, you will have to prepare the illumination knob.

- 12** Insert the illumination knob with the spring and snap all the parts together.

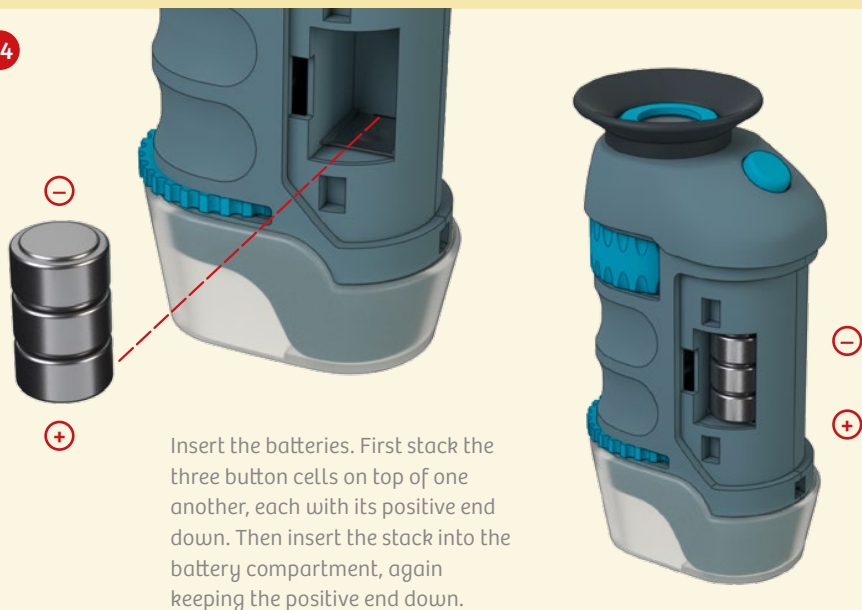


- 13** Turn the instrument upside down and attach the transparent bottom housing cover with the small screw.



ASSEMBLY

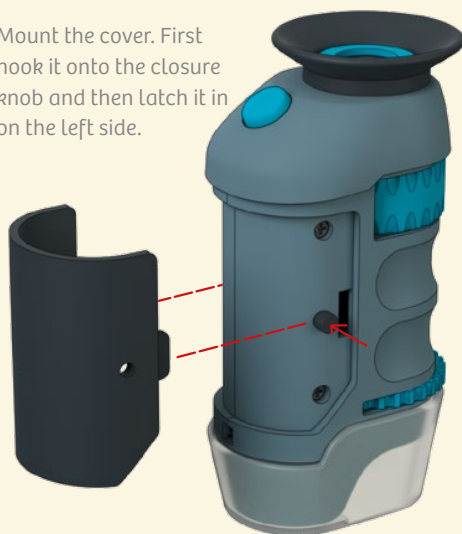
14



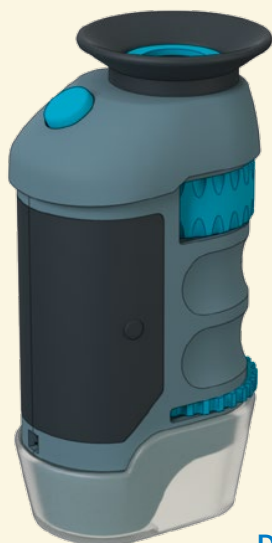
Insert the batteries. First stack the three button cells on top of one another, each with its positive end down. Then insert the stack into the battery compartment, again keeping the positive end down.

15

Mount the cover. First hook it onto the closure knob and then latch it in on the left side.



16



Done!

CHECK IT OUT

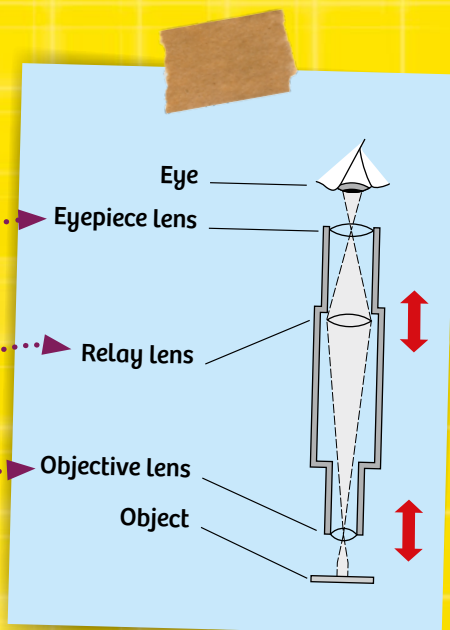


Light path

In putting together your microscope, you assembled the various lenses and their sleeves into a so-called “optical path.” The **eyepiece lens** sits fixed at the upper end. This is what your eye looks through.

The **relay lens** can be moved up and down with the zoom adjustment ring. It lets you switch between a low level of magnification (20 times) and high magnification (40 times).

The focus adjustment ring moves the **objective lens**. That adjusts the distance from the object in a way that lets you focus the image.



Circuit

When you installed the wires and electronic components, you built a circuit. From the positive terminal of the battery compartment, the red wire goes to the **switch** and then to the illumination unit, where the LED bulb is installed. From the bulb the black wire leads to the negative terminal of the battery compartment. When batteries are inserted and the switch is turned on, the circuit is closed. The current flows from the batteries through the **light**, and the LED lights up. If the switch is pushed again, the circuit is interrupted. Then the light goes out.



DID YOU KNOW?

An instrument that has at least a 40-fold magnification is called a microscope. Lower levels of magnification are often called “macroscopic.” Both words are based on Greek roots. “Mikros” means small, and “makros” means large. In either case, what it means is that small things can be seen as if they were noticeably larger.



FIRST LOOK

Use the illumination knob to switch the LED light on and off.



Attach the carrying strap by wrapping the thin end around the pin.



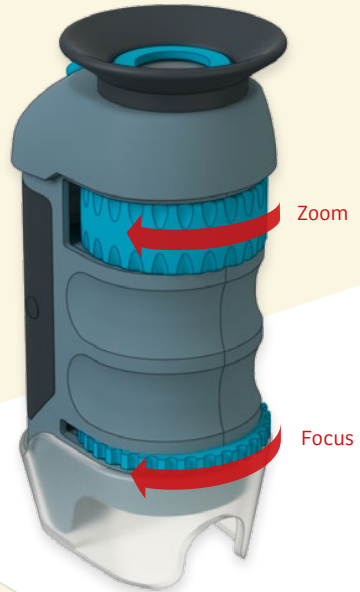
2 Then pull the thick end through the loop.

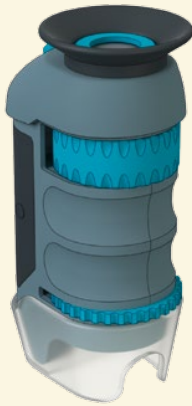


3 Now you can take the microscope with you wherever you go.

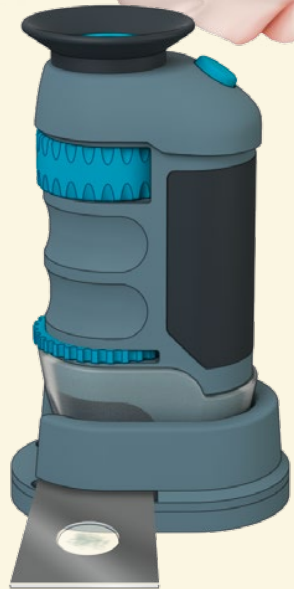
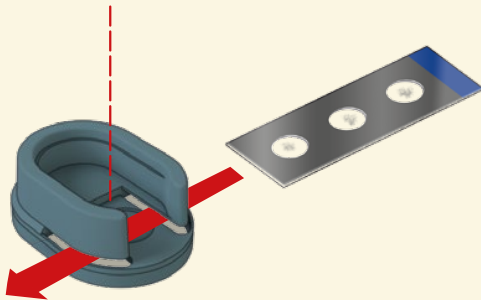


Now look through the microscope. First, set it on a flat surface (such as a piece of fabric or a sheet of paper), and use the lower wheel to adjust the focus. After that, you can still use the upper wheel to select your magnification (20-fold all the way to the left, 40-fold all the way to the right). Then focus it again.

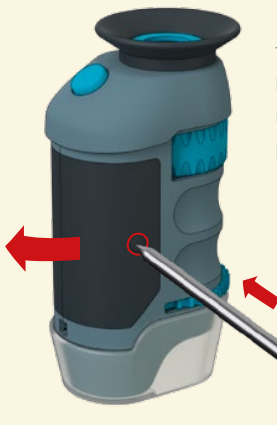




The microscope stand can be mounted in order to examine slide specimens.



Try examining the prepared slide included in the kit. It has fish and snake scales and a bird feather on it.



To replace the batteries, press the battery compartment knob with a pen or pencil while pushing the cover to the side.



Be sure to pay attention to the proper polarity when changing the batteries (see page 10).

Exploring the World with your Microscope

Here's where you will find suggestions for all the things you can study under your microscope.



EXPERIMENT 1

YOU WILL NEED

- › **Pocket microscope**
- › *Leaves and flowers of various plants (such as thyme, rosemary, blackberry, daisy, and dandelion)*

HERE'S HOW

Use your microscope without its stand. Place it directly over the flowers or leaf surfaces. Choose various settings and study both sides of the leaves.



PLANTS UP CLOSE!

In the **flowers**, you can often see **stamens** with pollen and **ovaries** with ovules. Some **flower heads** such as those of daisies consist of lots of tiny individual flowers.

On the surface of **leaves**, you will often notice countless details such as **hairs**, **stomata** (little pores), **spines**, and other structures that protect the plant from the sun, from drying out, or from predators.



EXPERIMENT 2



YOU WILL NEED

- › **Pocket microscope**
- › *Dead insect (from a window sill, for example)*

HERE'S HOW

Use your microscope without its stand. Place a dead insect on the table or another smooth surface and then position the microscope over it.

TIP!

There are lots of places where you can find “bugs” such as insects, spiders, or roly-polies. Take a look in the corners of the basement, under boards or rocks in the garden, or in a lampshade inside a room. Be sure to have your parents help you.

There are plenty of dead bugs that you will be able to find. Do not kill any bugs for your experiments!

BUGS UP CLOSE!

Insects and other bugs possess an **exoskeleton** made of chitin. On the surface, you will often find hairs, scales, or other structures. The eyes of insects consist of many individual eyes and are called **compound eyes**. On their feet, you can often see claws or suction disks, and the wings will have lots of fine veins running through them.



EXPERIMENT 3

YOU WILL NEED

- › Do-it-yourself microscope
- › Stand
- › Empty slide
- › Tape
- › Clues from a mock "crime scene," such as hairs, fibers, or crumbs

HERE'S HOW

Use your microscope with the stand. Collect hairs, fibers, or crumbs with a piece of tape, affix the tape to the empty slide, and study the objects under the microscope.

Compare the unidentified clues against identified fibers or hairs (such as wool, **cat hairs**, **dog hairs**, linen, human hairs, etc.) or against identified crumbs (soil, sand, cookies, etc.).



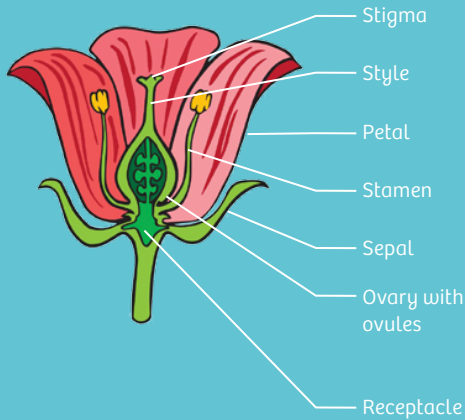


FLOWERS

When you study various flowers under the microscope, you will notice that while they are all different, they also have a lot in common.

All flowers have the same **basic structure** and include a calyx made of individual sepals, and a corolla made of individual petals.

In the interior, you will find **stamens** carrying pollen in their anthers, along with **ovary**, style, and stigma. Inside the ovary, there are ovules that will turn into seeds once they are fertilized.

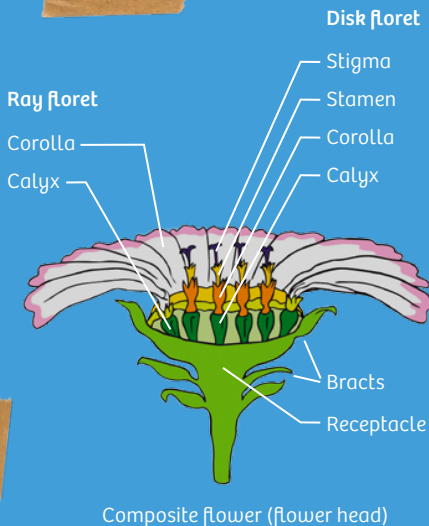


COMPOSITE FLOWERS

Some blooms actually consist of lots of little individual flowers. You are probably familiar with some of them, such as the daisy and the dandelion. Composite flowers are sometimes also called **flower heads**.

At the edge, a composite flower often has **ray florets**, which just consist of a calyx and corolla. Their colors and shapes attract pollinators.

On the inside, there are usually lots of **disk florets**, each with stamen and ovary. You won't always see all the parts, since they mature at different rates in the individual flowers.



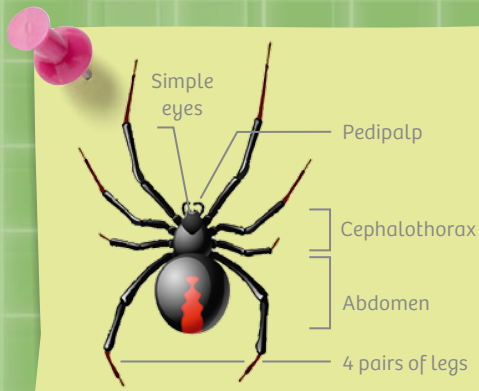
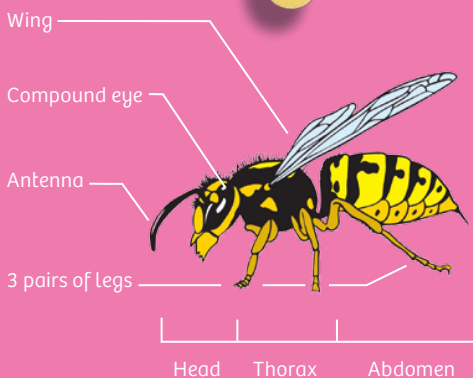


BUGS

You are no doubt familiar with a lot of different kinds of bugs. They can be divided into groups. The two most important groups are formed by insects and spiders, which are presented below. But you have probably also seen **millipedes**, which belong to their own group, and **roly-polies** (also known as woodlice, sow bugs, pill bugs, etc.), which belong to the **crustacean** group.

INSECTS

Insects have **three-part bodies** consisting of head, thorax, and abdomen. They always have six legs, all attached to the thorax. They usually have **wings**. On their head, they carry antennae as sensory organs and usually have **compound eyes** composed of lots of individual eyes.



ARACHNIDS

Spiders have a **two-part body** consisting of cephalothorax (head and thorax combined) and abdomen. They always have **eight legs**, all of which are attached to the cephalothorax. They have no wings. On their head, they have little mouth parts known as pedipalps, and usually several **simple eyes**. Scorpions, ticks, and mites also belong to the arachnid group.



Other things you can study ...

Let your imagination run free when looking for things from nature and around the house to examine under the microscope. You will be astounded by all the details that you can suddenly see.

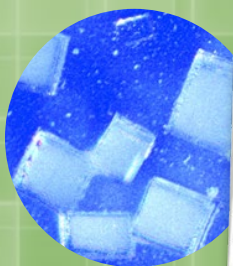


DID YOU KNOW?

Velcro is composed of little hooks on one surface and fine loops of fiber on the other side. This kind of closure is modeled after nature, where burs and thistles attach themselves to animal fur in much the same way.

BIRD FEATHERS

Bird feathers also have a system of interlocking **barbs**. Can you see them with the microscope?



CRYSTALS

Take a drop of salt water or sugar water and let it dry on an empty **slide**. Then study the shape of the crystals that are left behind.

