

Conceptual Questions

26.1 Physics of the Eye

1.

If the lens of a person's eye is removed because of cataracts (as has been done since ancient times), why would you expect a spectacle lens of about 16 D to be prescribed?

2.

A cataract is cloudiness in the lens of the eye. Is light dispersed or diffused by it?

3.

When laser light is shone into a relaxed normal-vision eye to repair a tear by spot-welding the retina to the back of the eye, the rays entering the eye must be parallel. Why?

4.

How does the power of a dry contact lens compare with its power when resting on the tear layer of the eye? Explain.

5.

Why is your vision so blurry when you open your eyes while swimming under water? How does a face mask enable clear vision?

26.2 Vision Correction

6.

It has become common to replace the cataract-clouded lens of the eye with an internal lens. This intraocular lens can be chosen so that the person has perfect distant vision. Will the person be able to read without glasses? If the person was nearsighted, is the power of the intraocular lens greater or less than the removed lens?

7.

If the cornea is to be reshaped (this can be done surgically or with contact lenses) to correct myopia, should its curvature be made greater or smaller? Explain. Also explain how hyperopia can be corrected.

8.

If there is a fixed percent uncertainty in LASIK reshaping of the cornea, why would you expect those people with the greatest correction to have a poorer chance of normal distant vision after the procedure?

9.

A person with presbyopia has lost some or all of the ability to accommodate the power of the eye. If such a person's distant vision is corrected with LASIK, will she still need reading glasses? Explain.

26.3 Color and Color Vision

10.

A pure red object on a black background seems to disappear when illuminated with pure green light. Explain why.

11.

What is color constancy, and what are its limitations?

12.

There are different types of color blindness related to the malfunction of different types of cones. Why would it be particularly useful to study those rare individuals who are color blind only in one eye or who have a different type of color blindness in each eye?

13.

Propose a way to study the function of the rods alone, given they can sense light about 1000 times dimmer than the cones.

26.4 Microscopes

14.

Geometric optics describes the interaction of light with macroscopic objects. Why, then, is it correct to use geometric optics to analyse a microscope's image?

15.

The image produced by the microscope in Figure 26.16 cannot be projected. Could extra lenses or mirrors project it? Explain.

16.

Why not have the objective of a microscope form a case 2 image with a large magnification? (Hint: Consider the location of that image and the difficulty that would pose for using the eyepiece as a magnifier.)

17.

What advantages do oil immersion objectives offer?

18.

How does the NA of a microscope compare with the NA of an optical fiber?

26.5 Telescopes

19.

If you want your microscope or telescope to project a real image onto a screen, how would you change the placement of the eyepiece relative to the objective?

26.6 Aberrations

20.

List the various types of aberrations. What causes them and how can each be reduced?