

The Hand Spectroscope

AstroMedia 
Cardboard kits for hands-on science

Shows the spectrum of light and measures the wavelengths of spectral lines

With diffraction grating 900 lines / mm, nanometre scale and magnifying lens. Accuracy: 5 nanometres

Made in Germany
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Cardboard kit for a fully functional hand spectroscope

Contents: 1 casing (printed cardboard), 1 diffraction grating (900 lines / mm), 1 magnifying lens (focal distance $f = +120$ mm), 1 film with nanometre scale (750 to 440 nm) and light slot (0.3 mm).

Assembly Instructions:

You will need just about an hour and the following tools: a pair of scissors, a sharp cutter knife, a blunt knife for grooving the flaps, some adhesive tape and a solvent-containing all-purpose glue. Assembly is carried out in 12 easy steps, which are also marked on the casing by the corresponding numbers.

Step 1: Cut out all parts, fold back along the dotted lines. Only the one line (eyepiece protection, the one with little dots) is bent forwards.

Step 2: Cut out the rectangular eyepiece and glue the lens by its rim onto the white circle. **Caution:** Avoid getting glue on the lens! (Replacement lens: O*M No. 6, available from AstroMedia*)

Step 3: Assemble the casing by gluing the long flap underneath the opposite side.

Step 4: Bend the supporting piece over the back opening of the casing and glue it behind the opposite flaps.

Step 5: Glue the film with the scales and the light gap onto the two long, narrow flaps and the support of the casing. You should be able to read the scales correctly from the inside (test by looking through the lens).

Step 6+7: Bend down both flaps at the narrow sides of the casing and glue them onto the film. This will prevent light entering here.

Step 8+9: Glue the light slot tube together giving it a square diameter and then glue it over the light slot onto the casing.

Step 10: Attach the diffraction grating with some adhesive

tape onto the inside of the eyepiece flap (it is not important which side of the film is turned down), close the flap temporarily without glue and point the light gap at a bright light source. When the spectrum appears before the scale you can glue the flap, otherwise you must read-just the grating film.

Step 11: To disperse the light which shines through the nanometre scale you can glue a strip of thin white paper (20 x 70 mm) onto the small flap beside the scale and then adhere it to the other end with adhesive tape. Another 2 to 3 strips are placed on top, but in such a way that they can be easily removed if more light is needed.

Last Step: Glue the eyepiece protection around the eyepiece.

This is how the finished hand spectroscope looks:

Light spectrum and spectral analysis
The examination of the spectral colours which are produced when light goes through a prism or a diffraction grating is called spectrum (or spectral) analysis. It is one of the most efficient methods of examining what we know in natural science. Using the spectrum of a luminous sample, chemists can prove the existence of even the minutest amounts of individual substances. With the help of spectral analysis of starlight, astronomers can discover important information about the universe.

Examinations you can carry out with this hand spectroscope

- Sun light (especially rays when the moon is shining very brightly)
- The light from bulbs and candles
- Street lighting (different colour tones)
- Neon light advertisements and other types of illuminated ads
- The light of salt crystals in a gas flame (lighter)
- Light emitting diodes (red, green, yellow, white)
- Light which falls through different colour filters or fluids of different chemical substances

Questions you can ask when using the spectroscope
 Is the spectrum continuous or does it show isolated coloured lines? Or does it show both?
 In which range of wavelengths are the colours of the continuous spectrum? Where are the coloured or black lines?
Easy to observe spectral lines
 Indication of mercury in fluorescent lights: 436 (blue), 546 (green), 577 and 579 (yellow)
 Indication of sodium in street lights and glowing salt crystals: 589 and 590 (yellow)

How to use this spectroscope:
 Point the light slot at a light source and at the same time look through the magnifying lens at the scale. The diffraction spectral colours visible on the scale. The lines of the scale indicate the wavelengths of the colours in nanometres. If you wish to focus the spectral lines more clearly push a piece of cardboard under the light slot, thereby decreasing the width of the light slot. Avoid looking directly at the sun!

Measurement range: 750 to 400 nanometres (nm)
 1,000,000 nm = 1 mm · 1 nm = 1 millionth mm

Direction of light source

Light slot: 0.3 mm

Step 1: Cut out the casing, groove and fold back along the dotted lines

Step 3: Assemble the casing by gluing this flap behind the opposite side.

Step 4: Insert and glue this supporting piece behind the opposite flap.

Step 5: Glue the film with the nanometre scale onto this and the opposite flap.

Step 6: Glue the sides of the light slot tube here.

Step 7: Glue the back side of the light slot tube here.

Step 8: Glue the other side of the light slot tube here.

Step 9: Glue the back side of the light slot tube here.

Step 10: Attach the diffraction grating with some adhesive tape onto the inside of the eyepiece flap (it is not important which side of the film is turned down), close the flap temporarily without glue and point the light gap at a bright light source. When the spectrum appears before the scale you can glue the flap, otherwise you must read-just the grating film.

Step 11: To disperse the light which shines through the nanometre scale you can glue a strip of thin white paper (20 x 70 mm) onto the small flap beside the scale and then adhere it to the other end with adhesive tape. Another 2 to 3 strips are placed on top, but in such a way that they can be easily removed if more light is needed.

Last Step: Glue the eyepiece protection around the eyepiece.

Technical specifications:
 Line distance of diffraction grate: 1111 nm = 900 lines per mm
 Eyepiece lens: OPT1*Media No.6
 Focal length 120mm

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