

Section 12.2: Review Answers

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1. The eye's external layer is a white, tough and fibrous protective layer called the sclera. Light enters the eye through the cornea, the transparent part of the sclera at the front of the eye.

The intermediate layer of the eye is the choroid, which absorbs stray light rays not detected by photoreceptors. The choroid also contains blood vessels that nourish the eye. Toward the front, the choroid forms the doughnut-shaped, coloured iris, which contains a central dark pupil.

The retina, the internal layer of the eye, is a thin layer of tissue containing the photoreceptors—the rods and cones. It also contains a bipolar cell layer and a ganglion cell layer, whose axons form the optic nerve that exits the eye at the blind spot. The fovea centralis is the area on the retina where the cornea and lens focus light for vision.

2. As the person approaches and the viewer's eye tries to keep him/her in focus, the lens changes shape. The changing shape of the lens of the eye to focus images clearly on the retina is a reflex called accommodation. As the person gets closer, the ciliary muscles contract and the suspensory ligaments relax, causing the lens to become more rounded.
3. Light rays from each point on an object enter the eye and are bent (refracted) by the cornea, lens, and humours to focus on the retina.

In people with myopia, the eyeball is elongated and the focussed light falls *in front* of the retina instead of on the photoreceptors. To see distant objects, nearsighted people can wear concave lenses, which diverge incoming light rays so that the image falls directly on the retina.

In people with hyperopia, the eyeball is too short. The light rays do not meet before they reach the retina, and so the image is focussed *behind* the retina. Convex lenses can correct this problem by bending the light rays at a sharper angle.

4. A person can be blind even with a functioning optic nerve. This person may have had a stroke or other injury that damaged the vision perception centres in the brain. This damage would prevent the interpretation of the nerve impulses coming in from the eyes and the person would therefore be blind.
5. As people age, the lens of their eyes is thought to become less elastic. This results in the loss of the accommodation reflex and the inability to focus at different distances. For example, older people begin to hold the newspaper farther away to read because fine objects close to them look blurred. However, objects far away may also be blurred. Bifocals are the most common type of multifocal lens and are usually prescribed for people with declining accommodation. The lens is split in two sections; the upper part is concave for distance vision and the lower part is convex for near vision.
6. Students may need to do some research on the Internet to complete the chart.

Eye Condition	Description of the problem	Method of correction
glaucoma	A small amount of aqueous humour is continually produced every day and normally leaves the anterior compartment by way of tiny ducts. These drainage ducts are blocked in a person with glaucoma, and aqueous humour builds up. If not treated, the pressure builds up and restricts the blood flow to the retina. The nerve fibres begin to die due to a lack of nutrients, and the person becomes blind.	Treatment is to lower the pressure in the eye, either through eye drops or surgery.
cataract	Cataracts affect the lens. As the protein structure degenerates, the lens becomes opaque and does not allow light rays to pass through. Grey-white spots can be seen on the lens.	Surgery to replace the cataract with an artificial lens is a common surgical procedure.
astigmatism	When the cornea or lens has an uneven curvature, a fuzzy image is produced because light rays cannot be evenly focussed on the retina.	Astigmatism can be corrected by an unevenly ground artificial lens to compensate for the uneven cornea or lens.
nearsightedness (myopia)	Nearsightedness is caused by an elongated eyeball; rays focus in front of the retina when a person is viewing distant objects.	A concave lens allows the subject to see distant objects.
farsightedness (hyperopia)	Farsightedness is caused by a short eyeball; rays focus behind the retina when a person is viewing close objects.	A convex lens allows the subject to see close objects.

7. Humans are adapted to perceive their surroundings mostly using the sense of sight. The more we rely on a sense, the larger the area of the brain that is devoted to interpreting the nerve impulses arriving from those sensory receptors.

Some students may also relate their answer to the previous chapter. These students may indicate that the occipital lobes are located at the back of the brain, directly above the cerebellum. These lobes process visual stimuli—stimuli that are sent to the brain from the eyes. (Advanced students may be interested in the following additional information: A visual stimulus enters and goes directly to structures deep within the brain, where it is scanned and relayed to the occipital lobes for processing. Within the occipital lobes are groups of specialized neurons—neurons that “handle” specific colours, motions, straight lines, objects, depth, etc. These neurons then communicate with other neurons within the visual association area to compare what they have perceived with what may have been stored previously. Visual stimuli do not become meaningful until the sensory perceptions are matched to previously stored cognitive associations.)