OPITEC

Hobbyfix

115.028

Telescope

Contents

Part No.	Description	Quantity	Size
1	Lens holder (eye)	1	30 x 17.7/13.3 x 2.2mm
2	Small tube	1	147 x 22.0/17.7 x 2.15mm
3	Telescope rings(small)	3	20 x 27.4/22.2 x 2.65mm
4	Middle tube	1	147 x 33.9/27.5 x 3.2mm
5	Telescope rings (medium)	3	20 x 40.1/34.1 x 3mm
6	Large tube	1	147 x 46.1/40.3 x 2.9mm
7	Object. ring (outer)	1	10 x 46.1/40.3 x 2.9mm
8	Object. ring (inner)	1	10 x 40.3/34.1 x 3.1mm
9	Telescope ring(large)	1	20 x 52.5/46.3 x 3.1mm
10	Lens holder (objective)	1	50 x 52.5/46.3 x 3.1mm
11	Lens (small)	1	16.5mm dia, f=35mm
12	Lens (large)	1	45mm dia, f=360mm
13	Adjusting rings and covering paper	1 sheet	

Please Note

The OPITEC range of projects is not intended as play toys for young children.They are teaching aids for young people learning the skills of Craft, Design and Technolo- gy.These projects should only be undertaken and tested with the guidance of a fully qualified adult. The finished projects are not suitable to give to children under 3 years old. Some parts can be swallowed. Dan- ger of suffocation!

Necessary Tools

Pencil,steel rule
Scissors,cutter
All purpose glue
Permanent black felt tip pen

General information:

The first hand held telescope was invented in Holland in **1609.**
Legend has it, that an optician's children discovered the principles whilst playing with some discarded lenses. They noticed, that if you hold a concave lens near your eye and a convex lens a little distance away, objects appear much closer. They were excited by this discovery and their father helped them by placing the lenses in a card tube. This was the beginning of the seamans telescope, the discovery was soon to be heard about all over Europe.

Galileo Galilei a professor for physics in Venice, heard about this discovery and thought about the exact relationship of the lenses.
Before receiving one from Holland, he had made his own version and sold it to the state of Venice as his own discovery. The townspeople were overwhelmed that they could now watch approaching ships from a long way off in great detail.
Even though he was not quite the original inventor of the telescope, he was the first person to use it for astronomy. Until then it was thought that the planets were fixed and moved inside large crystal spheres.
Gallieo saw through his telescope that, the planet Jupiter was orbited by little moons and put the existing theory in question. Many other scientists at the time did not want to believe this idea and would not even look through his telescope. Today we credit Galileo with the beginning of the use of telescopes in astronomy.

The Lenses

Lenses that are convex, such the objective lens in our telescope, are so called collecting lenses. They enlarge objects as you look through them. If you use them for starting a fire you can measure the distance between the lens and the burnt mark. This is the so called focal point and is different in differing lenses.

Lenses that are concave, eg the occular lens are so called dispersing lenses. They make things appear smaller when you look through them.
Their focal point is harder to determine and is shown with a minus sign. Today only simple enlarging instruments, such opera glasses, are made with a convex and concave lens. Other telescopes are made from a combination of many convex lenses each with differing focal points.
This idea was discovered by Johannes Keppler a German astromonist who developed Gallileo's telescope further,so that even better enlargements could be achieved.
A hundred years later Issac Newton discovered the principle of the mirror telescope,that instead of using collecting lenses, used a mirrored dish. Still now, this type of telescope, is used to achieve the greatest magnification.

Planning an Making

Please read through the plans before starting this project.

Tip:
card is a natural material and therefore small differences in size can appear in the tubes which are supplied. Should this cause problems with the joining eg. too loose a fit, an inserted strip of paper can help.
Make sure that no glue is dropped on the lenses and all parts are dust free before assembly.

1. Sort out the cardboard tubes and rings according to the parts list and mark them, with a pencil near the end so that they can be assembled in the correct order.

2. Paint one end of all the tubes and rings black (with a felt tip pen) that fit inside each other. This will cut out any unwanted reflections.
   Only part 10 will need both ends blackened.

3. Seal all the ends of the tubes with a layer of glue. This will help to prevent the cardboard fibres from breaking up and falling on to the lenses.

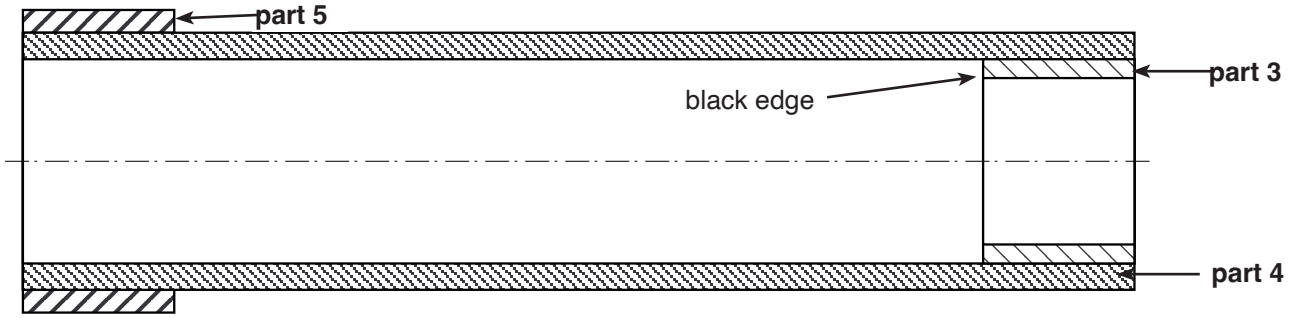
4. Push one of the small telescope rings (part 3) with the black end into the unpainted end of the middle tube (part 4) and glue into position. The unpainted ends of these two tubes should be level. Now the inner diameter of these two tubes should be the same as the outer diameter of the small tube.(see diagram 1)

5. Take another small telescope ring (part 3) and push it on to the small tube (part 2) so that both black ends are level. Glue the small ring into position. Now this double end of the small tube has the same outer diameter as the inner diameter of the middle tube. (see diagram 2)

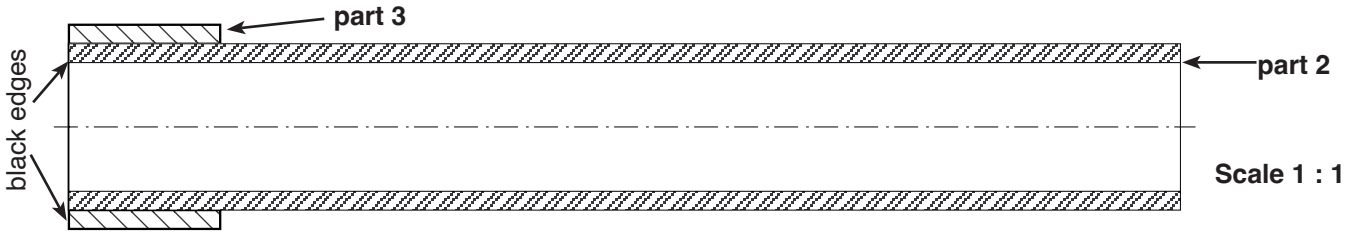
6. Take the small tube (part 3) and insert into the open end of the middle tube right through into the glued ring at the far end of the tube. Now you can push the small and middle tubes in and out from each other. (see diagram 3)

7.Take one of the medium size telescope rings (part 5) and push it on the middle size tube (part 4) so that both black ends are level. Glue the ring into position. Now the outer diameter of this double end is the same size as the inner diameter of the large tube. (see diagram 1)

Dia. 1



Dia. 2



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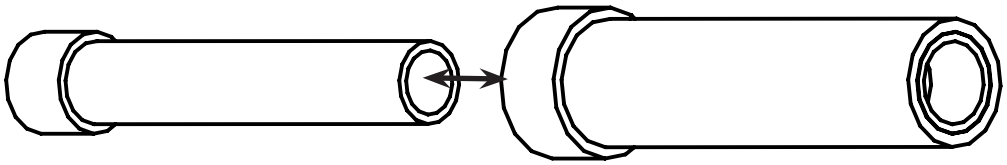
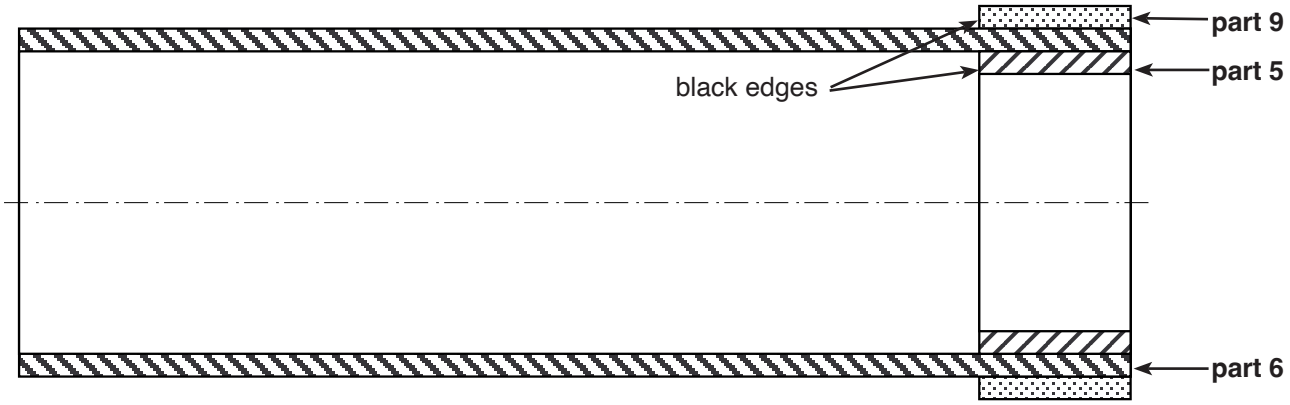


8.Take another medium size telescope ring (part 5) and push it with the black end first into the unpainted end of the large tube (part 6) and glue in position. The unpainted ends should be level. Now the inner diameter of this double end is the same size as the outer diameter of the middle tube.

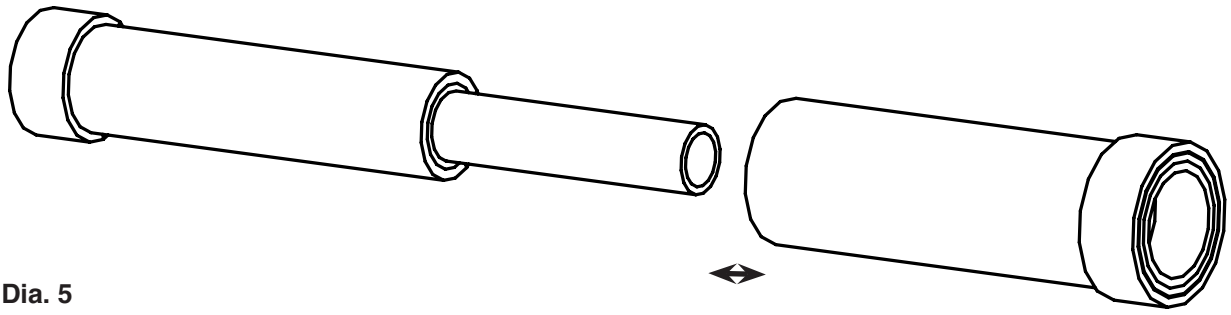
9.The large telescope ring (part9) must be pushed on to the large tube, on end which has the medium ring on the inside, and glued in position.
The unpainted end of this ring is faces the open end of the tube. All three sections should be level at this point. (see diagram 4)

10.The middle tube with the inserted small tube can now be pushed into the open end of the large tube and guided right through into the ring at the far end. (see diagram 5)

Dia. 4



Scale 1 : 1



Dia. 5

11. Now you can stretch the telescope to its final length.

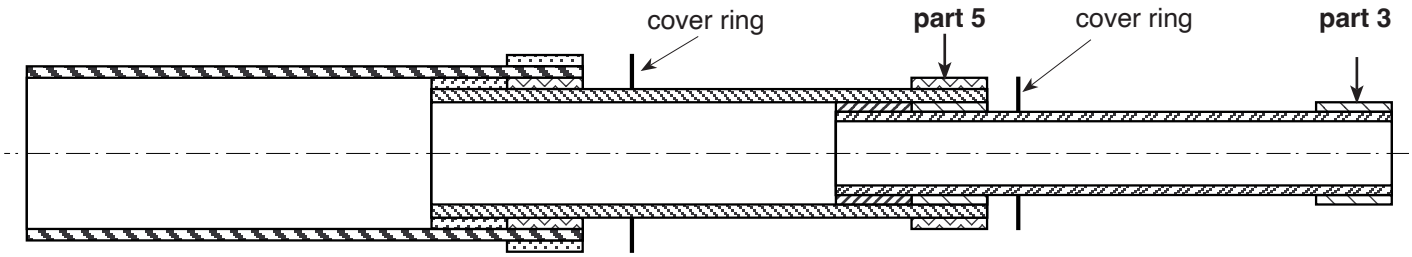
12. Cut out the two paper cover rings from the printed sheet. Slide the larger cover ring over the small and middle tube and glue it to the unpainted end of the large tube.

13. Now take the last medium sized telescope ring (part 5) and push it on to the middle tube and glue it to the end where the small tube joins the middle tube. This brings round sections togehther again.

14. Now slide the second cover ring along the small tube to hide the joint. Glue the cover in position. (see diagram 6)

15. Finally push the small telescope ring (part 3) on to the end of the small tube and glue it in position. The unpainted end of the ring is at the open side of the tube and level with it. (see diagram 6)

Dia. 6



Scale 1 : 2

16. Cut out the black paper inner cover ring making sure the hole remains round.(4.5mm dia) Paint the reverse side of the ring black and glue it to the unpainted end of the lens holder tube (part 1) (see diagram 7) Glue the concave lens (part 11) on to the other end of the lens holder tube. The concave side faces inwards.

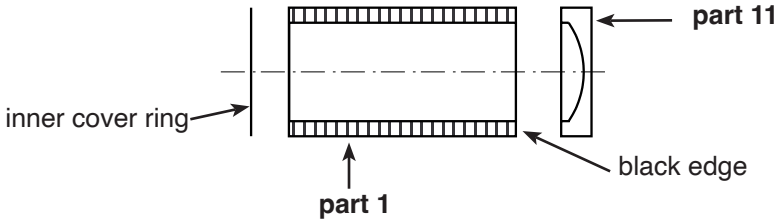
Important!

Make sure that you do not get any glue on the middle of the lens. File away burrs on the lens first!

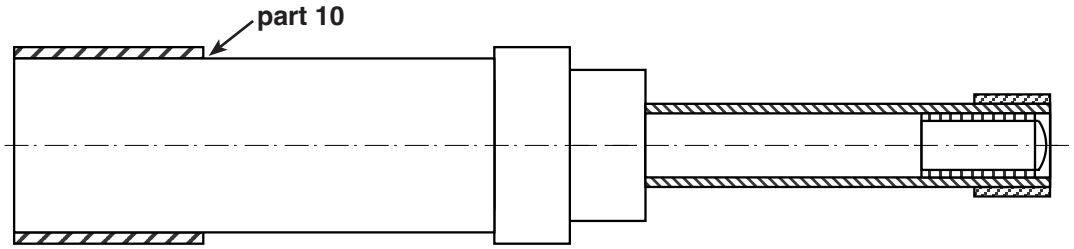
17.Insert the lens holder into the open end of the small tube and push it until it is level with the end of the tube and ring. (see diagram 8)

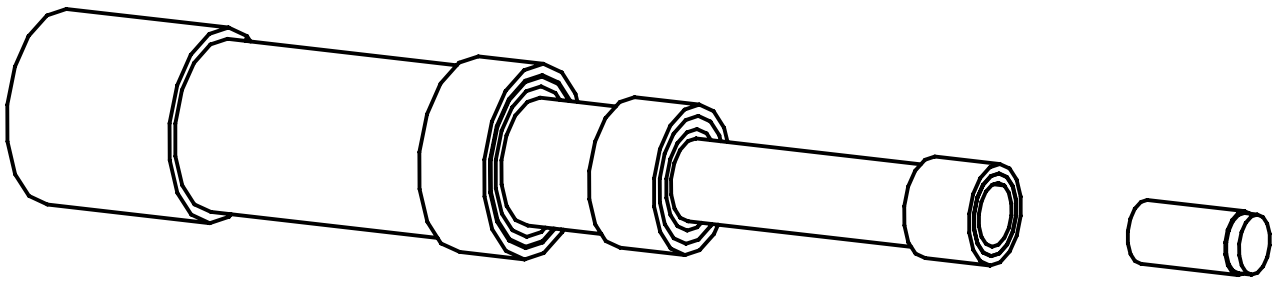
18. Cut out the covering paper for the objective lens holder (part 10).
Push the objective lens holder on to the end of the large tube. Wrap the paper around and glue it in position. Remove the holder again from the tube.(see diagram 8)

Dia. 7



Dia. 8





Dia. 9

19. Take the objective ring (part 7) and slide it, black end first over the inner objective lens holder so that the ends are level.This makes a thick walled section ring. (see diagram 10 + 11)

20. Cut out the paper objective cover (outer ring with scissors, inner ring using a modelling knife) Glue this to unpainted end of this thick ring (parts 7&8).

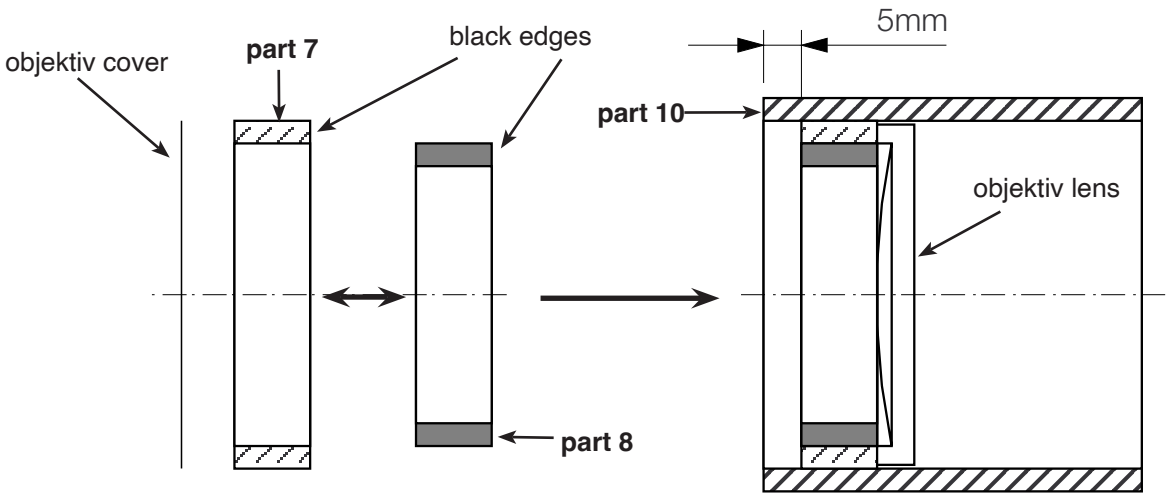
21. Push the double ring and cover (part 7&8) (black end first) into the objective lens holder (part 10) to a depth of 5mm. You can now test to see if it fits properly by pushing it on to the large tube.(see diagram 12)

22. Insert the objective lens with convex side (bowed) forwards in the objective lens holder until it meets the double ring and then fix with glue. (see diagram 11

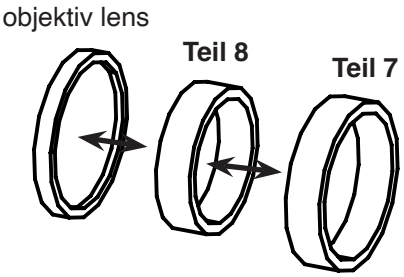
Important!

Apply the glue to the double objective ring and then insert the lens as decribed above. Now push this objective ring with the lens on to the open end of the large tube and press until dry and then slide it off again until later.

Dia. 10



Dia. 11



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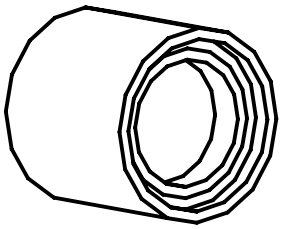
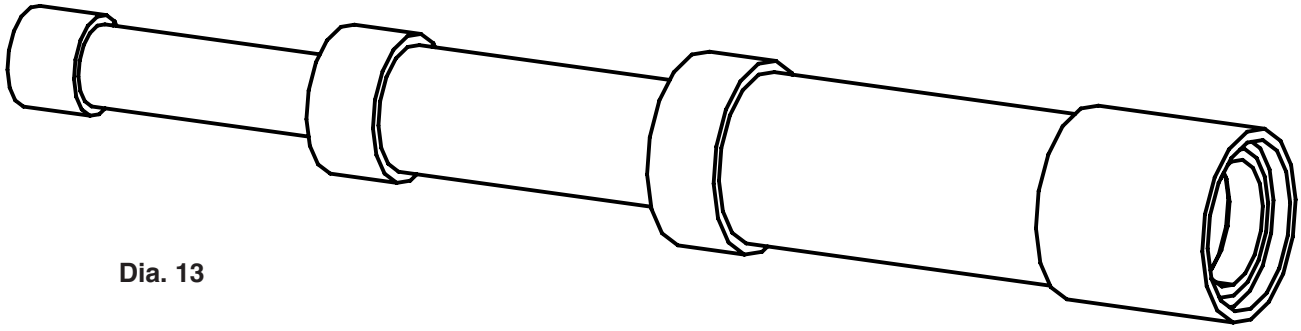




Dia. 13

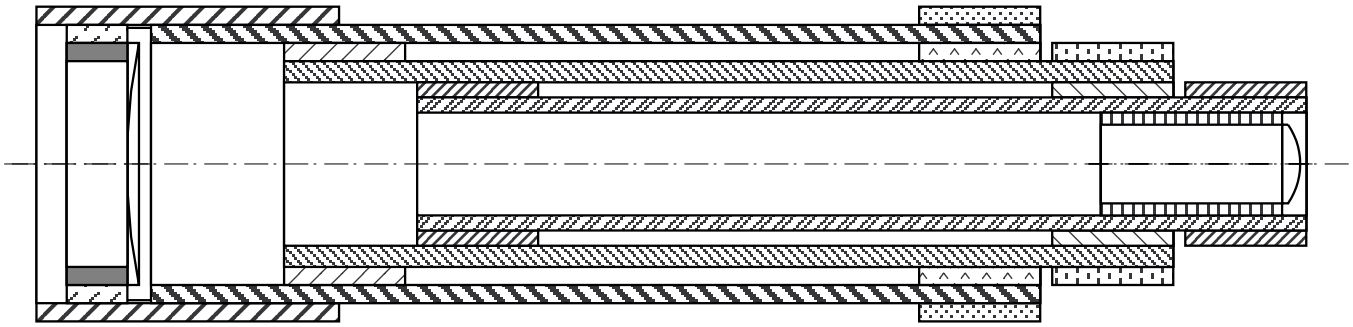
23. Cut the out eyepiece cover and glue it to the occular lens.
Important!
Be careful not to get any glue on to the middle of the lens.

24. Cut out the decorative covering papers for the rings and glue them in position. The paper with the text and picture should be glued on to the large tube so that the plain edge is at the lens end. Make sure that the paper is glued down without any creases, this will ensure that all the parts can slide easily.

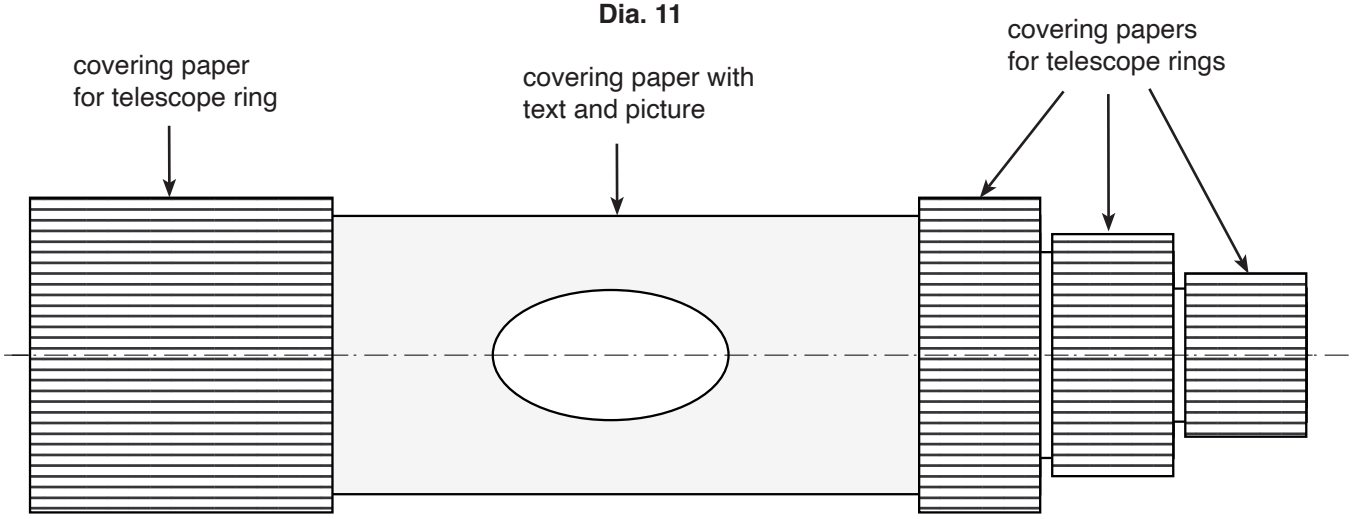
25. Finally push the objective lens holder on to the end of the large tube. Only if it is a loose fit, use a small spot of glue to hold it, as this part may need to be removed for cleaning at a later date.
Plastic lenses tend to attract dust.

Have fun observing with your telescope!
Remember not to point it directly at the sun! As you can damage your eyesight due to the concentrated power of the light.

Dia. 10 **section through the folded telescope**



Dia. 11



covering paper with text and picture for the large tube

covering paper for the middle telescope ring

glue along this edge

Galileo Galilei
1564-1642

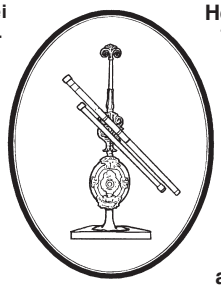
In the year 1609 Galileo Galilei the great Italian scientist heard that an optician in Holland had developed a telescope with which it was possible to make distant objektsappear nearer. He gave it some thought nd worked out that it must employ two lenses: one objective and

one occular. The objective to collect the light,a large convex and a smaller concave lens as the eyepiece. After this idea, he built his own telescope without having seen the Dutch one and made his design known throughout Italy. Still today this type is called the

'Galilean or Dutch' telescope.

Galileo Galileis
First telescope

Galileo Galilei First telescope Galileo Galilei was the first person to use a telescope to observe the stars, moon and planets.



He dicovered that the planet Jupiter had its own moons and so he was one of the founders of modern astronomy.

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Important!
Do not point any telescope directly at the sun, as this can cause permanent damage to your eyesight!
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This telescope belongs to:

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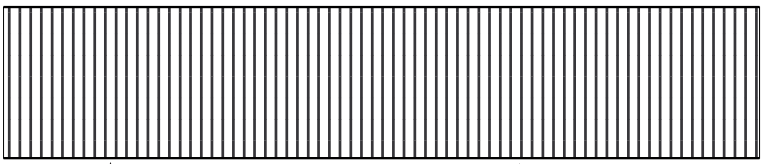
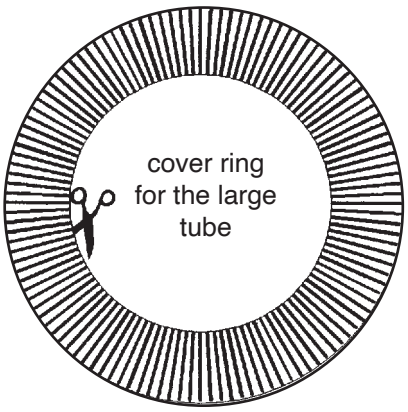
A project from OPITEC Educational Materials Ltd 7 West Rd, Woolston, Southampton. Tel. 01703 446515

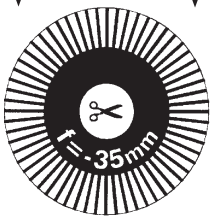
black inner ring

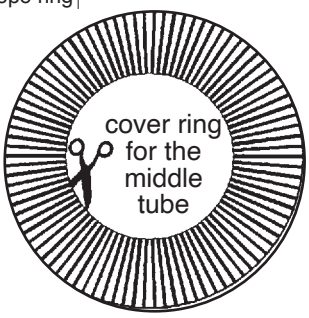


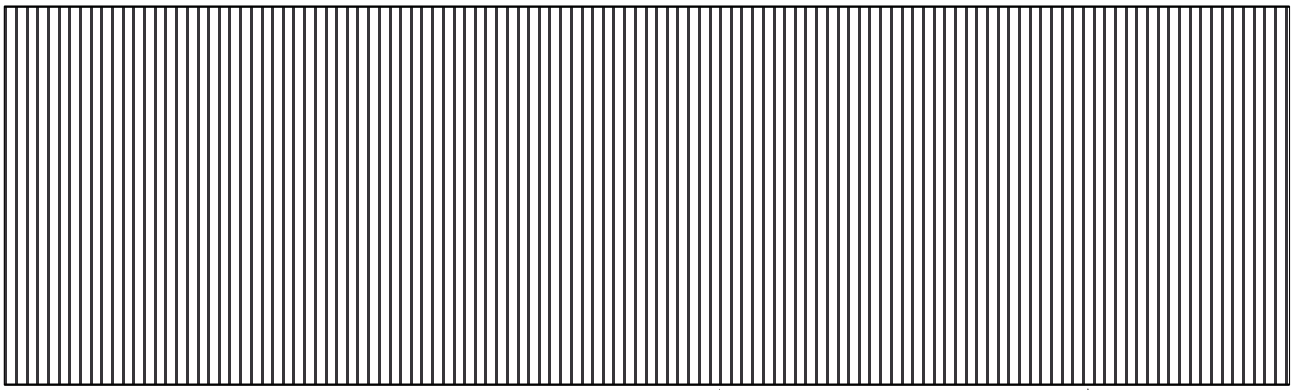
covering paper for the smal telescope ring



eye piece cover







covering paper for the large telescope ring

covering paper for the objektiv holder