Hands On Learning
with Reading Museum Service

READING MUSEUM SERVICE

LENSES AND PRISMS S4

Wooden lens holders

Place the lenses described below into the wooden holders. This will make them easier to use.

Biconvex and biconcave lens



Biconvex simply means that the object is convex (curves out) on both sides - like a lentil (see picture on the right). In fact, the word lens comes from the Latin name for lentil. So biconcave means the opposite - both sides curve in.

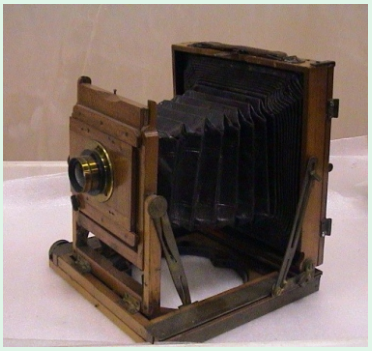
If a straight beam of light passes through a biconvex lens it will focus on a particular point on the other side (known as the focal point), but a biconcave lens will spread the light.



Camera lens



Look at this lens - is it convex or concave? It comes from a Rochester plate camera, dating from about 1900. The Rochester Camera Manufacturing Company was founded in 1891 and was one of the first to develop a camera encased in a box. This made it easier to carry around and provided more protection. The camera was attached to concertina bellows, which allowed it to move in and out of the box, like in the picture on the right.



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Glasses



These glasses were made for a child. Glasses help to correct problems with the vision. Sometimes, the eye is not able to focus light properly - this is called a refractive error and makes vision appear blurry. The amount of refractive error varies from person to person and needs to be tested by an eye care professional, who will give the patient the correct strength lens. Have you had your eyes tested? Did you read letters from a chart on the wall?



Binocular part



Small binoculars have two straight-forward lens at either end of each eye piece. The further the distance between the two lenses, the more the view is magnified. If you want really strong binoculars, the lenses would need to be really far apart and then the casing would be really long (and therefore very heavy). However, the binoculars this part belonged to had mirrors inside, which fold the light and bounce it from one mirror to the next. This makes the whole thing smaller and more portable.

Opera glasses



Opera glasses are used by people sitting quite far away from the stage during theatrical performances. The glasses work on the same principle as a refracting telescope. They have a concave eyepiece lens and a convex lens at the other end and usually give about 3 times magnification. Any more than this and the image becomes fuzzy and shakes.

These opera glasses are French and they date from about 1910. They were as much for fashion and spying on the audience as actually watching the action on stage!

Pocket telescope



The telescope in the box is designed to fit in the pocket. It is very small and not very powerful. Some telescopes are huge and extremely powerful, like the Hubble telescope, pictured on the right.

A telescope works by magnifying things that are far away in the distance. Perhaps you would like to take a closer look at the stars at night or want to examine the surface of the moon. You'd need a telescope to do this.



Telescopes use either glass lenses or mirrors to collect light from a distant object and bring it to focus. The reason you can't see something far away with the naked eye is because the retina is so small that it can't take in enough light. The telescope basically acts like a bigger eye.



A Dutchman called Hans Lippershey (1570 - 1619) is often named as the 'inventor' of the telescope, but it is thought that people were using telescope-like devices much earlier. Lippershey was the first to patent the idea in 1608 and make the invention widely known. In 1609 the famous Italian scientist, Galileo, used a telescope in astronomy to look at the craters of the moon. He used an arrangement of glass lenses to magnify objects.

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Teleidoscope



The large teleidoscope has a ball-shaped lens at the end, which allows the user to view objects in front of them and transform them into a colourful design. This is different to a kaleidoscope, which has a sealed end and a picture, coloured glass or an object inside.

There are mirrors inside the cylinder, which create the fragmented illusion you see when you look into it.

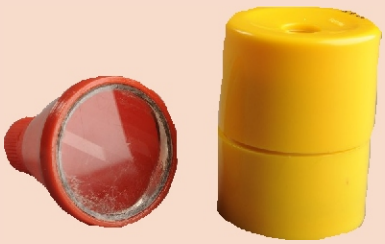
The teleidoscope was invented by John Burnside, who was from The United States of America.

The pictures on the right show the way objects can appear through a teleidoscope. Can you guess what the person was looking at when they took these pictures?



Pocket teleidoscopes

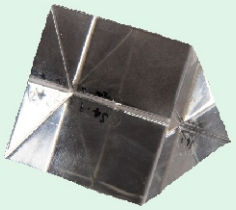
These are smaller versions of the teleidoscope described above. But notice they have flat lenses, rather than ball-shaped.



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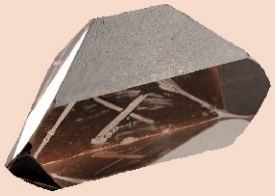
Perspex triangular prism



A prism is an object with flat, polished sides, which is able to refract light. This means that when the light enters the glass side of the prism it changes speed, which in turn makes its direction change.

A prism can be used to break up light into its spectral colours - the colours of the rainbow. See if you can do this by holding the prism up to the light and looking into it.

Glass prism



This glass prism comes from the periscope of a Second World War tank. A periscope is a long tube with an angled mirror at either end. Light bounces between the mirrors taking the image to the eye. A periscope can help the user see from a concealed position (see pictures below). Periscopes like this were used to peep over the top of trenches in the First World War.





More complex periscopes containing prisms rather than mirrors are used on submarines and armoured vehicles. (like the one in the box). This provides magnification as well as changing the direction of the light.

Calcite



Calcite is mineral, which is commonly found in sedimentary rocks such as limestone. It is a crystalline mineral, meaning that its atoms and molecules are arranged in an orderly repetitive pattern. Look through the piece of quartz and it does the same thing to the light as the prism. It is a great example of a natural prism.

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Bicycle reflector

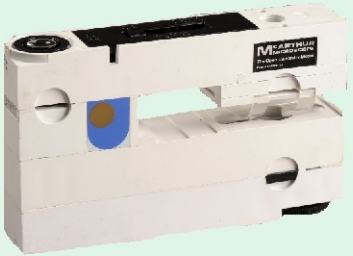


You probably have one of these on your bike. A reflector helps cyclists to be more visible, although proper lights should always be used as well at night. The reflector is covered in mini prisms, which bounce back any light that hits them.





Open University microscope



The instructions for the microscope are included in the box. It looks completely different to a standard microscope, but works in exactly the same way.

A microscope gathers light from a tiny specimen and magnifies it. This is the opposite to a telescope, which takes light from a very large object in the far distance.

Daylight from the room or from a bright lamp shines in at the bottom of the microscope. It hits the specimen and passes through a lens (called an objective lens), which is found just above. The objective lens brings the image of that object into focus. The light then travels up to the eyepiece (or ocular lens), which magnifies the image and brings it to your eye. Some objective lenses and ocular lenses are incredibly powerful. They can even make specimens visible, when they appear almost invisible to the naked eye.