OPITEC

115615

Smartscoop – the Smartphone microscope

Please Note

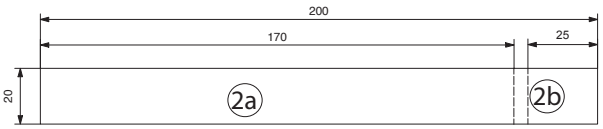
The OPITEC range of projects is not intended as play toys for young children. They are teaching aids for young people learning the skills of Craft, Design and Technology. These projects should only be undertaken and operated with the guidance of a fully qualified adult. The finished projects are not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

Required Tools:
Scroll saw or jigsaw
Drills: ø4, ø5, ø6, ø8,5, ø10mm (oil)
Sandpaper
Hot glue gun, tape
Mitre saw, round file
Wire stripper
Wood glue
Soldering iron & solder
Engineer's file, Hacksaw,
Diagonal cutter

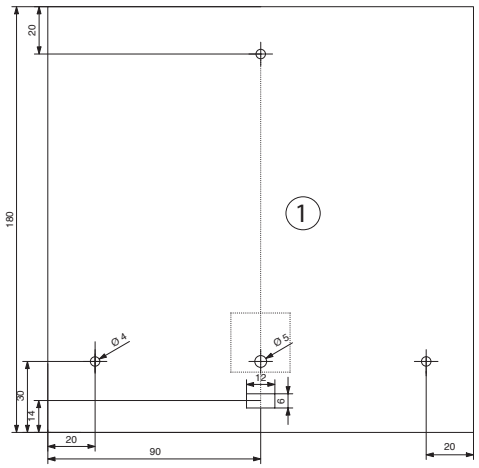
Contents list				.
	Qty	**Size (mm**	**Designation**	**Part no**
Plywood	1	179x179x4	Base	1
Pine strip	4	200x20x10	Frame	2
Gaboon plywood	1	130x40x5	Construction, reflector	3
Pine cube	1	25x25x25	Construction, reflector	4
Acrylic glass	1	170x170x2	Cover for lens	5
Acrylic glass	1	250x50x2	Auflageplatte	6
Plastic lens	1	9x6	Lens	7
Polystyrene mirror	1	140x33x1	Mirror	8
Compression spring	1	38x7x0,5	Spring	9
Light Emitting	1	ø5	Lighting	10
Battery clip	1		Power source	11
Micro sliding switch	1	19x6	Switch	12
Resistor 33 ohm	1		Resistor	13
Threaded rod	3	150xM4	Construction	14
Cylinder head bolt	1	50x4	Fastening, Reflector	15
Nut	9	M4	Screw connection	16
Butterfly nut	3	M4	Distance adjustment	17
Cap nut	3	M4	Screw connection	18
Washer	10	9/4,3	Screw connection	19
Hook-up wire	1	500	Cabling	20

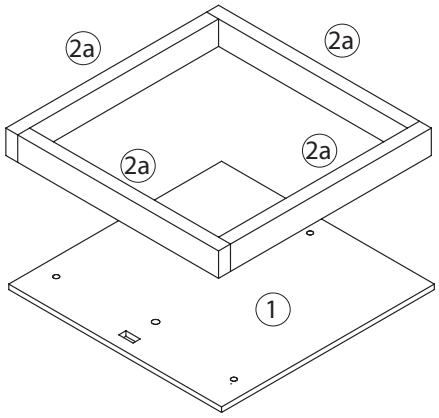
Instructions

1. Shorten each of the pine strips (2) to 170mm length with the jigsaw or scroll saw as shown. Keep the remaining pieces for further work stages!

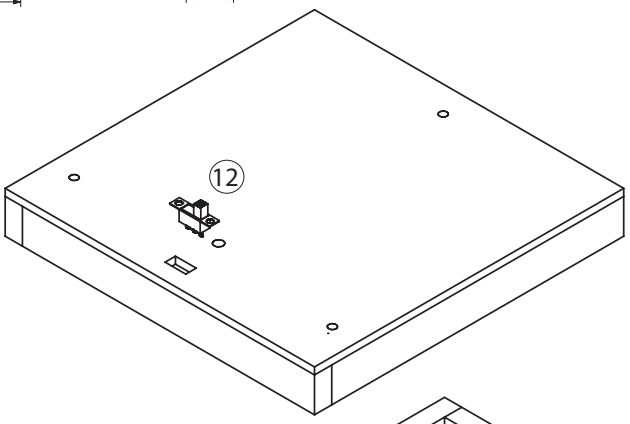


2. Mark the drill holes (ø 4mm/ ø 5mm) and the recess for the switch (12x6mm) on the base (1). Drill the holes with the ø 4mm and ø 5mm drills. Cut out the recess from the base with a jigsaw. Glue the four strips (2a) to the base (1) as shown. Let the glue dry thoroughly



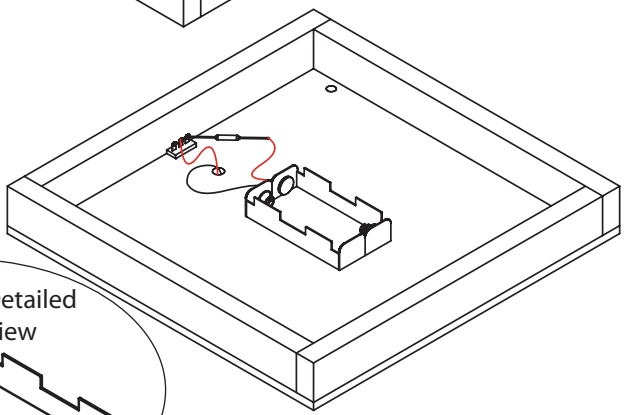


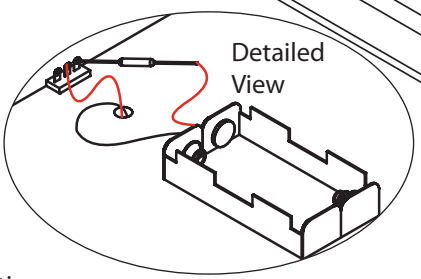
3. Stick or glue the micro sliding switch (12) in its designated opening as shown. Be careful not to get any glue on to the contacts and the switch when gluing.



4. Use the hot glue gun to glue the battery clip (11) centrally on to the underside of the base (1) as shown. Feed the black cable of the battery clip through the drill hole in the base to the upper side. Connect the red cable of the battery clip with one end of the resistor (13).

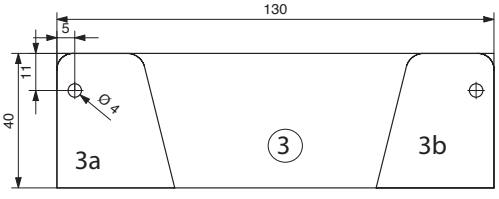
   Connect the second end of the resistor with the outer connection of the switch (12). Cut an approx. 80-100mm piece of hook up wire (20) and remove the insulation from both ends. Connect one end of the hook up wire with the central switch port. Feed the other end through the drill hole in the base to the upper side.

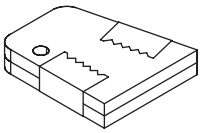


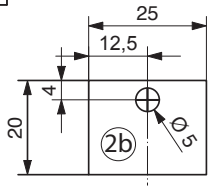


5. Transfer the side panels for the reflector construction from the template (page 7) onto the plywood (3). Cut both pieces out with a jigsaw or scroll saw. Tidy up the saw cuts with sandpaper. Fixate both parts above each other with tape as shown, and drill a ø4mm hole through both parts.

   Shorten one of the remaining pine strips (2b - step 1) to 25mm length with a jigsaw or scroll saw, and tidy up the saw cut. Measure, sketch and drill a ø 5mm hole.

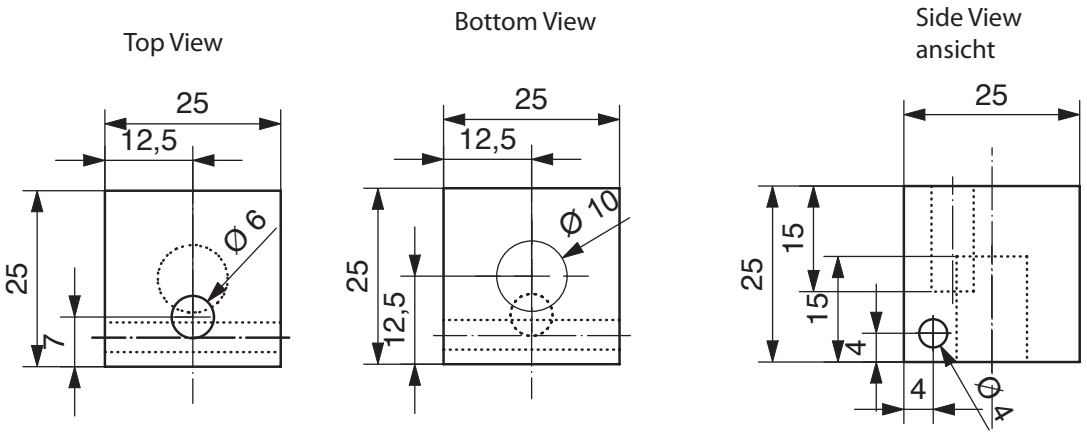




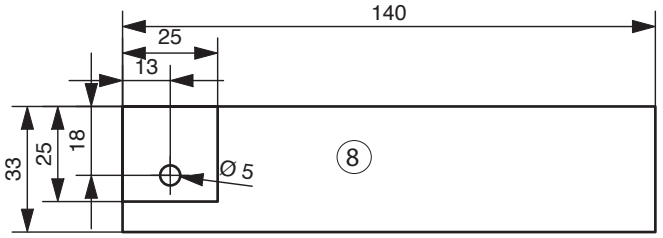


Instructions

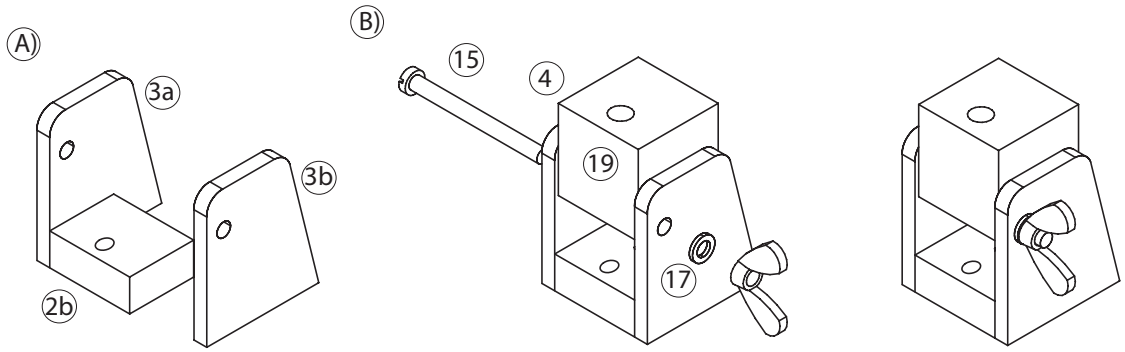
6. Work on the wooden cube (4) as follows:
   Drill a 15mm blind hole with a ø6mm drill to the measurements shown in Top View. Turn the wooden cube over and drill a 15mm blind hole in the centre with a ø10mm drill. Then drill ø 4mm hole on one side (see Side View)



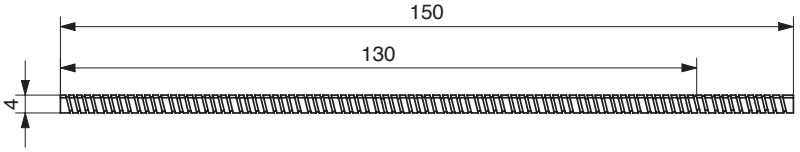
7 . Use jeweller's cutters or tin cutters to cut a 25x25mm piece of polystyrene mirror (8). You can also use a craft knife or a jigsaw. When doing this score along the lines from both sides and carefully break off the cut-out piece. Measure and mark the correct position of the drill holes and drill, using ø5mm drill.



8. A) Glue both side parts (3a+3b) to part 2b as shown. Note: The drill hole in part 2b has to point towards the back.
   B) Attach the wooden cube (4) with the cylinder head bolt (15), a washer (19) and a butterfly nut (17) between the two side parts (3a+3b)!

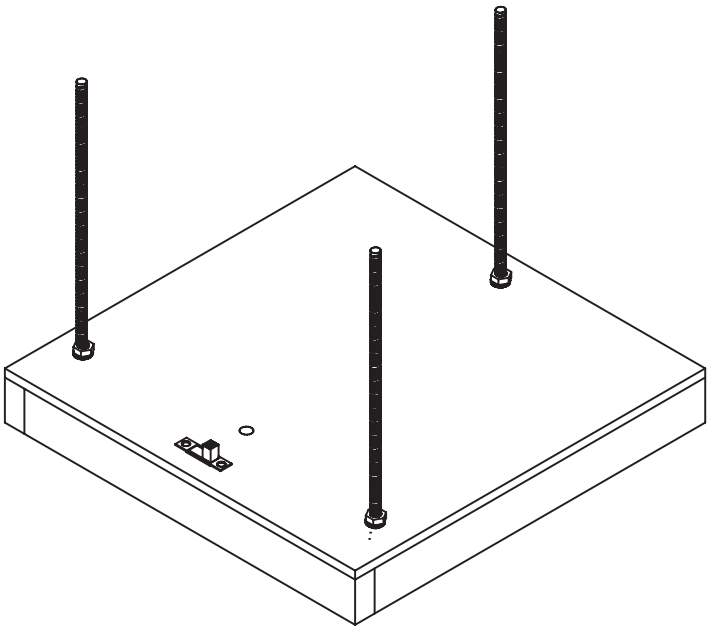


9. Shorten the threaded rods (14) to 130mm length with a hacksaw. Deburr the saw cuts.

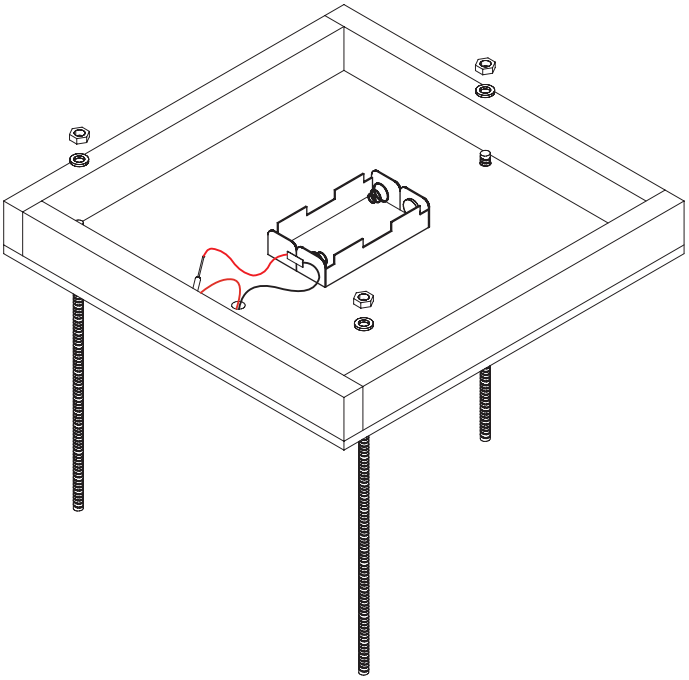


Instructions

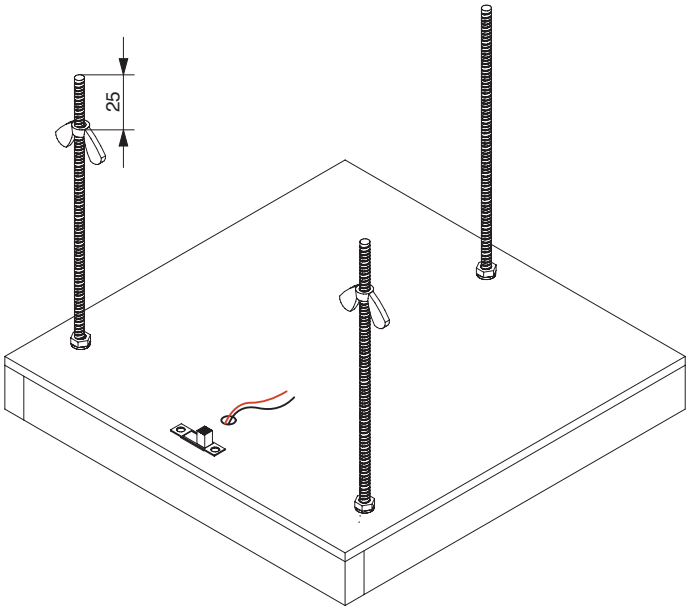
10. Screw a nut (16) approx. 10mm on each of the threaded rods and slide a washer (19) over it. Then stick into the drill holes from above (see illustration).



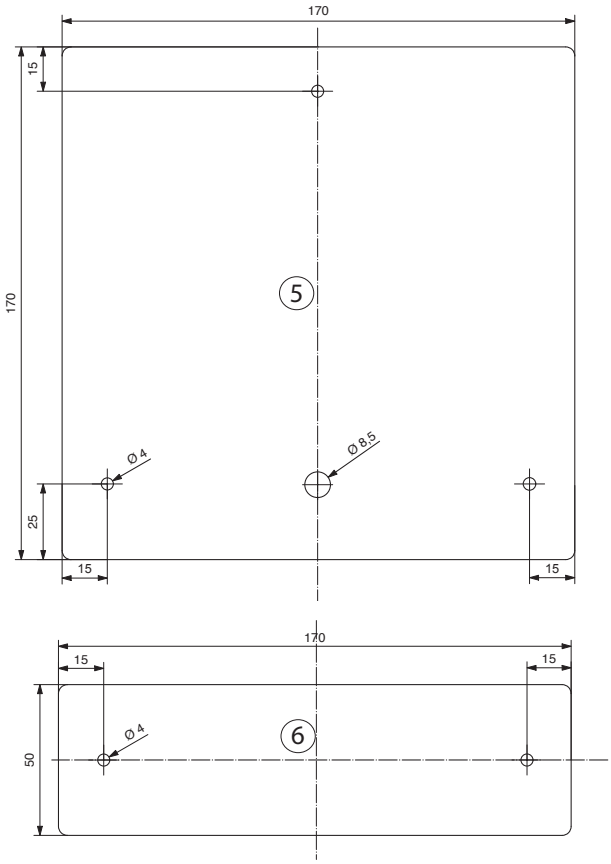
11. Turn the object over and add a washer (19) and a nut (16) onto each of the threaded rods. Lock the nuts so that the threaded rods stick out of the upside at an equal length of approx. 120mm.



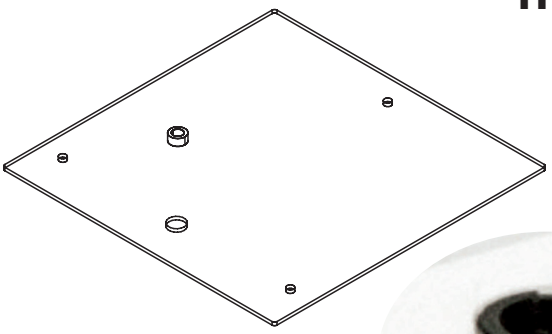
12. Screw a butterfly nut (17) each on the front two threaded rods (on both sides of the reflector structure), at an indent of approx. 25mm as shown.

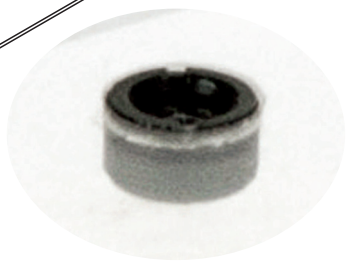


13. Drill holes through the acrylic glass plate (5) as per template (page 9). You might want to use a drop of oil for drilling.

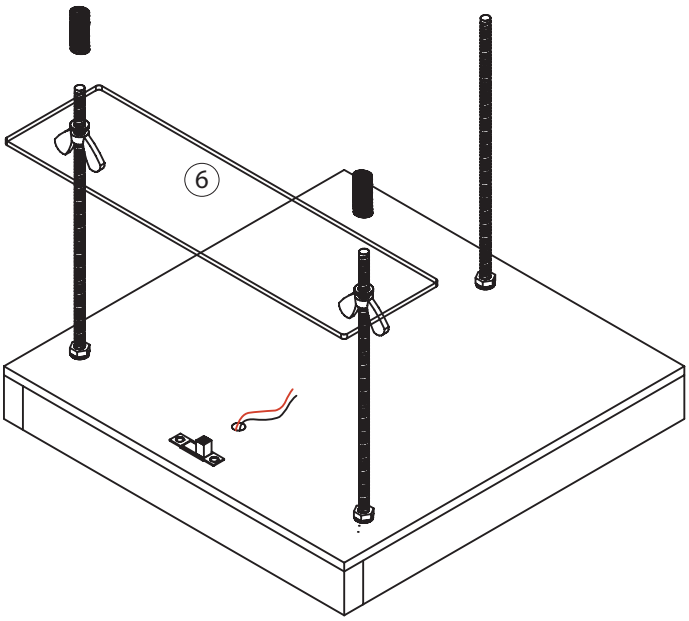


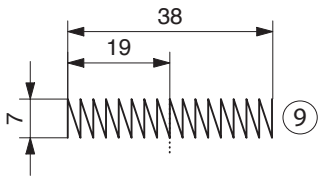
Instructions





14. Carefully enlarge the drilled hole for the plastic lens with a round file until the plastic lens fits exactly into the hole. Glue the plastic lens (7) as shown into the correct drill hole (approx. ø 8,8mm) in the acrylic glass plate (5). Make sure that it doesn't protrude upwards. Let the glue dry properly. Note: Pay attention to the installation direction! Notches face upwards

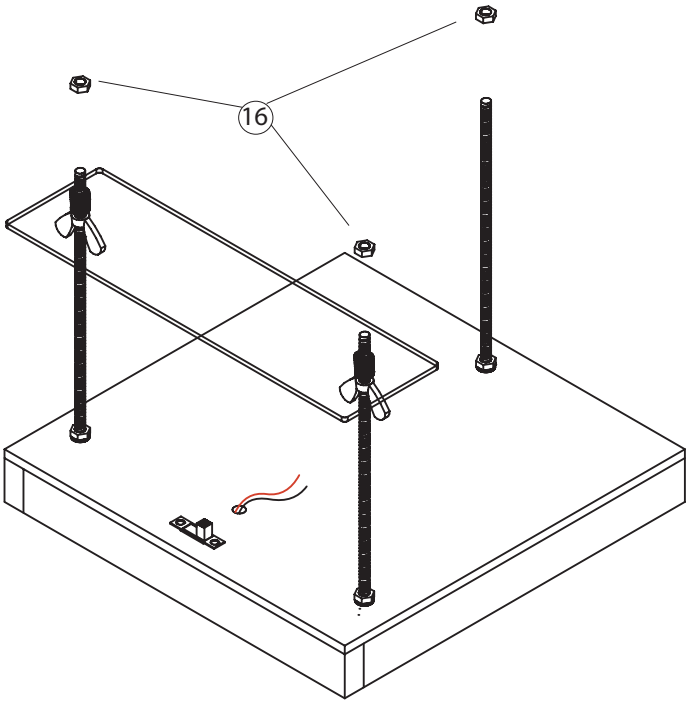


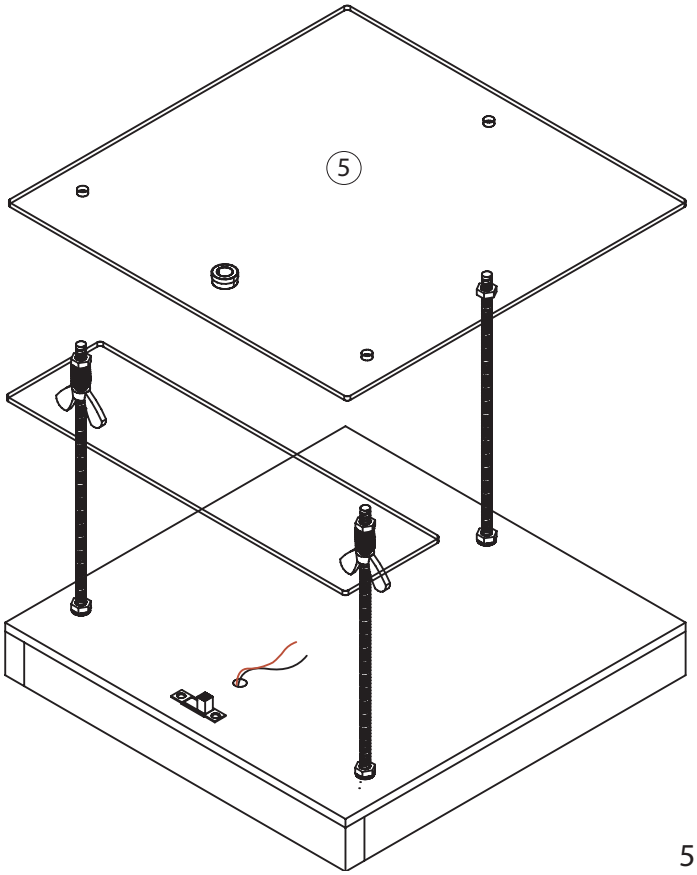


15. Place the acrylic glass plate (6) on the two butterfly nuts (17) as shown in the illustration. Cut the compression spring (9) in half with a diagonal cutter. Add a washer (19) to each of the front threaded rods. Stick one half of the cut compression spring (9) on each of the threaded rods as shown in the illustration.

16. Screw a nut (16) approx. 10mm onto each threaded rod.

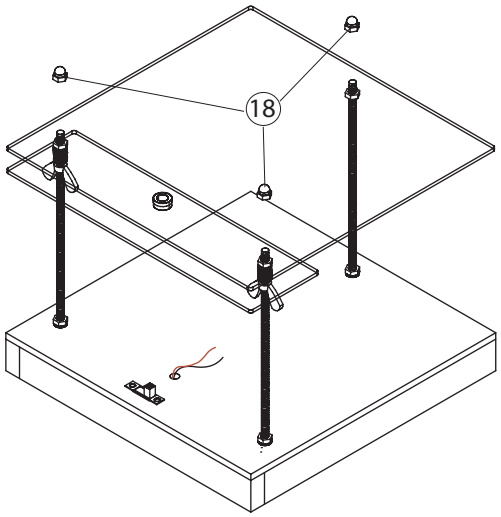
17. Place the acrylic disk (5) on top of the nuts (16). Align the nuts (16) so that the acrylic glass plate is level.



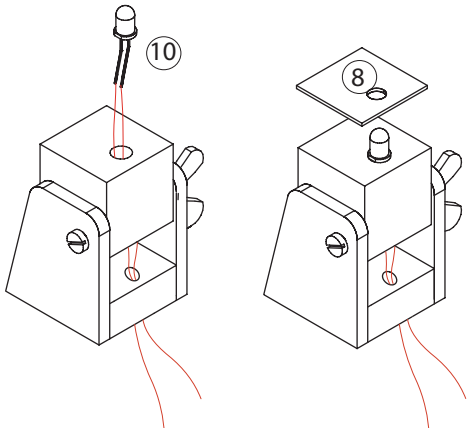


Instructions

18. To fix screw on a cap nut (18) each and lock.

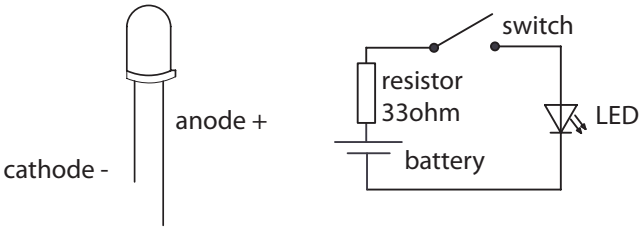


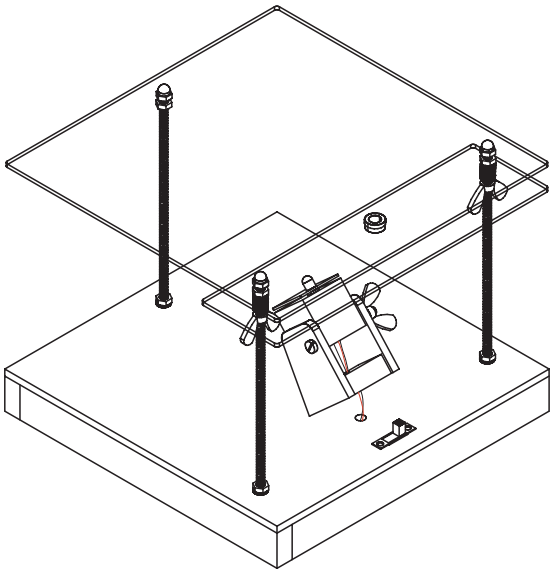
19. Thread two approx. 100mm long pieces of hook-up wire (20) through the two drill holes (see illustration) to the top, and connect to the two LED connectors (10). Insulate one of the LED connectors with tape. Then stick the LED (10) from above in the ø6mm drill hole in the cube (4). Glue the polystyrene mirror piece (8) on to the wooden cube (4) with hot glue or double-sided tape as shown.

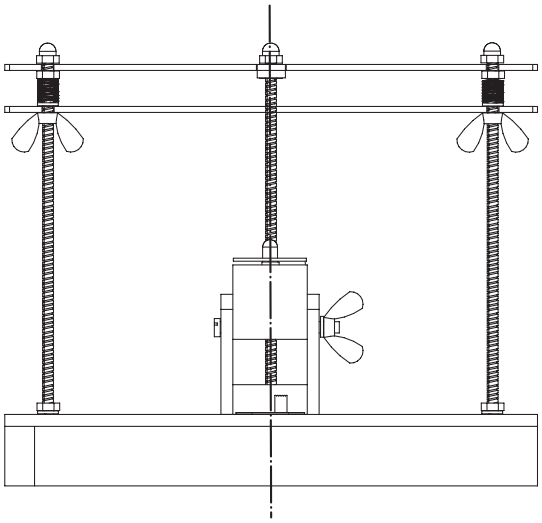


20. Connect the LED's cathode cable (short leg, flat side) to the black cable of the battery clip. Then connect the cable from the LED's (10) anode with the free switch cable. Add batteries to the battery clip and switch on the switch. Does the LED light up? If yes, continue building. If it doesn't light up, double-check the cables. Then glue the reflector construction with switched-on light on to the base so that the LED stands vertically under the lens.

wiring diagram:





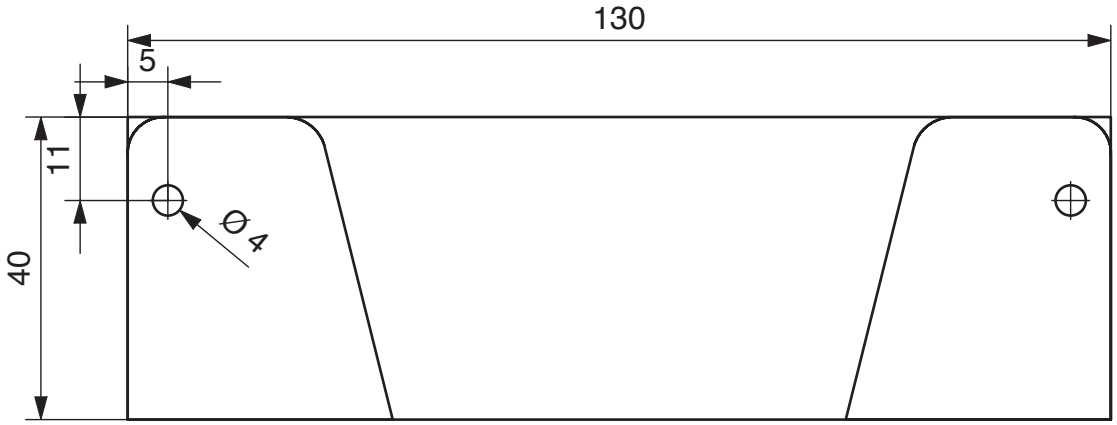


Instructions

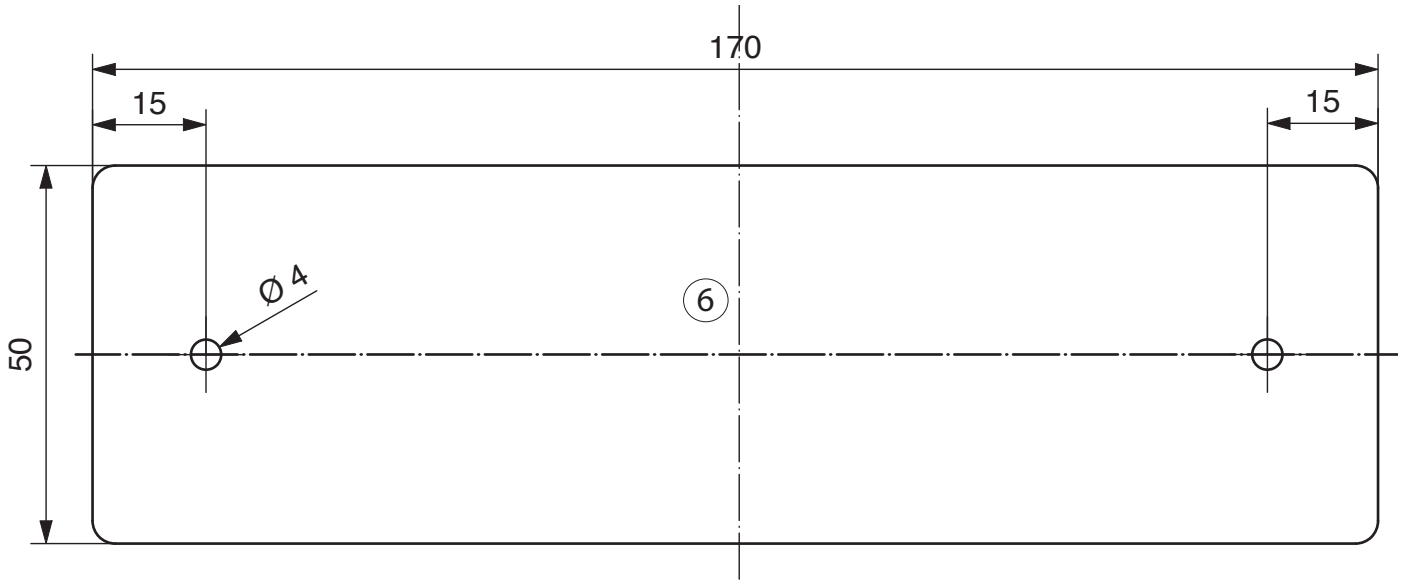
21. Place the chosen object between the two acrylic glass plates under the lens. Put a smartphone camera on to the lens and take a picture. This will produce fascinating photos.

    Note: The picture can be sharpened by turning the butterfly nut.

Template Construction of reflector
scale 1:1

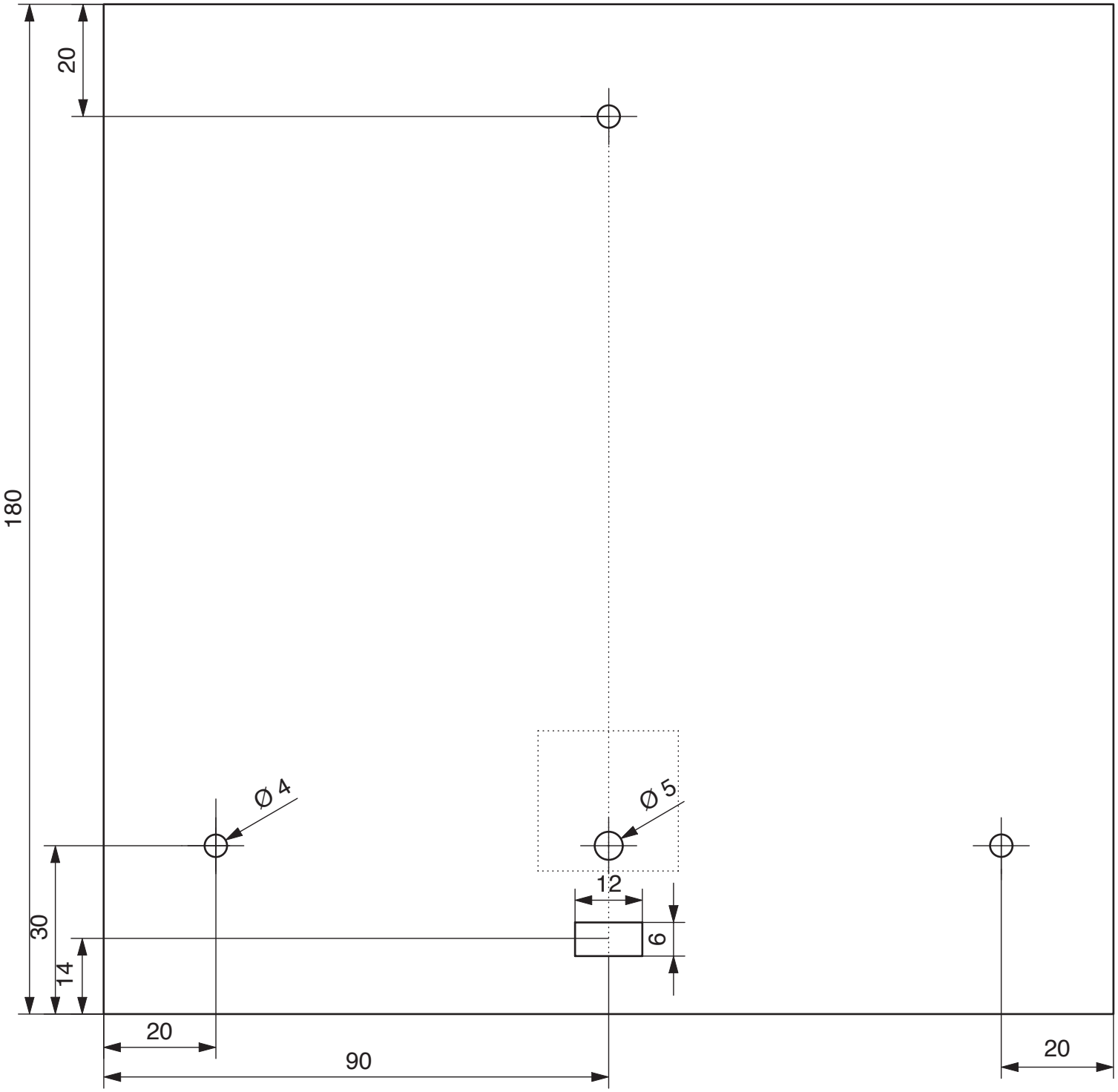


Template small acrylic glass plate
scale 1:1



Instructions

Template plywood base
scale 1:1



Instructions

Template big acrylic glass plate
scale 1:1