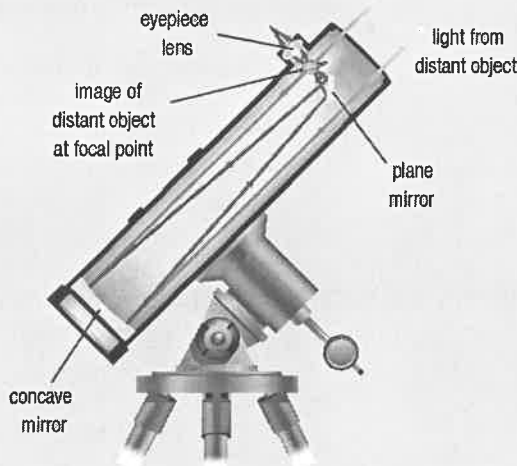


- A reflecting telescope uses a large concave mirror to capture light and converge it towards a lens.
- Astronomical telescopes tend to be reflecting telescopes because large mirrors weigh less and transmit more light than a lens of the same diameter.

CHAPTER REVIEW ANSWERS

Checking Concepts

- The cornea and the lens are used to refract light in the human eye.
- Students' answers may vary, but should be similar to the following examples:
 - Both the sclera and the cornea cover the outside of the eye, with the difference being that the sclera is white and opaque, while the cornea is transparent.
 - The iris is a ring of opaque muscle that forms a circular opening, called the pupil, through which light enters the eye.
 - The retina is made of many cells, including rod cells, which detect black and white, and cone cells, which detect colour.
- The diagram reveals the existence of the blind spot, which everyone has. It also shows that our brain fills in the blind spot with whatever colours are surrounding it.
- A near-sighted person should use a concave lens, which helps form the image of a distant object on the retina instead of in front of it.
 - A far-sighted person should use a convex lens, which helps form an image on the retina, instead of behind it.
- Astigmatism is a condition caused by an irregularly shaped cornea that makes it impossible to form a clear image. Sometimes several blurry images of the same object are produced.



- In a microscope, the object being viewed is moved closer to or farther from the objective lens until it comes into focus.
 - This does not work for a telescope because the distance of the object being observed cannot be moved farther from or closer to the telescope.
- The shortening of the body of a pair of binoculars is accomplished by the use of prisms, which allow the light to travel a greater distance than the length of the binoculars by causing the incident light to reflect many times before reaching the observer.

Understanding Key Ideas

- Our eyes can adapt to different amounts of light in several ways, including changing the size of the pupil in order to regulate the amount of light reaching the retina, as well as becoming more or less sensitive to certain colours, depending on how bright they are.
- When someone walks into a darkened room from a bright room, the pupil is too small to permit enough light to enter the eye. It takes a few minutes for the iris to respond by enlarging the size of the pupil. Also acceptable: Rod cells play a major role in low light vision and cone cells play a much lesser role. This adjustment takes a few minutes to occur.
- Laser surgery reshapes the shape of the cornea, causing light to be refracted differently. Lenses accomplish this refraction by altering the path of light rays before they reach the eye. Lenses act as if they are reshaping the cornea.
- The objective lens or mirror in a telescope collects the incident light and forms a magnified image inside the body of the telescope.
 - The eyepiece lens magnifies the image formed by the first lens and directs the light rays into the eye or camera of the observer.
- A refracting telescope converges all incident light rays of an object to a single point. These rays then continue to expand until they form an image of the object, but during this expansion the image is inverted.
- To focus on a distant object after being focussed on a close object, less refraction is needed, because the light rays from a close object are diverging, whereas the light rays

from a distant object are nearly parallel. Rays from a distant object will form an image closer to the lens than light rays from a nearby object. Therefore the lens should be brought closer to the CCD.

15. (a) A very high magnification on a microscope may result in a darker image because the reflecting surface of the image is smaller and fewer light rays reach the observer's eye.
- (b) Shining a light on or through the image being observed can help to brighten the image.

Pause and Reflect Answer

Students' answers may vary. Sample answers: The availability of eyeglasses might cause a greater demand for books by people who would not otherwise be able to read them. Similarly, with the greater availability of books the demand for eyeglasses would certainly increase. Even if eyeglasses were not available, books would be important. For example, even today, those who cannot read can still be read to.

UNIT 2 ASSESSMENT

PROJECT

Designing Fog Lights, p. 234

Purpose

- Students investigate which is the best colour to use to make fog lights.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO	APPARATUS/MATERIALS
2 days before	Gather materials and apparatus.	For each group: <ul style="list-style-type: none"> glass or plastic jar with no label milk water flashlight coloured film or cellophane wrap light meter

Time Required

- 60 min

Safety Precautions

- Remind students to wipe up any spills immediately.

Science Background

Red and green lights have special meanings as traffic signals so these colours would not be useful as fog lights. Amber is the most common colour used in fog

lights. Since amber means caution, or prepare to yield, it is not contradictory to road customs to use it in fog, where extra caution is warranted anyway.

Studies show that there is not much difference in the penetrating power or backwards reflectance between the different colours. However, this does not mean there is anything wrong with trying to find the most effective colour.

Light meters can use metric or non-metric units for light intensity, but this does not matter as long as the same units are used throughout.

Activity Notes

- Have students work in pairs or small groups.
- Students can probably figure out how to use a light meter themselves.
- Since this activity ends with a group decision, students might wish to make use of Science Skill 4, Societal Decision Making, on pages 482-483 of the student book.
- Some research might be useful prior to performing the experiment; however, note that coming across the results of other people's work does not void the importance of being able to replicate, verify, or expand upon previous studies.
- Although this experiment can be done very quickly using the equipment suggested, other ways of making fog besides using milky water might be tried.

Supporting Diverse Student Needs

- This is a very good hands-on activity for tactile and visual learners.
- Visually impaired students should be included by partnering them with other students.
- Since this experiment involves making a decision (what colour to recommend to their company) and that decision must be made even though some data may be inconclusive (many colours will be fine, possibly even including white light), this activity can provide practice in consensus building.

Report Out Answers

- Accept any data that appears to be well presented and to have been obtained in a systematic and careful manner.
- A number of studies have shown that there is no great difference with regard to the penetration of fog by lights of different colour. The theory of light scattering (Rayleigh Scattering, also known as Raleigh Scattering) suggests that, due to the large size of water droplets in fog, the amount of scattering is essentially independent of the wavelength of the incident light. However, students may find that yellow