

ESSENTIAL STEM TOOLS

# MICROSCOPE

with Smartphone Adapter

INSTRUCTION MANUAL



THAMES & KOSMOS

## SAFETY INFORMATION

### Warnings

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

Before starting, check the parts list to be sure that all of the correct pieces are included in the kit. Keep the packaging and instructions as they contain important information.

**WARNING!** This kit contains functional sharp edges or points. Do not injure yourself! Be careful when handling tools and cover slips and when cutting objects with sharp blades (not included).

**WARNING!** Never leave the magnifying eyepiece unattended in the sun. Fire danger! Never look directly into the sun, either with your naked eye or through the magnifying eyepiece. You could blind yourself!

**WARNING:** Only for use by children over 8 years old. Only for use under the supervision of an adult.

Always wash your hands carefully after handling any specimens and always dispose of any specimens in a safe manner. When working with specimens, keep your hands away from your mouth and eyes.

Read all instructions before use, follow them and keep them for future reference. Keep small children and animals away from any experiments or projects. Store your microscope set out of reach of small children. Eye protection is not included.

### Safety for Experiments with Batteries

To operate the microscope, you will need two AA batteries (1.5-volt, type AA/LR6), which could not be included in the kit due to their limited shelf life. An adult should insert and change the batteries. For instructions on how to insert and change the batteries, see page 4.

- 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.
- Different types of batteries 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. Press them gently into the battery compartment.
- Exhausted batteries are to be removed from the toy.
- The supply terminals are not to be short-circuited.
- Avoid a short circuit of the batteries. A short circuit can cause the wires to overheat and the batteries to explode.
- Avoid deforming the batteries.
- Dispose of used batteries in accordance with environmental provisions, not in the household trash.

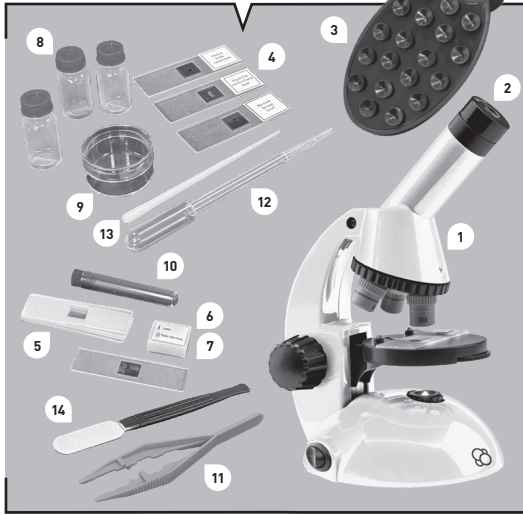
**Notes on environmental protection:** The electronic components of this product are recyclable/reusable. For the sake of the environment, do not throw them into the household trash at the end of their lifespan. They must be delivered to a collection location for electronic waste, as indicated by the following symbol:

Please contact your local authorities for the appropriate disposal location.



## CONTENTS

## What's included:



## Checklist:

✓ No.	Description	Qty.
○ 1	Microscope with 4x, 10x, and 40x objective lenses	1
○ 2	Ocular lens (eyepiece), 15x (packed separately from microscope)	1
○ 3	Smartphone adapter	1
○ 4	Prepared slide	3
○ 5	Blank slide	8
○ 6	Cover slip (in box)	16
○ 7	Slide label (in box)	8
○ 8	Specimen vial	3
○ 9	Petri dish	1
○ 10	Test tube	1
○ 11	Tweezers	1
○ 12	Pipette	1
○ 13	Stirring rod	1
○ 14	Spatula	1

*Good to know!*

If you are missing any parts, please contact Thames & Kosmos technical support.



**YOU WILL ALSO NEED:** 2 AA batteries (1.5-volt, type LR6), small Phillips-head screwdriver, smartphone with camera for using the smartphone adapter

## INTRODUCTION

With your new microscope, you can discover the world of the smallest things, the microcosmos. A microscope is an instrument with lenses for making very small objects appear much larger so they can be studied. There are millions of tiny living plants, animals, and things that can be easily seen with your microscope.

In today's high-tech world, scientists in many fields use microscopes. Microscopes are used by geologists, archaeologists, forensic detectives, and even astronomers when they study meteorites. Your microscope will let you see the basic building blocks of life on Earth.

Parents and adults: please provide assistance to children. The help of an adult is particularly necessary when making thin slices with a sharp blade (not included) during slide preparation. Adults should insert and change

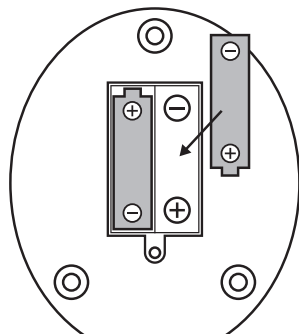
the microscope's batteries. When setting up the microscope for the first time, go through the steps from the instructions together with your child to make sure it is used correctly. With a little practice, your child will soon be able to enjoy using the microscope on their own.

Find a suitable workplace with a flat work surface on which the microscope can stand securely upright. If necessary, protect the work surface with a mat or an old newspaper. Always have some paper towels ready when you prepare slides, as it's always possible for some water or other investigation materials to spill. Make sure that you wash all of the tools and your hands after experimenting.

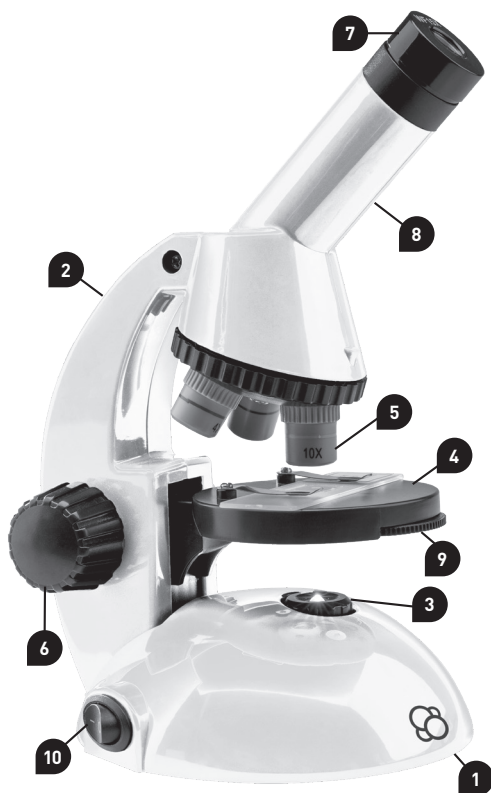
We hope you have a lot of fun using your microscope!

## SETUP AND FIRST USE

1. Before you start, have an adult insert the batteries into your microscope. To do this, first remove the plastic stopper from the microscope **tube**. Then turn the microscope upside down. The **battery compartment** is on the bottom of the **base**. Unscrew the screw that secures the battery compartment with the help of a small Phillips-head screwdriver. Lift up the lid and insert two new AA batteries. Pay attention to the correct polarity (see the picture to the right). Then close the battery compartment and tighten the screw.
2. Now put the **eyepiece** (also called the **ocular**) in the tube. Turn on the **illuminator** with the **power switch** on the base of the microscope. The light shines through the hole in the **stage**. Under the stage, you will find a round disc with openings of different sizes. This is the **aperture wheel**. You can turn it to control how much light passes through the specimen on your slide. Always choose the largest aperture at the beginning.
3. Take the **prepared slide** of the onion skin. Scientists refer to the onion skin as the epidermis of the onion. Position the specimen as precisely as possible over the center of the opening in the stage (the aperture) so it is well illuminated by the light source.
4. Rotate the nosepiece so that the **objective lens** with the lowest magnification (4x) is above the slide. (**Tip:** Always start with the lowest magnification in order to orient yourself with an overview of the object on the slide.) Looking through the eyepiece, use the **fine focus adjustment knob** to lower the objective lens all the way down (without hitting the slide) and then gradually up again until the image viewed through the eyepiece appears sharp and clear (in other words, in focus).
5. Next try rotating the nosepiece to the two other magnification levels, using the fine adjustment knob to sharpen the image each time.



Insert the batteries into the battery compartment on the bottom of the microscope.



- |  |                               |
|--|-------------------------------|
| 1. Base  | 6. Fine focus adjustment knob |
| 2. Arm   | 7. Ocular (eyepiece)          |
| 3. Illuminator (light source)                    | 8. Tube                       |
| 4. Mechanical stage with clips and diaphragm     | 9. Aperture wheel             |
| 5. Three objective lenses on revolving nosepiece | 10. Power switch              |

**Warning!** At the highest magnification (600x), the objective is so long that you have to be careful not to let it hit the slide!

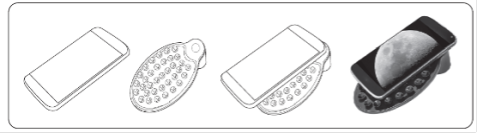
## TROUBLESHOOTING

- If you just see a **blurry image**, it is because the two lenses (in the eyepiece and the nosepiece) are not yet at the optimum distance from each other. To get a clear enlarged image, the distance between the lenses will have to be adjusted. To do this, slowly (!) turn the fine adjustment knob while looking through the eyepiece, and you will get a clear image. Don't get frustrated if you don't immediately see something. Try again!
- If you **don't see anything at all**, it's probably because the specimen is not positioned precisely beneath the objective lens. Carefully and slowly move the slide around on the stage in order to bring the specimen into the correct position until you can see it through the eyepiece.

## USING THE SMARTPHONE ADAPTER

The smartphone adapter allows you to connect almost any camera-enabled smartphone to the microscope. Because smartphones are not toys and are for adults, an adult must help children use the smartphone with the microscope.

1. To use the adapter, slide its tube directly onto the microscope's eyepiece.
2. The camera lens on your smartphone will need to be centered over the eyepiece. This alignment is best done by opening the camera app and viewing the image on screen while you center the device. Starting with the camera further away from the hole in the adapter, move the camera around until you see the microscope image on the screen. Then, slowly move the device closer to the adapter, keeping the image in the center of the screen.
3. Once you have positioned the device correctly, carefully press it down onto the suction cups on the adapter.
4. Do not let go of the smartphone, as it might slip off the adapter or cause the microscope to tip over if it is too heavy. You may want to hold the base of the microscope. You can also rotate the adapter upside-down, so the smartphone is more stably positioned above the microscope.
5. Since there are many different smartphones on the market, you will need to experiment with which of your own device's camera settings work best with the microscope. Try turning off "macro mode" before positioning your camera. For some devices, the "video mode" yields a better image than the "photo mode." Also try adjusting the aperture wheel setting.
6. After positioning your device and capturing images, you can enhance and edit the photos using the imaging software of your choice.

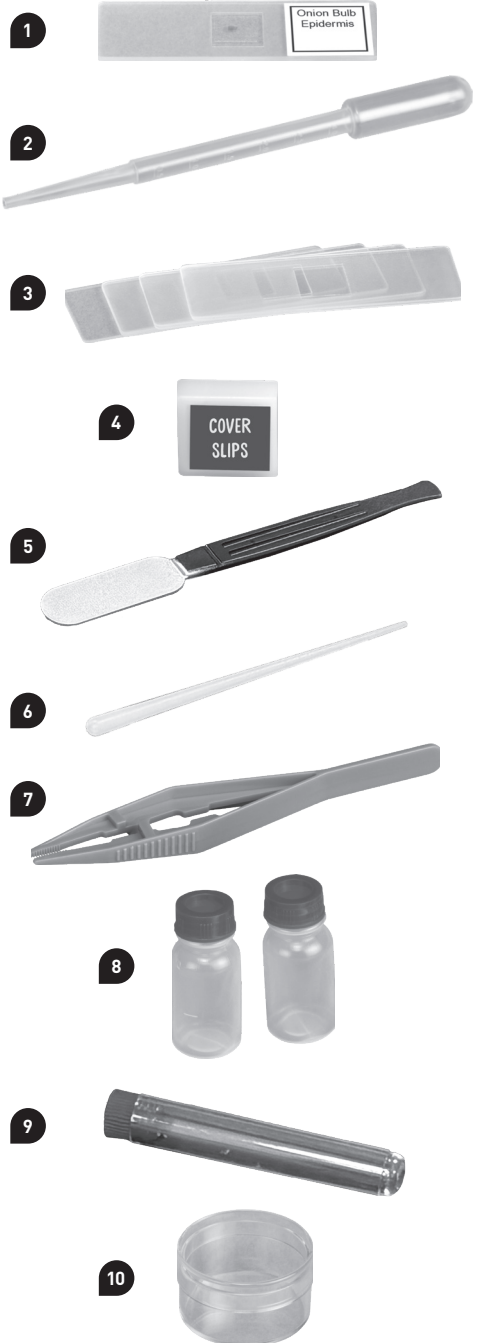


**Warning!** Do not leave your device unsupported or unattended on the adapter. Though the surface of the adapter has suction cups and is non-slip, the setup might not support the weight of some devices and the suction cups might not adhere securely to the surfaces of all smartphones and their cases. The adapter is not intended to secure, balance, or support the device on its own, and the operator should not let the device rest solely on the adapter. Leaving the device unattended or allowing it to balance on its own without user support may result in the device falling or the microscope tipping over, possibly damaging the microscope or your smartphone.

## PREPARING YOUR OWN SLIDES

### How to use the microscope accessories

1. A **permanent prepared slide** is a slide with a specimen that has already been mounted in a stable, long-lasting way — such as with a permanent glue or fixative. Prepared slides are handy because they are ready-to-use and they can be quickly pulled out whenever you want to compare different samples.
2. The **pipette** is used whenever you want to drip small amounts of water onto a slide.
3. Place the various specimens that you want to study under the microscope onto the **blank slides** for viewing.
4. When you prepare a slide, you will cover the specimen with a **cover slip** in order to get the best image and protect the lenses from getting dirty. There are also **labels** in the box with the cover slips, which you can use to label your slides with a description of the specimen on it.
5. Use the **spatula** to help you move specimens around, scrape off small pieces of material for viewing, and press soft specimens down to make them flatter before viewing.
6. Use the **stirring rod** to stir up mixtures or nudge samples into place before viewing.
7. The **tweezers** help you pick up small specimens and retrieve specimens from containers to prepare them for viewing.
- 8-10. The **specimen vials**, **test tube**, and **petri dish** will come in handy when you're collecting new specimens, storing specimens, or conducting experiments to then view under the microscope.



## PREPARING YOUR OWN SLIDES

### Preparing slides

Samples for examination under the microscope should be very thin so that light can pass through them. If the sample is too thick, it will appear dark under the microscope. Cloth fibers, pollen, dust, and salt crystals will be easy to see and make good samples for beginners to observe. See below for a list of suggested specimens to observe.

### Making a temporary slide

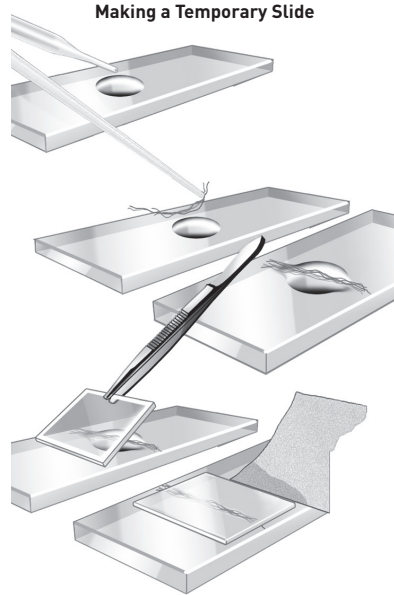
1. Start with a clean blank slide.
2. Prepare a thin sample. You may have to slice it with a scalpel or a razor blade (not included). Be very careful. You must always have adult help with this.
3. Pick up your sample with the tweezers and put it on the center section of the slide. Add one drop of water with the pipette.

4. Gently place a temporary cover slip (plastic) over the sample, being careful not to allow any air bubbles in.
5. Remove any excess water with a piece of paper towel by pressing it down gently at the edge of the cover slip.
6. Now you can observe your slide.

### Making a permanent slide

1. Start with a clean cover slip. Avoid getting fingerprints on the cover slip.
2. Follow steps 1 through 3 for making a temporary slide.
3. Before placing the cover slip over your sample, use the stirring rod to add several drops of gum media, Canada balsam, or transparent glue (not included).
4. Place the cover slip gently over the sample and gently squeeze out any air bubbles.

5. Place your new slide out of the way in a safe place and let it dry for a day.
6. Now you can observe your slide.



## Suggestions for specimens to observe

**Pond water:** Collect a sample from a pond and observe the microorganisms like algae, protozoa, and tiny aquatic insects.

**Plant cells:** Thin slices of onion or leaf epidermis can be stained and observed for plant cell structures.

**Insect wings:** Wings from already-dead butterflies, moths, or other insects can be very interesting to examine under the microscope.

**Human hair:** Pluck a strand of hair and observe it to understand its structure and texture.

**Feathers:** Collect feathers dropped by different birds to compare their structures.

**Salt crystals:** Evaporate a drop of saltwater on a slide to observe the formation of salt crystals.

**Cheek cells:** Swab the inside of your cheek with a clean cotton swab, transfer it to a slide, and observe your own cheek cells.

**Dust particles:** Dust from various surfaces, such as a bookshelf or window sill, can reveal tiny particles under the microscope.

**Spider silk:** If you can find a spider web, carefully collect a strand of spider silk for observation.

**Microbe-rich soil:** Collect a small amount of soil from a garden or a park and observe the microorganisms present.

**Moss spores:** Moss is abundant in damp areas, and its spores can be interesting to study.

**Fruit skin:** A thin slice of the skin of fruits like apple or banana can show the arrangement of cells.

**Fabric fibers:** Cut small pieces from different types of fabric and observe the individual fibers under the microscope.

**Paper fibers:** Examine the fibers in different types of paper, such as newspaper, tissue paper, and cardboard.

**Yogurt culture:** A drop of yogurt on a slide can reveal bacteria and other microorganisms in a microbial culture.

**Mold spores:** Leave a piece of bread in a damp place for a few days and observe the mold spores that develop.

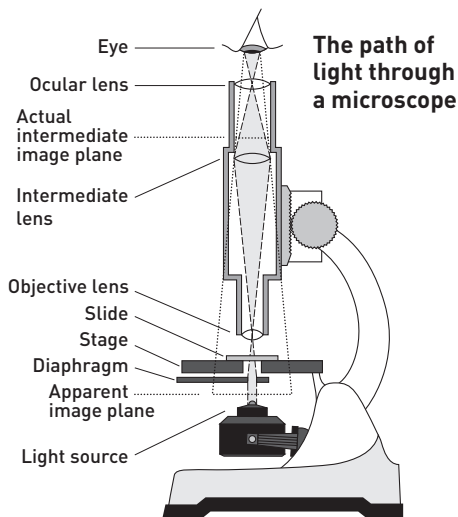
**Pollen grains:** Collect pollen from flowers and observe the different shapes and sizes of pollen grains.

## HOW DOES A MICROSCOPE WORK?

### How a microscope magnifies objects

Inside your microscope, there are curved, clear plastic disks called **optical lenses**, which are located in the **eyepiece (ocular lens)** and lower down in the **nosepiece (objective lenses)**. These lenses bend light waves to make objects viewed through them appear larger, like a magnifying glass or a pair of glasses.

The different lenses enlarge objects on the stage to different degrees. The lens in the eyepiece enlarges the object 15 times. The objective lenses enlarge the object 4 times (red lens), 10 times (yellow lens), or 40 times (blue lens). To calculate the **total magnification**, you have to multiply these two numbers together.



### Tips for properly caring for your microscope

- The lenses are the most important parts of your microscope. Treat them with care. Dirty or scratched lenses will no longer give you sharp images!
- Never touch the lenses with your fingers, and be careful not to let the lenses in the eyepiece or nosepiece bump against other objects. Do not wipe the lenses with paper tissues.
- If dust has collected on one of the lenses, gently wipe it away with a soft, dry cloth. Do not use a cleaning solution to clean your microscope, since it might damage some of the components.
- Ideally, hold onto the microscope by the arm or the base only.
- If you are not going to use your microscope for a week or more, remove the batteries that power the illuminator.
- Protect your microscope from dust and moisture by always storing it in the box or another storage case.

1st Edition © 2024 Thames & Kosmos, LLC, Providence, RI, USA  
Thames & Kosmos® is a registered trademark of Thames & Kosmos, LLC.

This work, including all its parts, is copyright protected. Any use outside the specific limits of the copyright law is prohibited and punishable by law without the consent of the publisher. 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 other copyright or other protection.

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

Distributed in United Kingdom by Thames & Kosmos UK LP, Cranbrook, Kent TN17 3HE  
Phone: 01580 713000; Web: [www.thamesandkosmos.co.uk](http://www.thamesandkosmos.co.uk)

We reserve the right to make technical changes.

Printed in China

#### Do you have any questions?

Our technical support team will be glad to help you!

Thames & Kosmos US  
Email: [support@thamesandkosmos.com](mailto:support@thamesandkosmos.com)  
Web: [thamesandkosmos.com](http://thamesandkosmos.com)  
Phone: 1-800-587-2872

Thames & Kosmos UK  
Web: [thamesandkosmos.co.uk](http://thamesandkosmos.co.uk)  
Phone: 01580 713000