**These review questions are for the Senses lecture topic. The questions were adapted from several sources, including 1700+ Review Questions for Anatomy and Physiology II (3rd edition) by R. Michael Anson, Ph.D.**

You are required to know and understand all the material on the senses that is covered in the lecture and the laboratory. Questions marked with an asterisk are from material presented in the laboratory section of the course.

**Multiple choice review questions:**

1) The term \_\_\_\_\_ means cells that detect sense stimuli (such as light, sound, touch, etc.) and transducer the stimuli into a nerve signal.

 A) Sensory generator

 B) Sense cells

 C) Sense receptor

 D) Nerve sensors

2) All sense receptors contain a \_\_\_\_\_\_\_ (a cell type).

 A) Epithelial cell

 B) Smooth muscle cell

 C) Sensory neuron

 D) Skeletal muscle cell

3) The \_\_\_\_\_\_ are the sensory receptors in the skin.

 A) Epithelial receptors

 B) Neuron receptors

 C) Cutaneous receptors

 D) Sensory dermis

4) The receptors that produce pain are called

 A) chemoreceptors

 B) mechanoreceptors

 C) proprioceptors

 D) nociceptors

5) Receptors in the muscles, tendons, and joints that inform the brain of the position and movements of the body parts, are known as

 A) nocioceptors.

 B) cutaneous receptors.

 C) proprioceptors.

 D) exteroreceptors.

6) The cutaneous senses would include all of the following except

 A) pressure.

 B) temperature

 C) light

 D) pain

7) The posterior cavity of the eye (the large cavity between the lens and the retina) is filled with

 A) aqueous humor.

 B) vitreous humor.

 C) endolymph.

 D) perilymph.

8) The outer muscles on the eye are called the \_\_\_\_\_\_\_ muscles. They are skeletal muscles that control voluntary eye movements such as looking left, looking right, etc.

 A) Extrinsic

 B) Ciliary

 C) Ocular

 D) External

9) The wall of the eye has three layers called \_\_\_\_\_\_\_.

 A) Tunics

 B) Tissues

 C) Vision lamella

 D) Ocular epithelium

10) Which is **not** one of the three tunics?

 A) Sclera

 B) Retina

 C) Ciliary body

 D) Choroid coat

11) Light enters the interior of the eye through a small hole called the \_\_\_\_\_\_.

 A) Cornea

 B) Iris

 C) Lens

 D) Pupil

12) The colorful part of the eye (the part that can be brown, blue, gray, or green) is called the \_\_\_\_\_\_.

 A) Cornea

 B) Iris

 C) Lens

 D) Pupil

13) In innermost tunic contains the sensory neurons that transduce light into nerve signals. This tunic is called the \_\_\_\_\_\_\_.

 A) Optic sclera

 B) Optic nerve

 C) Retina

 D) Endoneurium

14) The cells of the retina that absorb and detect light are the \_\_\_\_\_\_\_\_ cells.

 A) mechanoreceptor

 B) thermoreceptor

 C) nocioceptor

 D) photoreceptor

15) The retina has three layers of nervous tissue. Which is the correct order of the retina’s layers, from anterior to posterior?

 A) Ganglion cells, Bipolar cells, Photoreceptors

 B) Photoreceptors, Ganglion cells, Bipolar cells

 C) Bipolar cells, Ganglion cells, Photoreceptors

 D) Bipolar cells, Photoreceptors, Ganglion cells

16) Within the retina

 A) the photoreceptors synapse directly with the bipolar cells.

 B) the bipolar cells stimulate the photoreceptors.

 C) the ganglion cells are directly coupled to the photoreceptors.

 D) bipolar cell axons form the optic nerve

17) The optic nerve is composed of axons extending from the \_\_\_\_ cells in the retina.

 A) ganglion

 B) bipolar

 C) cone

 D) photoreceptor (rods and cones)

18) The area of the eye where the optic nerve passes through the retina is called the \_\_\_\_\_\_\_.

 A) Sclera fenestra

 B) Nerve foramen

 C) Blind spot

 D) Pupil

19) The photoreceptors known as cones allow for

 A) vision at normal daylight intensities.

 B) sharply detailed vision.

 C) color vision.

 D) a high degree of light sensitivity.

20) Which is **not** one of the cone types?

 A) Yellow

 B) Blue

 C) Green

 D) Red

21) When light is absorbed by photoreceptor cells, which of the following events does **not** occur?

 A) Visual pigment changes shape

 B) The photoreceptor cells become depolarized.

 C) The photoreceptor cells release neurotransmitter

 D) The ciliary body muscles conduct the signal.

22) The change in visual pigment molecules when stuck by light is called

 A) transudction

 B) polarization

 C) depolarization

 D) bleaching

23) Which phrase best describes the arrangement of rods and cones in the retina?

 A) Cones mostly at the sides, rods mostly in the anterior region

 B) Cones and rods evenly found throughout the retina

 C) Cones mostly in the posterior region, rods mostly at the sides

 D) Cones spread evenly throughout the retina but rods mostly at the posterior

24) The cones-only area in the center of the retina is called the \_\_\_\_\_\_. This is the area of greatest color vision.

 A) optic nerve.

 B) ganglion cells.

 C) fovea centralis.

 D) optic disc.

25) The function of the lens of the eye is to

 A) serve as the major site of focusing of light rays.

 B) control the size of the pupil.

 C) control the amount of light entering the eye.

 D) All of these are functions of the lens.

26) To keep an object in focus when the object is near the eye, the ciliary body muscles change the shape of the lens. This process is called \_\_\_\_\_\_.

 A) myopia.

 B) hyperopia.

 C) adaptation.

 D) accommodation.

27) When a far object is sharply focused on the retina the

 A) lens is rotated by the iris

 B) lens is rotated by the sclera

 C) ciliary muscle is relaxed.

 D) the retina is relaxed

28) The visual disorder where far objects can be focused but near objects can’t is sometimes called “far sighted”, but the correct term for the condition is \_\_\_\_\_\_.

 A) myopia.

 B) hyperopia.

 C) astigmatism.

 D) cataracts.

29) The visual disorder where near objects can be focused but far objects can’t is sometimes called “near sighted”, but the correct term for the condition is \_\_\_\_\_\_.

 A) myopia.

 B) hyperopia.

 C) astigmatism.

 D) cataracts.

30) Which structures are found in the outer ear? Select all correct answers.

 A) Tympanic membrane

 B) Auricle

 C) Ossicles

 D) Endolymph

 E) Cochlea

 F) Semicircular canals

 G) Vestibule

 H) Auditory canal

31) Which structures are found in the middle ear? Select all correct answers.

 A) Tympanic membrane

 B) Auricle

 C) Ossicles

 D) Endolymph

 E) Cochlea

 F) Semicircular canals

 G) Vestibule

 H) Auditory canal

32) Which structures are found in the inner ear? Select all correct answers.

 A) Tympanic membrane

 B) Auricle

 C) Ossicles

 D) Endolymph

 E) Cochlea

 F) Semicircular canals

 G) Vestibule

 H) Auditory canal

33) The middle ear

 A) contains the cochlea and semicircular canals.

 B) is responsible for transmitting sound waves from the outer ear to the

 inner ear.

 C) contains the otolith organs.

 D) has abundant hair cells.

34) Hair cells send a nerve signal when

 A) they are exposed to endolymph

 B) they bind molecules

 C) their cilia bend

 D) Another neuron stimulates them

35) Hair cells are the sense receptors in all of the following sense organs except

 A) the semicircular canals.

 B) the cochlea.

 C) the skin.

 D) the otolith organs

36) The area of the inner ear that detects sounds (where sounds are transduced into nerve signals) is the

 A) Cochlea

 B) Vestibule

 C) Semicircular canals

 D) Endolymph

37) The \_\_\_\_\_\_\_ is the structure within the cochlea that contains hair cells sandwiched between two membranes.

 A) Organ of Corti

 B) Eustation tube

 C) Utricle

 D) Ossicle

38) The sensory hair cells of the organ of Corti rest on the

 A) basilar membrane.

 B) vestibular membrane.

 C) tectorial membrane.

 D) tympanic membrane.

39) The brain can distinguish low pitched sounds from high pitched sounds because low pitched sounds

 A) cause a higher amplitude of vibration of throughout the organ of Corti.

 B) vibrate the tectorial membrane of the organ of Corti more than the basilar membrane.

 C) vibrate the basilar membrane of the organ of Corti more than the tectorial membrane.

 D) stimulate the deeper organ of Corti more than the outer organ of Corti

40) In addition to housing our hearing sense, the inner ear also houses our \_\_\_\_\_\_ sense.

 A) Vibration

 B) Danger/Crisis

 C) Equilibrium

 D) Telekinetic

41) The equilibrium sense allows us to detect

 A) Homeostasis of internal nutrient concentrations

 B) Changes in our general well being

 C) Equal amounts of positive and negative ions in body fluids

 D) Movement

42) Which parts of the inner ear are involved in the equilibrium sense? (Choose all correct answers)

 A) Cochlea

 B) Vestibule

 C) Semicircular canals

 D) Ossicles

43) Straight line motion is detected by structures in the \_\_\_\_\_\_, whereas rotational motion is detected by structures in the \_\_\_\_\_\_.

 A) Vestibule, Cochlea

 B) Semicircular canals, Vestibule

 C) Vestibule, Semicircular canals

 D) Semicircular canals (for both types of movement)

44) Linear movement of the body is detected primarily by structures in the vestibule known as \_\_\_\_\_\_.

 A) otolith organs

 B) kinetochores

 C) endolymphs

 D) ossicles

45) Which of the following are otolith organs? Choose all correct answers.

 A) Saccule

 B) Ampulla

 C) Cupula

 D) Utricle

46) The hair cells in a semicircular canal are located in a gel called the \_\_\_\_\_\_\_.

 A) ampulla.

 B) cupula.

 C) otolith membrane.

 D) tectorial membrane.

47) The cupula in a semicircular canal is located in a wide region at the end of the canal called the \_\_\_\_\_\_\_.

 A) ampulla.

 B) cupula.

 C) utricle.

 D) saccule.

48\*) The sensation that the room is spinning when one feels dizzy is due to

 A) after-discharge of the sensory neurons.

 B) continued movement of the semicircular canals.

 C) movement of the endolymph fluid.

 D) movements of the otolith membrane.

49) The correct term for the sense of smell is the \_\_\_\_\_\_ sense.

 A) Fragrance

 B) Olfactory

 C) Huelaratory

 D) Aromatic

50) Olfactory receptors are located in the…

 A) Bladder and kidneys

 B) Alimentary canal

 C) Oral cavity

 D) Nasal epithelium

51) The senses of smell and taste have all of the following in common except

 A) both sense five different types of molecules

 B) both use chemoreceptors

 C) the brain have specialized sense areas to receive their signals

 D) both transmit nerve signals directly to the brain (not via the spine)

52) How many different types of molecules can be detected by the olfactory (smell) sense?

 A) 5

 B) 25

 C) 350

 D) 10,200

55) How many different types of molecules can be detected by the gustatory (taste) sense? (In other words, how many different types of taste receptors do we have?).

 A) 5

 B) 25

 C) 350

 D) 10,200

54) Which of the following is not a taste receptor type?

 A) salty

 B) fatty

 C) bitter

 D) sweet

55) H+ ions (acids) cause which taste sensation?

 A) sour

 B) sweet

 C) salty

 D) bitter

56) The chemoreceptors on the tongue that are most sensitive to and respond to many types of plant toxins are the taste receptors for

 A) sweet.

 B) salty.

 C) bitter.

 D) sour.

**Answers to multiple choice questions:**

1 = C

2 = C

3 = C

4 = D

5 = C

6 = C

7 = B

8 = A

9 = A

10 = C

11 = D

12 = B

13 = C

14 = D

15 = A

16 = A

17 = A

18 = C

19 = C

20 = A

21 = D

22 = D

23 = C

24 = C

25 = A

26 = D

27 = C

28 = B

29 = A

30 = B and H

31 = A and C

32 = D, E, F, and G

33 = B

34 = C

35 = C

36 = A

37 = A

38 = A

39 = D

40 = C

41 = D

42 = B and C

43 = C

44 = A

45 = A and D

46 = B

47 = A

48 = C

49 = B

50 = D

51 = A

52 = C

53 = A

54 = B

55 = A

56 = C

**Fill-in-the-blank review questions:**

1) In order for an event to be sensed, an appropriate sensory receptor must convert the stimulus to

a(n) \_\_\_\_\_.

2) The function of sensory receptors is to \_\_\_\_\_\_\_ (a word meaning “change”) sense stimuli such as light, sound, taste, etc. into a nerve signal.

3) \_\_\_\_\_ are receptors that are dedicated to sensing pain.

4) Receptors in the skin that respond to pressure (touch), temperature, and tissue damage are called \_\_\_\_\_\_\_\_.

5) \_\_\_\_\_ are receptors which are found in skeletal muscles, tendons, joints, ligaments, etc.,

which allow us to sense the position of the body.

6) Each eye has how many extrinsic (external) muscles to move the eyeball? \_\_\_\_\_\_

7) The eye has wall composed of three layers, or "\_\_\_\_\_."

8) The outermost tunic of the eyeball has two regions: In the front, it is clear, forming the \_\_\_\_\_.

 The other areas are white, and form the \_\_\_\_\_.

9) The middle tunic of the eye is called the \_\_\_\_\_\_\_\_\_\_

10) The \_\_\_\_\_ is the innermost tunic of the three eye wall tunics.

11) In the front of the eye, the \_\_\_\_\_\_\_ is the pigmented area surrounding the pupil. Its purpose is to \_\_\_\_\_\_\_\_\_.

12\*) A defect (a non-smooth area) in the lens or the cornea that causes one part of the field of vision to be blurry is called a(n) \_\_\_\_\_\_\_\_\_\_\_\_.

13) In dimly lit areas, the pupil will dilate/contract (circle one).

14) The posterior chamber of the eye (the hollow space between the lens and the retina) is filled with a fluid called \_\_\_\_\_\_\_\_.

15) The anterior cavity of the eye (between the lens and the cornea) is filled with \_\_\_\_\_, a clear fluid similar to blood plasma.

16)The \_\_\_\_\_ is the clear part of the eye that focuses light images on the retina. Many patients benefit from having it re-shaped surgically to correct myopia, hyperopia, or astigmatism.

17) \_\_\_\_\_ are neurons that sense light energy; in humans, these are found in the retina.

18) The \_\_\_\_\_\_\_ are the photoreceptors that provide color vision and the \_\_\_\_\_\_\_\_ are the photoreceptors that provide black-and-white vision.

19) What are the two major types of photoreceptors called? \_\_\_\_\_ and \_\_\_\_\_.

20) What are the three types of color-sensing photoreceptors (what colors)? \_\_\_\_, \_\_\_\_, and \_\_\_\_.

21) The retina has three sub-layers. The cells of the three layers (from anterior-most to posterior-most) are called \_\_\_\_\_\_, \_\_\_\_\_\_\_, and \_\_\_\_\_\_\_.

22) In order to be absorbed by photoreceptors, light must actually pass through the \_\_\_\_\_ layer and the \_\_\_\_ layer of the retina.

23) The axons of the retinal ganglion cells run along the surface of the retina then they become bundled together, pass through the back of the eye, and connect to the brain. This bundle of axons is called the \_\_\_\_\_.

24) The region of the retina where the axons of the retinal ganglion cells leave the eye is called

the \_\_\_\_\_ or \_\_\_\_\_, and lacks \_\_\_\_\_.

25) Color blindness is due to the genetic absence of one type of \_\_\_\_\_.

26) Color blindness is more common in which sex? \_\_\_\_\_\_

27) The retina generates a nerve signal when it is struck by light. Use the numbers 1 – 5 to indicate in what order the nerve signal passes through the following structures:

 Optic nerve: \_\_\_\_

 Ganglion cell: \_\_\_\_

 Visual area of cerebrum: \_\_\_

 Photoreceptor cell: \_\_\_\_

 Bipolar cell: \_\_\_\_

28) When a visual pigment molecule in a photoreceptor cell is hit by light, it \_\_\_\_\_\_, and this results in the photoreceptor cell generating a \_\_\_\_\_\_\_.

29) The point on the retina directly behind the lens (therefore in the center of your vision) is called the \_\_\_\_\_\_\_\_\_\_\_. It has only one type of photoreceptor cell. Which type? \_\_\_\_\_\_\_.

30\*) 20/15 vision is better/worse (circle one) than 20/20 vision.

31) In the diagram below, name eye parts A – M. (Some hints: M and F are fluids, J is a small spot with that gives the greatest color vision, and L is a spot with no photoreceptors).



32\*) In lab, the chart below was used to test for what eye disorder?



33) The number of cones increases/decreases (circle one) toward the posterior of the retina.

34) \_\_\_\_\_\_\_\_\_\_\_ is the ability of eye to focus on near objects.

35) Accommodation occurs when the \_\_\_\_\_\_\_ bends the \_\_\_\_\_\_ into a different shape.

36) In a relaxed eye, the lens focuses far/near (circle one) objects on the retina.

37) Contracting the ciliary body of an eye results in focusing far/near (circle one) objects on the retina.

38) \_\_\_\_\_ is nearsightedness: All focal points are anterior/posterior (circle one) compared to where they normally are found.

39) \_\_\_\_\_ is farsightedness: all focal points are anterior/posterior (circle one) compared to where they normally are found.

40) Which disorder (hyperopia or myopia) is the one where the person can see far objects but not near objects? \_\_\_\_\_

41) The vision problem \_\_\_\_\_\_\_\_\_\_ occurs when the focal point of the lens is longer than the distance to the retina.

42) If a person with myopia is looking at a near object and their ciliary body is relaxed, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

43) If a person with myopia is looking at a near object and their ciliary body is contracted, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

44) If a person with myopia is looking at a far object and their ciliary body is relaxed, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

45) If a person with hyperopia is looking at a far object and their ciliary body is contracted, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

46) If a person with hyperopia is looking at a far object and their ciliary body is relaxed, the focal point of the object will fall in front of/on/behind (circle one of the three) the retina.

47\*) Name the test you performed in lab to measure how close an object could be and still be focused.

48\*) Explain briefly how you performed the near point of accommodation test.

49\*) Name the vision test that the chart below was used for in lab.



50\*) \_\_\_\_\_ is a problem in which the cornea or lens is unevenly shaped, so that some objects appear blurry but others are in focus.

51) The outer ear is composed of the visible portion of the ear, known as the \_\_\_\_\_\_\_, and the tube leading inward, known as the \_\_\_\_\_\_\_.

52) The \_\_\_\_\_ is the outermost structure of the middle ear.

53) The three small bones of the middle ear are called the \_\_\_\_\_\_ (Hint: One word for all three bones)

54\*) The two test hearing tests for deafness you performed in lab were the \_\_\_\_\_\_ test and the \_\_\_\_\_ test.

55) The inner ear contains fluids. The most abundant of the fluidsis called \_\_\_\_\_\_.

56) The correct anatomical term for the eardrum is the \_\_\_\_\_\_.

57) In the diagram below, identify ear structures A – F. (Hint: C is a term for all the bones in the middle ear).

58) As vibrations in the air cause the eardrum to vibrate, the eardrum pushes against the

 First of the three \_\_\_\_\_\_ bones.

59) Which part of the inner ear do vibrations first arrive at?

60) When vibrations arrive at the vestibule, they are converted to vibrations of the \_\_\_\_\_ fluid in the inner ear .

61) The cochlea is a snail shaped organ in the inner ear which is responsible for \_\_\_\_\_.

62) The actual organ within the cochlea which is responsible for hearing is the \_\_\_\_\_. (Hint: It is made of hair cells sandwiched between two membranes).

63) Movement of fluid in the inner ear causes movement of the \_\_\_\_\_\_ membrane, which results in movement cilia of the \_\_\_\_\_, which are the sensory receptors located in the cochlea.

64) The \_\_\_\_\_\_\_ membrane is an inflexible membrane that attaches to the cilia of hair cells within the cochlea.

65) Sounds of high pitch are detected by hair cells at the start/end (circle one) of the cochlea, whereas sounds of low pitch are detected by hair cells at the start/end (circle one) of the cochlea.

66\*) Name the test in lab where the subject closed their eyes and then had to point to the source of a sound.

67\*) \_\_\_\_\_ is a type of deafness caused by impairment of sound before reaching the inner ear. Usually the problem is caused by damage to the middle ear structures.

68\*) \_\_\_\_\_ is a type of deafness caused by damage to the neural structures of the inner ear, usually the cochlear hair cells.

69\*) If the joints of the middle ear bones became inflamed, the result would be \_\_\_\_\_\_\_ deafness.

70\*) Death of some hair cells in the Organ of Corti is common in old age, leading to \_\_\_\_\_ deafness.

71) The vestibule is a compartment of the inner ear which is the major region involved in the sense of

 \_\_\_\_\_.

72\*) In the hearing lab, you viewed a microscope slide like the one shown below. What part of the ear is it?



73) The semicircular canals are compartments of the inner ear which sense \_\_\_\_\_.

74) The \_\_\_\_\_ organs are structures in the vestibule which sense linear (up, down, left, right, forward, backward, etc.) movement.

75) There are two otolith organs in the vestibule: the \_\_\_\_\_ and the \_\_\_\_\_\_.

76) The otolith organs contain hair cells whose cilia are imbedded in a \_\_\_\_\_ that also contains \_\_\_\_\_, which are dense granules of calcium.

77) The otolith organs provide a sense of\_\_\_\_\_\_\_ movement; while the semicircular canals provide a sense of \_\_\_\_\_\_\_\_ movement.

78) The otoliths are composed of microscopic crystals of \_\_\_\_\_\_\_\_

79) The sensory hair cells of the semicircular canals are located within a wide region of the canals called the \_\_\_\_\_\_\_\_\_\_.

80) Using the letters from question 57 as answers, which part of the ear…

a) Contains the organ of Corti? \_\_\_\_

b) Is where spinning motion is detected? \_\_\_\_

c) Are the smallest bones in the body? \_\_\_\_

d) Contains a structure called the ampulla? \_\_\_\_

e) Contains structures called the utricle and saccule? \_\_\_\_

f) Contains otoliths? \_\_\_\_

g) Is where moving forward is detected? \_\_\_\_

h) Contains hair cells that are used in sensing? \_\_\_\_

81) The enlarged regions at the entrance to each semicircular canal are the \_\_\_\_\_, each of

which houses a jelly-like structure called a(n) \_\_\_\_\_. There are hair cells within this structure.

82) When we rotate, the \_\_\_\_\_\_ (a fluid) in the semicircular canals begins to flow. The moving fluid bends the \_\_\_\_\_\_, which bends the \_\_\_\_\_ of the hair cells’ cilia, which causes the hair cells to \_\_\_\_\_\_\_.

83) \_\_\_\_\_ are sensory neurons that detect molecules (chemicals) for the senses of smell and taste.

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84) Taste buds are located on ridges of the tongue called papilla. The taste buds are located on the \_\_\_\_\_ of the papilla (Hint: Possible answers are: top, bottom, or sides).

85) \_\_\_\_\_ is the correct term for the sense of smell.

86) The five kinds of taste receptors are\_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, and \_\_\_\_.

87) If you drank NaOH (the active chemical in Draino and oven cleaner…not a good idea), which of the taste sensations would you experience? Give all answers. (Hint: NaOH turns into Na+ and OH- in your saliva. Review the OH-- ion in the chapter on water chemistry).

88) If you drank HCl (a strong acid…not a good idea), which of the taste sensations would you experience? \_\_\_\_\_\_\_\_\_\_

89) Taste receptors in the tongue are located in clusters called \_\_\_\_\_.

90\*) The olfactory receptors are located in which part of the nasal cavity? \_\_\_\_\_.

91) There are only five kinds of taste receptors, but there are \_\_\_\_\_ (roughly how many?) different types of olfactory receptors.

**Answers to fill-in-the-blank review questions:**

1) Nerve signal

2) Transduce

3) Nociceptors

4) Cutaneous receptors

5) Proprioreceptors

6) Six

7) Tunics

8) Cornea

 Sclera

9) Choroid

10) Retina

11) Iris

 Control the pupil size

12\*) Astigmatism

13) Dilate

14) Vitreous humor

15) Aqueous humor

16) Lens

17) Photoreceptors

18) Cones

 Rods

19) Cones

 Rods

20) Red

 Blue

 Green

21) Ganglion cells

 Bipolar cells

 Photoreceptor cells

22) Ganglion cells

 Bipolar cells

23) Optic nerve

24) Blind spot

 Optic disc

 Photoreceptor cells/vision

25) Cone types

26) Males

27) 4

 3

 5

 1

 2

28) Bleaches/changes shape

 Nerve signal

29) Fovea centralis

Cones only

30\*) Better

31) a = Ciliary body

 b = Iris

 c = Lens

 d = Pupil

 e = Cornea

 f = Aqueous humor

 g = Retina

 h = Choroid

 i = Sclera

 j = Fovea centralis

 k = optic nerve

 l = Blind spot/optic disc

 m = Vitreous humor

32\*) Astigmatism

33) Increases

34) Accommodation

35) Cilary body

 Lens

36) Far

37) Near

38) Myopia

 Anterior

39) Hyperopia

 Posterior

40) Hyperopia

41) Hyperopia

42) On

43) In front of

44) In front of

45) On

46) Behind

47\*) Near point of accommodation

48\*) Place a ruler near the eye, then slide

 an object toward the eye. Read the

 closest distance that the object is

 still in focus.

49) Visual acuity test

50\*) Astigmatism

51) Auricle

 Auditory canal

52) Tympanic membrane

53) Ossicles

54\*) Rinne

 Weber

55) Endolymph

56) Tympanic membrane

57) A = Auricle

 B = Tympanic membrane

 C = Ossicles

 D = Semicircular canals

 F = Cochlea

 G = Vestibule

58) Ossicle

59) Vestibule

60) Endolymph

61) The sense of hearing

62) Organ of Corti

63) Basilar

 Hair cells

64) Tectorial

65) Start

 End

66\*) Sound localization test

67\*) Conduction

68\*) Sensory

69\*) Conduction

70\*) Sensory

71) Equilibrium

72\*) Cochlea (or Organ of Corti)

73) Rotational movement

74) Otolith

75) Utricle

 Saccule

76) Gel

 Otoliths

77) Linear

 Rotational

78) Calcium

79) Ampulla

80) a) = E

 b) = D

 c) = C

 d) = D or F

 e) = F

 f) = F

 g) = F

 h) = D, E, and F

81) Ampulla

 Cupula

82) Endolymph

 Cupula

 Cilia

 Generate a nerve signal

83) Chemoreceptors

84) Sides

85) Olfactory

86) Sweet

 Salty

 Sour

 Bitter

 Umami (meaty)

87) Salty

 Bitter (because OH- is a base)

88) Sour

89) Taste buds

90) The roof (the nasal epithelium)

91) 350

**Short answer questions:**

1) What do the extrinsic eye muscles do? In what ways are they different from the other eye muscles (the iris and the ciliary body)?

2\*) The diagram below is a view of a person’s eyes (as seen from looking down on the person from above). In each eye, mark the location of the blind spot with an X. Under the diagram, explain (in two or three sentences) what is the anatomical reason that we have a blind spot. In other words, what is at that spot instead of light-detecting cells?

3) If you stare at a blue-green colored dot for 30 seconds and then look at a white piece of paper, you will see a colorful after-image of the dot.

 a) What color will the after-image be?

 b) Explain briefly (2–3 sentences) what causes this phenomena:

4) Experiments have shown that for objects in our peripheral vision (the extreme sides of our field of vision), we can see the object but we have difficulty identifying its color. Explain why this is so using the anatomy of the eye.

5\*) Suppose you were testing a patient’s hearing using the Rinne test and the Weber test. On the Weber test, the patient reported that the tuning fork sounded quieter in their right ear. A Rinne test of their left ear showed that they could hear the tuning fork when it was on their mastoid process but not when it was next to their ear. A Rinne test of their right ear showed that they could hear the tuning fork equally when it was on their mastoid process and when it was next to their ear.

 a) In which ear (left or right) does the patient have deafness?

b) Which type of deafness (conduction or sensory) does the patient have?

c) Justify your answers.

6\*) When we are spun around in a circle and then come to a stop, we feel as if we are still spinning. Explain (using the anatomy of our rotation sensors) exactly why the spinning feeling persists after we stop. You may use drawings or diagrams to help clarify your explanation.

7\*) Given that we only have five types of taste receptors, explain how we can differentiate the tastes of thousands of different foods?

**Answers to short answer questions:**

1) The extrinsic eye muscles move the eyes up, down, left, and right. They differ from the iris and ciliary body muscles in two ways: They are skeletal (voluntary) muscle, and they are on the outside of the eye.

2)

 X X

 The blind spot occurs because the optic nerve passes through the retina. There is no room for photoreceptors at that location (because the optic nerve takes up that area) so we have no vision in the blind spot.

3) The afterimage would be red. The visual pigments in the green and blue cones have become temporarily bleached from staring at the blue/green dot, so only the red cones are able to fire when you look at a white piece of paper.

4) Objects at the sides of our field of vision are focused at the sides of the retina, where there are many rods but few cones. Therefore, we can see the object but have difficulty identifying its color. Objects in the center of our field of view are focused at the very back of the retina (the fovea centralis). This region is extremely rich in cones and so we have our most acute color vision in this region.

5) (a) The patient is deaf in their left ear.

 (b) The patient has conduction deafness in their left ear.

(c) In the Weber test, the patient reported that the tuning fork was quieter in their right ear. This result can indicate conduction deafness in the left ear or sensory deafness in the right ear.

 The results of the Rinne test on the left ear (hearing the tuning fork only when it was on the

mastoid process) conform conduction deafness in the left ear.

6) Rotation is sensed when the endolymph fluid in the semi-circular canals moves. The moving endolymph bends the cilia of hair cell neurons, which results the sensation of spinning. When we stop spinning, it takes a few seconds for the endolymph to stop flowing. This results a continued feeling of spinning.

7) Even though we have only five taste receptor types, we also smell foods as we eat them. We have hundreds of different olfactory (smell) receptor types, and this allows us to differentiate the “tastes” (really the smells) of many food types.