Test Bank

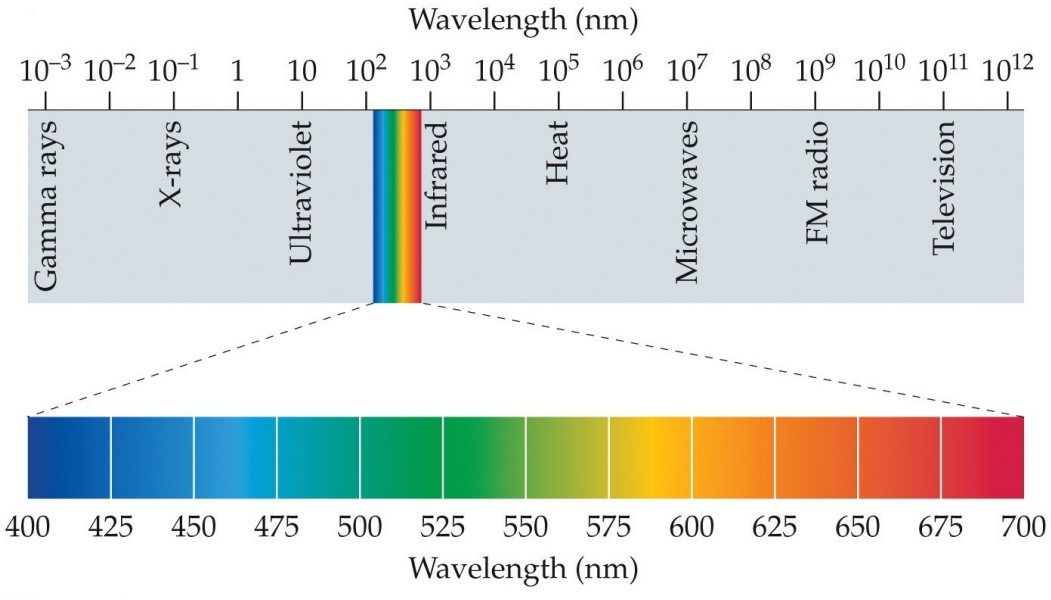
by Evan M. Palmer
to accompany
Sensation & Perception, Fifth Edition
Wolfe • Kluender • Levi • Bartoshuk • Herz • Klatzky • Merfeld

Chapter 2: The First Steps in Vision: From Light to Neural Signals

Multiple Choice

1. Light can be described as a stream of photons or a(n)
a. signal.
b. wave.
c. source.
d. outlet of energy.
e. illuminant.
Answer: b
Textbook Reference: A Little Light Physics
Bloom's Level: 1. Remembering
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed.

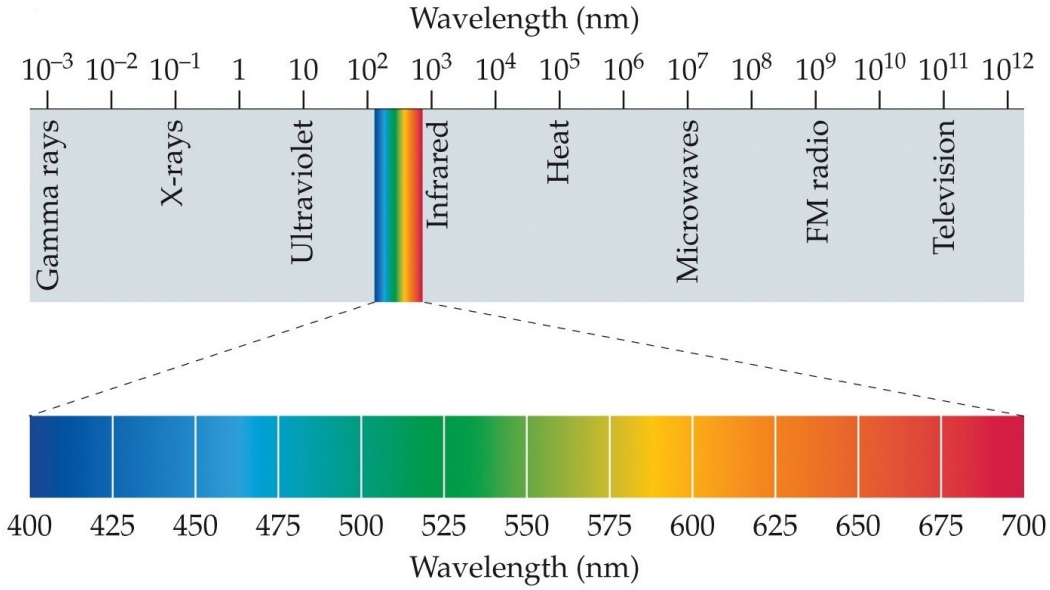
2. Refer to the figure.



The top part of the figure shows the
a. spectrum of visible light.

b. different kinds of light.
c. amount of heat emitted by a light source.
d. number of photons emitted by a light source.
e. spectrum of electromagnetic energy.
Answer: e
Textbook Reference: A Little Light Physics
Bloom's Level: 2. Understanding
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed.

3. Refer to the figure.



The bottom part of the figure shows the
a. spectrum of visible light.
b. different kinds of light.
c. spectrum of electromagnetic energy.
d. number of photons emitted by a light source.
e. amount of heat emitted by a light source.
Answer: a
Textbook Reference: A Little Light Physics
Bloom's Level: 2. Understanding
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed.

4. Light *cannot* be
a. absorbed.
b. refracted.
c. dissolved.
d. transmitted.

e. scattered.
Answer: c
Textbook Reference: A Little Light Physics
Bloom's Level: 2. Understanding
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed.

5. Refraction of a wave of energy means
a. oscillation that travels through a medium.
b. bending or spreading out of waves as they pass through a medium.
c. bending or spreading out of waves as they pass the edge of an obstacle.
d. passing of waves with no interruption.
e. redirection of light back toward its source.
Answer: b
Textbook Reference: A Little Light Physics
Bloom's Level: 1. Remembering
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed.

6. When something strikes a surface, especially light, sound, or heat, and is redirected (usually back toward its point of origin), it is being
a. refracted.
b. transmitted.
c. scattered.
d. reflected.
e. absorbed.
Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed.

7. The transparent "window" on the outer part of the eye that allows light into the eyeball is called the
a. pupil.
b. iris.
c. lens.
d. retina.
e. cornea.
Answer: e
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

8. The aqueous humor is a(n)

a. funny substance.
b. watery fluid between the cornea and iris.
c. gel-like fluid between the lens and retina.
d. circular opening at the center of the iris.
e. opaque fluid.
Answer: b
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

9. The vitreous humor is a(n)
a. funny substance.
b. watery fluid between the cornea and iris.
c. gel-like fluid between the lens and retina.
d. circular opening at the center of the iris.
e. opaque fluid.
Answer: c
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

10. The dark, circular opening at the center of the eye, where light enters the eye, is called the
a. pupil.
b. iris.
c. lens.
d. retina.
e. cornea.
Answer: a
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

11. The colored part of the eye, consisting of a muscular diaphragm, is called the
a. pupil.
b. iris.
c. lens.
d. retina.
e. cornea.
Answer: b
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their

functions, and the various errors of focusing that might require correction.

12. The structure that becomes thicker or thinner to allow images to be focused onto the back of the eye is called the
a. pupil.
b. iris.
c. lens.
d. retina.
e. cornea.
Answer: c
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

13. The light-sensitive membrane at the back of the eye that contains rods and cones is called the
a. pupil.
b. iris.
c. lens.
d. retina.
e. cornea.
Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

14. The retina
a. is the tough outer covering that protects the eye.
b. contains watery fluid.
c. focuses the image.
d. diffracts light.
e. contains rods and cones.
Answer: e
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

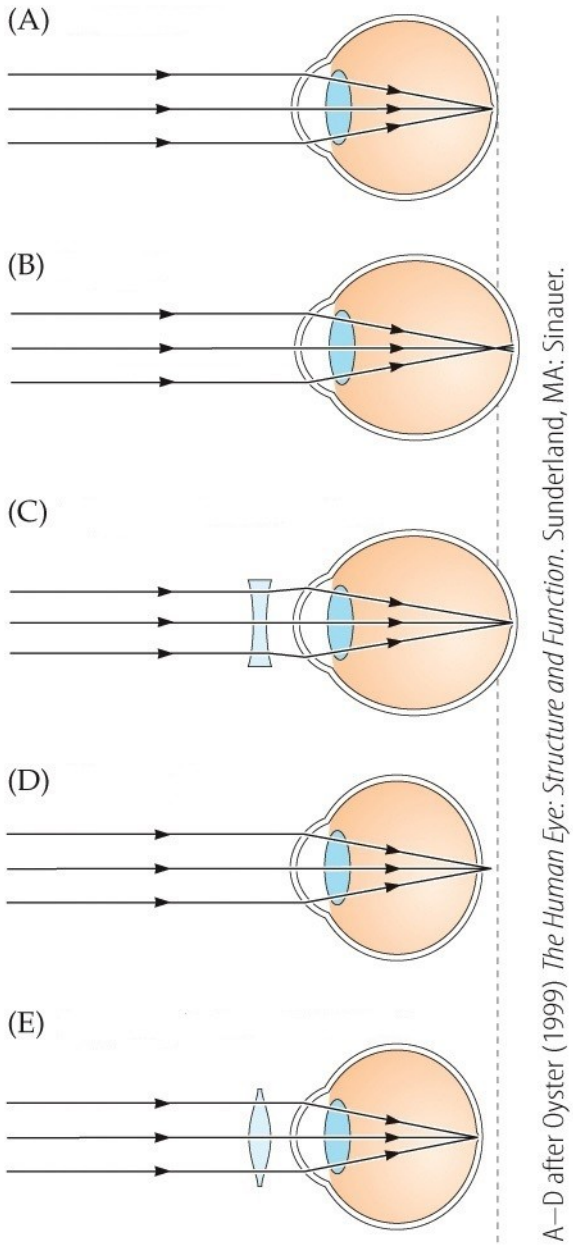
15. People with _____ do *not* require an optical correction to see normally.
a. myopia
b. hyperopia
c. astigmatism
d. emmetropia
e. All of the above require optical correction.

Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

16. Which of the following is a unit of measurement of the optic power of a lens?
a. Diopter
b. Visual angle
c. Accommodation
d. Hertz
e. Wavelength
Answer: a
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

17. Which of the following refers to nearsightedness?
a. Myopia
b. Hyperopia
c. Astigmatism
d. Emmetropia
e. Strabismus
Answer: a
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

18. Refer to the figure.

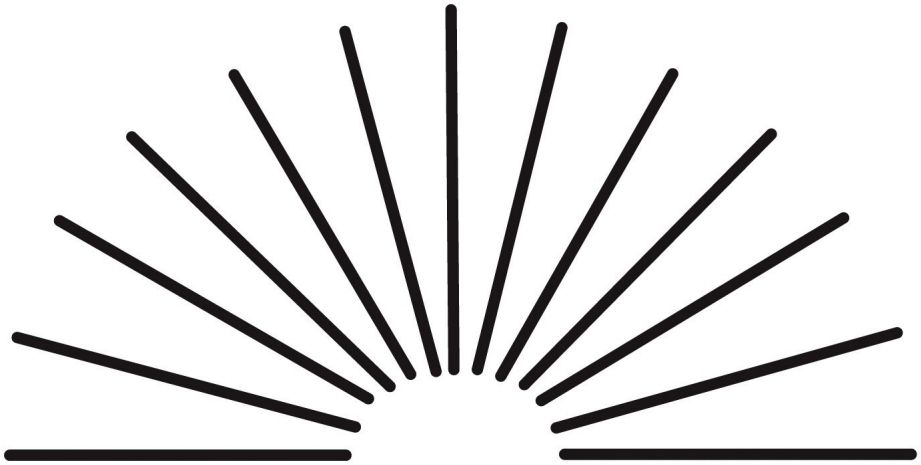


Which part of the figure depicts hyperopia without correction?
a. A
b. B
c. C
d. D
e. E
Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their

functions, and the various errors of focusing that might require correction.

19. Accommodation is the process during which the _____ of the eye changes its shape.
a. retina
b. lens
c. pupil
d. iris
e. cornea
Answer: b
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

20. Refer to the figure.



This chart is used to test for
a. myopia.
b. hyperopia.
c. astigmatism.
d. macular degeneration.
e. retinitis pigmentosa.
Answer: c
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.5 Understand the experimental methods used to study the functioning of the eye and retina.

21. Literally meaning "old sight," this term refers to age-related loss of accommodation, which makes it difficult to focus on near objects.

a. Emmetropia
b. Hyperopia
c. Macular degeneration
d. Retinitis pigmentosa
e. Presbyopia
Answer: e
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

22. In presbyopia, the lens becomes stiff with age and cannot change its shape. What is the perceptual consequence of this change?
a. Too much light gets into the eye, causing difficulties with daytime vision.
b. Not enough light gets into the eye, causing difficulties with nighttime vision.
c. It may become difficult to focus on objects at certain depths.
d. Light becomes so scattered in the eye that perception is impossible.
e. Peripheral vision is lost gradually over time.
Answer: c
Textbook Reference: Eyes That Capture Light
Bloom's Level: 3. Applying
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

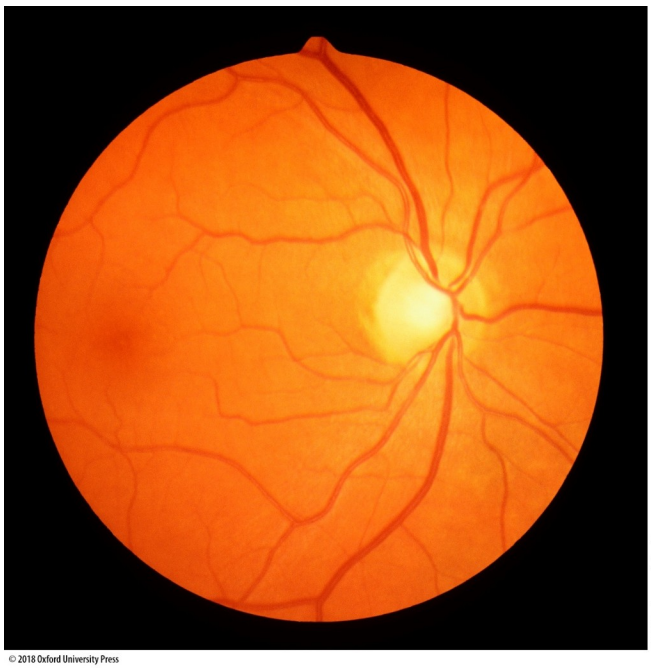
23. The retina is analogous to the _____ in a camera.
a. lens
b. stop
c. flash
d. film
e. shutter
Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

24. The iris is analogous to the _____ in a camera.
a. lens
b. aperture
c. flash
d. film
e. shutter
Answer: b
Textbook Reference: Eyes That Capture Light

Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

25. The light energy from an object is _____ into neural energy that can be interpreted by the brain.
a. transferred
b. transformed
c. transduced
d. absorbed
e. translated
Answer: c
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

26. Refer to the figure.



Eye doctors use an instrument called an ophthalmoscope to look at the _____ of their patients' eyes, as seen in the image.
a. cornea
b. iris
c. lens
d. focal point

e. fundus
Answer: e
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.5 Understand the experimental methods used to study the functioning of the eye and retina.

27. Which of the following sense light?
a. Ganglion cells
b. Rods and cones
c. Horizontal cells
d. Amacrine cells
e. Bipolar cells
Answer: b
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

28. Rods are photoreceptors that are specialized for
a. daylight vision.
b. sensing narrow objects.
c. transmitting light.
d. night vision.
e. processing color.
Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.3 Understand and describe the various ways the eye adapts to light and dark environments; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

29. Photoreceptors that are specialized for daylight vision, fine acuity, and color are called
a. duplexes.
b. ganglion cells.
c. rods.
d. bipolar cells.
e. cones.
Answer: e
Textbook Reference: Eyes That Capture Light

Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.3 Understand and describe the various ways the eye adapts to light and dark environments; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

30. The retina can be referred to as _____ because it contains rods and cones, which operate under different conditions.
a. a focal point
b. a shutter
c. duplex
d. a light-passing membrane
e. bipartisan
Answer: c
Textbook Reference: Eyes That Capture Light
Bloom's Level: 2. Understanding
Learning Objective: 2.3 Understand and describe the various ways the eye adapts to light and dark environments; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

31. The high-resolution part of the eye that is used for detailed vision is called the
a. cornea.
b. lens.
c. iris.
d. sclera.
e. fovea.
Answer: e
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

32. _____ refers to the distance between the location of a retinal image and the fovea.
a. Degradation
b. Density
c. Circularity
d. Eccentricity
e. Signal strength
Answer: d
Textbook Reference: Eyes That Capture Light
Bloom's Level: 1. Remembering
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.4 Know and

describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

33. Light and dark adaptation can occur by pupil constriction or dilation and
a. lateral inhibition.
b. changes in photoreceptor concentration.
c. photoactivation.
d. bipolar cell activation and deactivation.
e. ganglion cell activation and deactivation.
Answer: b
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 2. Understanding
Learning Objective: 2.3 Understand and describe the various ways the eye adapts to light and dark environments.

34. Suppose your pupils are dilated after visiting the eye doctor. What is the effect on the amount of photopigment in your photoreceptors, and why?
a. You have more photopigment than normal because your photoreceptors are trying to adapt to the decreased amount of light striking the retina.
b. You have more photopigment than normal because your photoreceptors are trying to adapt to the increased amount of light striking the retina.
c. You have less photopigment than normal because your photoreceptors are trying to adapt to the decreased amount of light striking the retina.
d. You have less photopigment than normal because your photoreceptors are trying to adapt to the increased amount of light striking the retina.
e. You have the same amount of photopigment as normal because photoreceptors do not adapt to changes in the amount of light entering the eyes.
Answer: d
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 3. Applying
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.3 Understand and describe the various ways the eye adapts to light and dark environments.

35. In retinitis pigmentosa, there is
a. regeneration of too many photoreceptors.
b. loss of color in the iris of the eye.
c. loss of macular opacity.
d. loss of the ability to use the lens in order to focus.
e. degeneration of the pigment epithelium.
Answer: e
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 2. Understanding
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

36. In aging-related macular degeneration (AMD) there is a _____ loss of _____ vision.
a. sudden; peripheral
b. gradual; peripheral
c. sudden; central
d. gradual; central
e. complete; all
Answer: d
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 2. Understanding
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

37. With regard to retinitis pigmentosa (RP) and age-related macular degeneration (AMD), which would have the greatest impact on scotopic (nighttime) vision, and why?
a. RP, because it damages peripheral vision, which is most important for scotopic vision.
b. RP, because it damages central vision, which is most important for scotopic vision.
c. AMD, because it damages peripheral vision, which is most important for scotopic vision.
d. AMD, because it damages central vision, which is most important for scotopic vision.
e. Neither of these diseases affects scotopic vision.
Answer: a
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

38. With regard to retinitis pigmentosa (RP) and age-related macular degeneration (AMD), which would have the greatest impact on photopic (daytime) vision, and why?
a. RP, because it damages peripheral vision, which is most important for photopic vision.
b. RP, because it damages central vision, which is most important for photopic vision.
c. AMD, because it damages peripheral vision, which is most important for photopic vision.
d. AMD, because it damages central vision, which is most important for photopic vision.
e. Neither of these diseases affects photopic vision.
Answer: d
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

39. The part of the photoreceptor that contains photopigment molecules is called the
a. retina.
b. outer segment.
c. inner segment.
d. synaptic terminal.

e. vitreous humor.
Answer: b
Textbook Reference: Retinal Information Processing
Bloom's Level: 1. Remembering
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

40. _____ is the visual pigment found in rods.
a. Macular pigment
b. Aqueous humor
c. Rhodopsin
d. Chromopsin
e. Vitreous humor
Answer: c
Textbook Reference: Retinal Information Processing
Bloom's Level: 1. Remembering
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

41. Lateral inhibition is the
a. increase in activation caused by nearby regions of the retina.
b. measure of the finest detail that one can resolve.
c. process of inhibiting light from moving.
d. processing of inhibitory cells.
e. antagonistic neural interaction between adjacent regions of the retina.
Answer: e
Textbook Reference: Retinal Information Processing
Bloom's Level: 1. Remembering
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

42. Why is lateral inhibition important for retinal ganglion cell receptive fields?
a. It opposes and counteracts the lateral excitation also happening in the retina.
b. It inhibits perception of the sides of objects, causing the eyes to focus on the center.
c. It creates the center-surround receptive field structure, which acts like a filter for perception.
d. It stops the receptive fields from responding to contrast in the retinal image.
e. Lateral inhibition is not important in the retina.
Answer: c
Textbook Reference: Retinal Information Processing
Bloom's Level: 4. Analyzing
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

43. Which of the following is a specialized retinal cell responsible for lateral inhibition?
a. Amacrine cell

b. Bipolar cell
c. Ganglion cell
d. Horizontal cell
e. Photoreceptor
Answer: d
Textbook Reference: Retinal Information Processing
Bloom's Level: 1. Remembering
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

44. Retinal cells that make connections with bipolar cells, ganglion cells, and other cells like themselves are called
a. amacrine cells.
b. cones.
c. horizontal cells.
d. chromophores.
e. rods.
Answer: a
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

45. Which of the following are retinal cells that synapse with photoreceptors, horizontal cells, and ganglion cells?
a. Amacrine cells
b. Bipolar cells
c. Chromophores
d. Cones
e. Rods
Answer: b
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

46. In the fovea, single cones pass information to single ganglion cells via _____ cells.
a. horizontal
b. amacrine
c. midget bipolar
d. diffuse bipolar
e. rod
Answer: c
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their

functions, including ganglion receptive field properties, and the diseases of the retina.

47. Retinal cells called _____ leave the eye via the optic nerve and transmit information to the brain and midbrain.
a. Ganglion cells
b. Bipolar cells
c. Amacrine cells
d. Horizontal cells
e. Photoreceptors
Answer: a
Textbook Reference: Retinal Information Processing
Bloom's Level: 1. Remembering
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

48. If the optic nerve is severed, which retinal cells are damaged?
a. Amacrine cells
b. Bipolar cells
c. Ganglion cells
d. Horizontal cells
e. Photoreceptors
Answer: c
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

49. The vertical pathway in the retina consists of all of the following *except*
a. cones.
b. rods.
c. bipolar cells.
d. ganglion cells.
e. amacrine cells.
Answer: e
Textbook Reference: Retinal Information Processing
Bloom's Level: 4. Analyzing
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

50. The lateral pathway in the retina consists of horizontal cells and
a. photoreceptors.
b. amacrine cells.
c. midget bipolar cells.
d. diffuse bipolar cells.
e. ganglion cells.
Answer: b

Textbook Reference: Retinal Information Processing
Bloom's Level: 2. Understanding
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

51. A neuron will *not* fire if a stimulus does not activate its
a. axon.
b. action potential.
c. central region.
d. photoreceptor.
e. receptive field.
Answer: e
Textbook Reference: Retinal Information Processing
Bloom's Level: 2. Understanding
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina; 2.5 Understand the experimental methods used to study the functioning of the eye and retina.

52. Which stimulus would optimally activate an ON-center ganglion cell?
a. A spot of light in the center of the receptive field
b. A shadow in the center of the receptive field
c. A ring of light covering the surround of the receptive field
d. A large spot of light covering both the center and surround portions of the receptive field
e. A large shadow covering both the center and surround portions of the receptive field
Answer: a
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina; 2.5 Understand the experimental methods used to study the functioning of the eye and retina.

53. Which stimulus would optimally activate an OFF-center ganglion cell?
a. A spot of light in the center of the receptive field
b. A shadow in the center of the receptive field
c. A ring of shadow covering the surround of the receptive field
d. A large spot of light covering both the center and surround portions of the receptive field
e. A large shadow covering both the center and surround portions of the receptive field
Answer: b
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina; 2.5 Understand the experimental methods used to study the functioning of the eye and retina.

54. P ganglion cells are different than M ganglion cells in that P ganglion cells
a. have larger receptive fields than M ganglion cells do.
b. are more sensitive to motion than M ganglion cells are.
c. synapse with more photoreceptors than M ganglion cells do.
d. operate better in low-light conditions than M ganglion cells do.
e. are more sensitive to color than M ganglion cells are.
Answer: e
Textbook Reference: Retinal Information Processing
Bloom's Level: 3. Applying
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

55. If the P ganglion cells in the retina suddenly disappeared, what would be the consequences for perception?
a. Motion perception would be severely impaired.
b. Peripheral vision would be severely impaired.
c. Color and form perception would be severely impaired.
d. Color and form perception would be improved.
e. Scotopic vision would be severely impaired.
Answer: c
Textbook Reference: Retinal Information Processing
Bloom's Level: 4. Analyzing
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

56. If the M ganglion cells in the retina suddenly disappeared, what would be the consequences for perception?
a. Motion perception would be severely impaired.
b. Peripheral vision would be greatly improved.
c. Foveal vision would be greatly improved.
d. Foveal vision would be severely impaired.
e. Color and form perception would be severely impaired.
Answer: a
Textbook Reference: Retinal Information Processing
Bloom's Level: 4. Analyzing
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

Short Answer

57. Describe the journey of light from the time it is emitted by the sun to the time it is registered by our eyes. In what ways is light reflected, refracted, transmitted, and absorbed?
Answer: Light is emitted by the sun, enters the atmosphere where some of it is absorbed and scattered, and the rest of it is transmitted through the air until it hits an object. When

light hits an object, some of it is absorbed and the rest of it is reflected. Reflected light may strike the eye, where it is transmitted and slightly refracted by the cornea and aqueous humor. It then passes through the pupil, is refracted and focused by the lens, transmitted through the vitreous humor and finally is absorbed by photoreceptors in the back of the eye.
Textbook Reference: Eyes That Capture Light
Bloom's Level: 3. Applying
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed; 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

58. Describe how the shape of the human lens and eyeball can cause blurry vision that requires correction. What are the differences between emmetropia, myopia, hyperopia, and astigmatism?
Answer: The eyeball may be too long or too short for light that is refracted by the cornea and lens to be properly focused on the back of the eye. An eye that is too long, such that the focus point is in front of the retina, results in myopia, or nearsightedness. An eye that is too short, such that the focus point is behind the retina, results in hyperopia, or farsightedness. An eye that has unequal curving results in an astigmatism, which will cause an image to be blurry along a particular angle. A corrective lens in front of the eye (either in the form of a contact lens or glasses) bends the light in such a way that it properly focuses on the back of the eye. When the eyeball is perfectly round and the image is focused properly on the back of the eye, one is said to have the happy condition of emmetropia, which does not require any correction.
Textbook Reference: Eyes That Capture Light
Bloom's Level: 4. Analyzing
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed; 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction.

59. We all have a blind spot in each eye. In normal circumstances, why is it that we do not experience large black empty regions in our visual field?
Answer: There are several reasons. First, we typically look at the world with two eyes, so the blind spot in each eye is covered by the other eye. Second, even when we look at the world with one eye, the brain "fills in" missing information in the blind spot to create a complete image. Finally, we don't have receptors for the blind spot in our eye or brain, so we don't have any cells to encode the lack of information in the first place!
Textbook Reference: Eyes That Capture Light
Bloom's Level: 4. Analyzing
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

60. What are age-related macular degeneration (AMD) and retinitis pigmentosa (RP)? How are they similar and how are they different?

Answer: Age-related macular degeneration and retinitis pigmentosa are progressive eye diseases that result in blindness in part of the visual field. AMD leads to central field loss, such that the center of one's vision disappears. RP leads to peripheral field loss such that the edges of one's vision disappears.
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 2. Understanding
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

Essay

61. Describe the various ways that our visual system adapts to darkness and allows us to see in low lighting conditions. Why are we said to have a "duplex retina"?
Answer: Our visual system adapts to dark situations using two strategies. First, the pupil (iris) expands to let more light into the eye than it would under higher lighting conditions. This response is rather quick and is responsible for short-term dark adaptation. Second, and more importantly, the number of photopigment molecules present in photoreceptors is increased such that the retina becomes more sensitive to what little light is actually present in the environment. In high illumination situations, our eyes detect light using mostly cones, while in low illumination, our eyes detect light using mostly rods. The presence of both rods and cones in the retina is what makes it "duplex." Together, rods and cones can support visual perception under a huge number of lighting conditions.
Textbook Reference: Dark and Light Adaptation
Bloom's Level: 4. Analyzing
Learning Objective: 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.3 Understand and describe the various ways the eye adapts to light and dark environments; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

62. In what ways is the human eye similar to a camera? In what ways does it differ from a camera? Compare and contrast camera functions to the physiology of the human eye.
Answer: The eye is analogous to a camera in the sense that both have an aperture for allowing light in (the pupil/iris of the eye and the aperture of a camera), a lens for adjusting focal length, and a medium for recording images (the retina in the eye and film or digital chip in a camera). An eye is unlike a camera in the sense that while a camera passively records images, an eye actively interprets images using the wiring of the retina, particularly horizontal and amacrine cells. Horizontal cells help to create the center-surround receptive fields through lateral inhibition, which emphasize edges in an image. Amacrine cells aid in contrast enhancement and temporal sensitivity. After the retina, image information is sent on to the LGN (lateral geniculate nucleus) and primary visual cortex for further analysis, interpretation, and enhancement. While film in a camera processes and represents all parts of an image equally, the retina processes the center of an image (the portion that falls on the fovea) in much more detail than the periphery.
Textbook Reference: Retinal Information Processing

Bloom's Level: 5. Evaluating
Learning Objective: 2.1 Describe the various ways light can be reflected, scattered, refracted, transmitted, and absorbed; 2.2 Know and describe the biological parts of the eyeball, their functions, and the various errors of focusing that might require correction; 2.3 Understand and describe the various ways the eye adapts to light and dark environments; 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.

63. Describe the transmission of information in the retina from photoreceptors to the optic nerve. What cells are functioning in what order, and how do they transform visual information on the way to the brain?
Answer: Once light strikes the outer segment of photoreceptors in the retina, a chromophore captures the light molecule which begins the process of photoactivation, causing the photoreceptor to become hyperpolarized. The graded potentials of the photoreceptor that result from photoactivation are sent on to the bipolar cells, which may be either diffuse bipolar cells or midget bipolar cells. Diffuse bipolar cells connect to multiple cones while midget bipolar cells connect to only a single cone. Horizontal cells connect to the synapse of photoreceptors and bipolar cells and help to create the center-surround receptive field organization through lateral inhibition. ON bipolar cells respond to increases in light and OFF bipolar cells respond to decreases in light. Bipolar cells connect to P and M ganglion cells as well as amacrine cells. Amacrine cells modulate the signals coming from bipolar cells to emphasize contrast and improve temporal processing. P ganglion cells receive excitatory input from midget bipolar cells and feed the parvocellular layer of the lateral geniculate nucleus (LGN). M ganglion cells receive excitatory input from diffuse bipolar cells and feed the magnocellular layer of the LGN Ganglion cells converge at the optic disk where they leave the eye and form the optic nerve. The optic nerve transmits signals from the retina to the LGN.
Textbook Reference: Retinal Information Processing
Bloom's Level: 4. Analyzing
Learning Objective: 2.4 Know and describe the biological parts of the retina and their functions, including ganglion receptive field properties, and the diseases of the retina.