

## Inverting Spectacles 1000895

### Instruction Sheet

09/15 ALF



#### 1. Safety instructions

Wearing the inverting spectacles disrupts your sense of orientation and balance. Wearing them for long periods can cause dizziness and nausea.

Another person must always be present to help a student doing the experiments if it becomes necessary.

- Never allow an experimenter to wear the inverting spectacles without supervision.
- Always be in a seated position when putting on or taking off the inverting spectacles.

#### 2. Description

By experimenting with inverting spectacles it is not only possible to see how inverting prisms work but also to gain a better understanding of human vision and the role of the brain therein.

The instrument consists of two 90° isosceles prisms set in an otherwise screened goggle frame made of flexible plastic such that the prisms can be rotated through 360°. This results in a lateral inversion of incoming light beams so that the image can be turned

upside-down or be transposed left to right. Ventilation holes are provided in the frame of the spectacles to stop the prisms misting up. An elastic strap that can be adjusted to match the circumference of the head holds the inverting spectacles in place. The spectacles are supplied in a carry case lined with foam rubber.

#### 3. Basic principles

Scientists have carried out many experiments with inverting spectacles since the end of the 19th century. Many such experiments involve studying how the brain can adapt to the inverted image and learn how to correct its perception accordingly.

When wearing the spectacles, the prisms can turn what you see upside-down so that the world itself seems to be standing on its head. This can cause unexpected problems in doing the simplest things, such as reaching for objects, drawing, or simply getting oriented in space.

Nevertheless, it has been observed that after wearing the spectacles continuously for a sufficient time (about 2 to 3 days), people eventually become adapted to them and regain

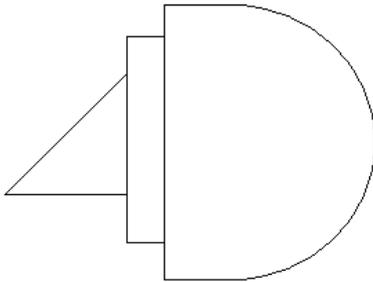
the ability to deal with things normally. Their view of the world rotates back into its normal position so that up is once again up and down is back to being down. Experimenters then see things exactly the same as before putting on the inverting spectacles. This indicates that the link between the sensing cells of the retina and the region of the brain that processes optical information is not fixed at birth but is formed by a learning process.

If the spectacles are then removed after being worn for a long time, the world appears upside-down again. However, perception then returns to normal relatively quickly.

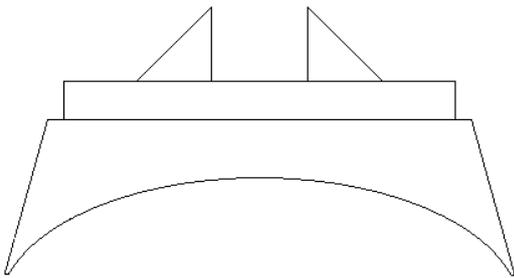
#### 4. Operation

- When adjusting the prisms, do not touch the glass surfaces.
- Ensure that the prisms are set parallel to each other.

Adjusting the prisms:



To make the image appear upside-down, set the prisms as shown above (side view of spectacles)



To invert the image right to left, set the prisms as shown above (top view of spectacles)

Should the prisms loosen in the frame after a while, tip the frame forward and tighten the securing ring.

#### 5. Sample experiments

1. Drawing and writing on a blackboard
2. Reading "mirror writing"
3. Seeing, grasping and balancing objects
4. Throwing and catching a ball
5. Fill a container with water and pour water into another container

#### 6. Maintenance

- To clean use a soft damp cloth.
- Only use mild cleaning agents that do not contain alcohol or solvents.