

Using Mirrors and Lenses

Some common optical devices, devices that use mirrors and/or lenses, include microscopes, telescopes, cameras, projectors, and lasers. **Microscopes** are used to magnify small objects. A compound microscope has two sets of convex lenses, an eyepiece and an objective. The objective produces an enlarged, inverted, real image in the microscope tube. The eyepiece magnifies the enlarged image further enlarging it. **Telescopes** are used to examine objects that are far away. Telescopes need to have a large objective lens in order to collect as much light as possible so far away objects are bright enough to be seen. There are two types of telescopes—a refracting telescope and a reflecting telescope. A **refracting telescope** works the same way that a microscope works. A **reflecting telescope** has a concave mirror instead of a convex objective lens to gather light. The concave mirror reflects light onto a secondary plane mirror. The secondary mirror reflects light through the eyepiece which magnifies the image. **Cameras** focus an image on a light sensitive layer to take a photograph. A camera uses a convex lens with a short focal length to focus an inverted, real image that is smaller than the object on the light sensitive layer. For many cameras, diaphragm with a variable f-stop is used to control the exposure. A **projector** is used to shine an image on a surface. A concave mirror reflects light from an intense source. A condenser consisting of two planoconvex lenses directs light through a slide or movie frame to a projection lens. The projection lens focuses an image on a screen. **Lasers** provide a high energy narrow beam of light. Most light beams spread out because they are composed of different frequency waves that are out of phase with each other. The more a light beam spreads, the less energy is focused on a given point. Lasers are monochromatic, so the waves stay in phase and they don't spread. This makes the laser beam narrower and higher energy.



Answer the questions below based on the reading above and on your knowledge of physics.

1. How are microscopes, telescopes, cameras, projectors, and lasers similar? How are they different? _____

2. Why can microscopes have a small objective lens, while telescopes need a large one? _____

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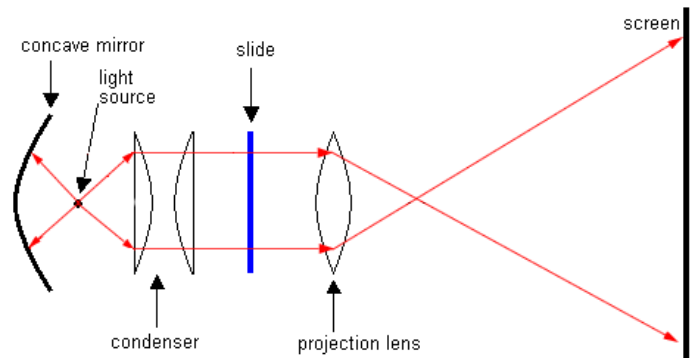
LIGHT

3. The first microscope consisted of a single lens with such a large curvature that it had to be placed against the eye because of its short focal length. How does the modern microscope get magnification without such a large curvature? _____

4. How is a refracting telescope different from a reflecting telescope? _____

5. Why does a camera need a convex lens with a short focal length? _____

6. The diagram to the right shows the set up of a projector. Describe the functions of the parts. _____



7. Why does a laser have a narrow high energy beam compared to other light sources? _____