CHAPTER OVERVIEW

Chapter 6 explores the processes by which our sense receptors and nervous system represent our external environment (sensation), as well as how we mentally organize and interpret this information (perception). The senses of vision, hearing, taste, touch (including kinesthesia and the vestibular sense), and smell are described, along with the ways in which we organize the stimuli reaching these senses to perceive form; depth; motion; and constant shape, size, and lightness. To enhance your understanding of these processes, the chapter also discusses research findings from studies of subliminal stimulation, sensory restriction, recovery from blindness, adaptation to distorted environments, perceptual set, and extrasensory perception. Note also the role of psychologists in human factors design.

In this chapter there are many terms to learn and several theories you must understand. Many of the terms are related to the structure of the eye, ear, and other sensory receptors. Doing the chapter review several times, labeling the diagrams, and rehearsing the material frequently will help you to memorize these structures and their functions. The theories discussed include the Young-Helmholtz three-color and opponent-process theories of color vision, the place and frequency theories of hearing, and the Gestalt theory of form perception. As you study these theories, concentrate on understanding the strengths and weaknesses (if any) of each.

NOTE: Answer guidelines for all Chapter 6 questions begin on page 151.

CHAPTER REVIEW

First, skim each section, noting headings and boldface items. After you have read the section, review each objective by answering the fill-in and essay-type questions that follow it. As you proceed, evaluate your performance by consulting the answers beginning on page 151. Do not continue with the next section until you understand each answer. If you need to, review or reread the section in the textbook before continuing.

Introduction and Sensing the World: Some Basic Principles (pp. 229–236)

Objective 1: Contrast sensation and perception, and explain the difference between bottom-up and top-down processing.

1. The perceptual disorder in which a person has lost the ability to recognize familiar faces is ____________________.

2. The process by which we detect physical energy from the environment and encode it as neural signals is ____________________. The process by which sensations are organized and interpreted is ____________________.

3. Sensory analysis, which starts at the entry level and works up, is called ________________-
   ________________ ____________________ .
   Perceptual analysis, which works from our experience and expectations, is called ________________-
   ________________ ____________________ .

Objective 2: Distinguish between absolute and difference thresholds, and discuss whether we can sense and be affected by subliminal or unchanging stimuli.

4. The study of relationships between the physical characteristics of stimuli and our psychological experience of them is ________________.
5. The ___________________________ refers to the minimum stimulation necessary for a stimulus to be detected ___________________________ percent of the time.

6. According to ___________________________, theory, a person’s experience, expectations, motivation, and fatigue all influence the detection of a stimulus.

7. Some entrepreneurs claim that exposure to “below threshold,” or ___________________________, stimuli can be persuasive, but their claims are probably unwarranted.

8. Some weak stimuli may trigger in our sensory receptors a response that is processed by the brain, even though the response doesn’t cross the threshold into ___________________________ awareness.

9. Under certain conditions, an invisible image or word can ___________________________ a person’s response to a later question. This illustrates that much of our information processing occurs ___________________________.

10. The minimum difference required to distinguish two stimuli 50 percent of the time is called the ___________________________.

   Another term for this value is the ___________________________.

   The principle that the difference threshold is not a constant amount, but a constant proportion, is known as ___________________________. The proportion depends on the ___________________________.

11. After constant exposure to an unchanging stimulus, the receptor cells of our senses begin to fire less vigorously; this phenomenon is called ___________________________.

12. This phenomenon illustrates that sensation is designed to focus on ___________________________ changes in the environment.

Vision (pp. 236–245)

Objective 3: Describe the characteristics of visible light, and explain the process by which the eye converts light energy into neural messages.

1. Stimulus energy is ___________________________ (transformed) into ___________________________ messages by our eyes.

2. The visible spectrum of light is a small portion of the larger spectrum of ___________________________ radiation.

3. The distance from one light wave peak to the next is called ___________________________. This value determines the wave’s color, or ___________________________.

4. The amount of energy in light waves, or ___________________________, determined by a wave’s ___________________________, or height, influences the ___________________________ of a light.

5. Light enters the eye through the ___________________________, then passes through a small opening called the ___________________________; the size of this opening is controlled by the colored ___________________________.

6. By changing its curvature, the ___________________________ can focus the image of an object onto the ___________________________, the light-sensitive inner surface of the eye.

7. The process by which the lens changes shape to focus images is called ___________________________.

8. The retina’s receptor cells are the ___________________________ and ___________________________.

9. The neural signals produced in the rods and cones activate the neighboring ___________________________ cells, which then activate a network of ___________________________ cells. The axons of ganglion cells converge to form the ___________________________, which carries the visual information to the ___________________________.

10. Where this nerve leaves the eye, there are no receptors; thus, the area is called the ___________________________.

11. Most cones are clustered around the retina’s point of central focus, called the ___________________________, whereas the rods are concentrated in more ___________________________ regions of the retina. Many cones have their own ___________________________ cells to communicate with the visual cortex.

12. It is the ___________________________ (rods/cones) of the eye that permit the perception of color, whereas
________ (rods/cones) enable black-and-white vision.

13. Unlike cones, in dim light the rods are ____________ (sensitive/insensitive).
Adapting to a darkened room will take the retina approximately ____________ minutes.

**Objective 4**: Discuss the different levels of processing that occur as information travels from the retina to the brain’s cortex.

14. Visual information percolates through progressively more ____________ levels. In the brain, it is routed by the ____________ to higher-level brain areas. Hubel and Wiesel discovered that certain neurons in the ____________ of the brain respond only to specific features of what is viewed. They called these neurons ____________

15. Feature detectors pass their information to higher-level cells in the brain, which respond to specific visual scenes. Research has shown that in monkey brains such cells specialize in responding to a specific ____________, ____________, or _____________. In many cortical areas, teams of cells (__________) respond to complex patterns.

**Objective 5**: Define parallel processing, and discuss its role in visual information processing.

16. The brain achieves its remarkable speed in visual perception by processing several subdivisions of a stimulus ____________ (simultaneously/sequentially). This procedure, called ____________, may explain why people who have suffered a stroke may lose just one aspect of vision.

17. Other brain-damaged people may demonstrate ____________ by responding to a stimulus that is not consciously perceived.

**Objective 6**: Explain how the Young-Helmholtz and opponent-process theories help us understand color vision.

18. An object appears to be red in color because it ____________ the long wavelengths of red and because of our mental ____________ of the color.

19. One out of every 50 people is color deficient; this is usually a male because the defect is genetically ____________.

20. According to the ____________ theory, the eyes have three types of color receptors: one reacts most strongly to ____________, one to ____________, and one to ____________.

21. After staring at a green square for a while, you will see the color red, its ____________ color, as an ____________.

22. Hering’s theory of color vision is called the ____________ theory. According to this theory, after visual information leaves the receptors it is analyzed in terms of pairs of opposing colors: ____________ versus ____________, ____________ versus ____________, and ____________ versus ____________.

Summarize the two stages of color processing.
Hearing (pp. 245–252)

Objective 7: Describe the auditory process, including the stimulus input and the structure and function of the ear.

1. The stimulus for hearing, or ___________________________, is sound waves, created by the compression and expansion of ___________________________.

2. The amplitude of a sound wave determines the sound’s ________________.

3. The frequency of a sound wave determines the ________________ we perceive.

4. Sound energy is measured in units called ___________________________. The absolute threshold for hearing is arbitrarily defined as ___________________________ such units.

5. The ear is divided into three main parts: the ___________________________ ear, the ___________________________ ear, and the ___________________________ ear.

6. The outer ear channels sound waves toward the ________________, a tight membrane that then vibrates.

7. The middle ear transmits the vibrations through a piston made of three small bones: the ___________________________, ___________________________, and ___________________________.

8. In the inner ear, a coiled, bony, fluid-filled tube called the ___________________________ contains the receptor cells for hearing. The incoming vibrations cause the ___________________________ to vibrate the fluid that fills the tube, which causes ripples in the ___________________________. Bending the ___________________________ that line its surface. This movement triggers impulses in the adjacent nerve fibers that converge to form the auditory nerve, which carries the neural messages (via the ___________________________) to the ___________________________ lobe’s auditory cortex.

9. The brain interprets loudness from the ___________________________ of hair cells a sound activates.

Objective 8: Contrast place and frequency theories, and explain how they help us to understand pitch perception.

10. One theory of pitch perception proposes that different pitches activate different places on the cochlea’s basilar membrane; this is the ___________________________ theory. This theory has difficulty accounting for how we hear ___________________________-pitched sounds, which do not have such localized effects.

11. A second theory proposes that the frequency of neural impulses, sent to the brain at the same frequency as sound waves, allows the perception of different pitches. This is the ___________________________ theory. This theory fails to account for the perception of ___________________________-pitched sounds because individual neurons cannot fire faster than ___________________________ times per second.

12. For the higher pitches, cells may alternate their firing to match the sound’s frequency, according to the ___________________________ principle.

Objective 9: Describe how we pinpoint sounds, and contrast the two types of hearing loss.

13. We locate a sound by sensing differences in the ___________________________ and ___________________________ with which it reaches our ears.

14. A sound that comes from directly ahead will be ___________________________ (easier/harder) to locate than a sound that comes from off to one side.

15. Problems in the mechanical conduction of sound waves through the outer or middle ear may cause ___________________________.

16. Damage to the cochlea’s hair cell receptors or their associated auditory nerves can cause ___________________________ hearing loss. It may be caused by disease, but more often it results from the biological changes linked with ___________________________ and prolonged exposure to ear-splitting noise or music.
Objective 10: Describe how cochlear implants function, and explain why Deaf culture advocates object to these devices.

17. An electronic device that restores hearing among nerve-deafened people is a __________________________.

18. Advocates of __________________________ object to the use of these implants on __________________________ before they have learned to __________________________. The basis for their argument is that deafness is not a __________________________.

19. Sign language __________________________ (is/is not) a complete language, __________________________ (with/without) its own grammar, syntax, and semantics. People who lose one channel of sensation (such as hearing) __________________________ (seem to/do not seem to) compensate with a slight enhancement in their other sensory abilities.

20. (Close-Up) Deaf children raised in a household where sign language is used express higher __________________________ and feel more __________________________.

Other Important Senses (pp. 252–263)

Objective 11: Describe the sense of touch, and distinguish between kinesthesia and the vestibular sense.

1. The sense of touch is a mixture of at least four senses: __________________________, __________________________, __________________________, and __________________________. Other skin sensations, such as tickle, itch, hot, and wetness, are __________________________ of the basic ones.

2. The __________________________ influence on touch is illustrated by the fact that a self-produced tickle produces less activation in the __________________________ than someone else’s tickle. This influence is also seen in the __________________________ illusion.

3. The system for sensing the position and movement of body parts is called __________________________. The receptors for this sense are located in the __________________________, __________________________, __________________________, and __________________________.

4. The sense that monitors the position and movement of the head (and thus the body) is the __________________________. The receptors for this sense are located in the __________________________ and __________________________ of the inner ear.

Objective 12: State the purpose of pain, and describe the biopsychosocial approach to pain.

5. People born without the ability to feel pain may be unaware of experiencing severe __________________________. More numerous are those who live with __________________________ pain in the form of persistent headaches and backaches, for example.

6. Pain is a property of our __________________________ as well as our __________________________ and __________________________, and our surrounding __________________________.

7. The pain system __________________________ (is/is not) triggered by one specific type of physical energy. The body has specialized __________________________ receptors that detect hurtful stimuli.

8. Melzack and Wall have proposed a theory of pain called the __________________________ __________________________ theory, which proposes that there is a neurological __________________________ in the __________________________ that blocks pain signals or lets them through. It may be opened by activation of __________________________ (small/large) nerve fibers and closed by activation of __________________________ (small/large) fibers or by information from the __________________________.

9. Pain-producing brain activity may be triggered with or without __________________________.
10. A sensation of pain in an amputated leg is referred to as a ____________, ____________ sensation. Another example is ____________, experienced by people who have a ringing-in-the-ears sensation. List some pain control techniques used in health care situations.

17. Odors are able to evoke memories and feelings because there is a direct link between the brain area that gets information from the nose and the ancient ____________ centers associated with memory and emotion.

Perceptual Organization (pp. 263–272)

Objective 14: Describe Gestalt psychology’s contribution to our understanding of perception, and identify principles of perceptual grouping in form perception.

1. According to the ____________ school of psychology, we tend to organize a cluster of sensations into a ____________, or form.

2. When we view a scene, we see the central object, or ____________, as distinct from surrounding stimuli, or the ____________.

3. Proximity, similarity, closure, continuity, and connectedness are examples of Gestalt rules of ____________.

4. The principle that we organize stimuli into smooth, continuous patterns is called ____________. The principle that we fill in gaps to create a complete, whole object is ____________. The grouping of items that are close to each other is the principle of ____________; the grouping of items that look alike is the principle of ____________. The tendency to perceive uniform or attached items as a single unit is the principle of ____________.

Objective 15: Explain the binocular and monocular cues we use to perceive depth.

5. The ability to see objects in three dimensions despite their two-dimensional representations on our retinas is called ____________. ____________. It enables us to estimate ____________.

6. Gibson and Walk developed the ____________ to test depth perception in infants. They found that each species, by the time it is ____________, has the perceptual abilities it needs.
Summarize the results of Gibson and Walk’s studies of depth perception.

For questions 7–15, identify the depth perception cue that is defined.

7. Any cue that requires both eyes:

8. The greater the difference between the images received by the two eyes, the nearer the object:

9. Any cue that requires either eye alone:

10. If two objects are presumed to be the same size, the one that casts a smaller retinal image is perceived as farther away:

11. An object partially covered by another is seen as farther away:

12. Objects lower in the visual field are seen as nearer:

13. As we move, objects at different distances appear to move at different rates:

14. Parallel lines appear to converge in the distance:

15. The dimmer of two objects seems farther away:

16. Our brain normally computes motion based partly on the assumption that shrinking objects are

17. The brain interprets a rapid series of slightly varying images as ____________, . This phenomenon is called ____________

18. The illusion of movement that results when two adjacent stationary spots of light blink on and off in quick succession is called the

Objective 17: Explain how perceptual constancies help us to organize our sensations into meaningful patterns.

19. Our tendency to see objects as unchanging while the stimuli from them change in size, shape, and lightness is called ____________

20. Due to shape and size constancy, familiar objects ____________ (do/do not) appear to change shape or size despite changes in our ____________ images of them.

21. Several illusions, including the ____________ and ____________ illusions, are explained by the interplay between perceived ____________ and perceived ____________ . When distance cues are removed, these illusions are ____________ (diminished/strengthened).

22. The brain computes an object’s brightness ____________ (relative to/independent of) surrounding objects.

23. The amount of light an object reflects relative to its surroundings is called ____________
24. The experience of color depends on the surrounding ________ in which an object is seen. In an unvarying context, a familiar object will be perceived as having consistent color, even as the light changes. This phenomenon is called __________________________.

25. We see color as a result of our brains' computations of the light ________ by any object relative to its ________

**Perceptual Interpretation** (pp. 272–281)

**Objective 18:** Describe the contributions of restored vision, sensory deprivation, and perceptual adaptation research to our understanding of the nature-nurture interplay in our perceptions.

1. The idea that knowledge comes from inborn ways of organizing sensory experiences was proposed by the philosopher __________________________.

2. On the other side were philosophers who maintained that we learn to perceive the world by experiencing it. One philosopher of this school was __________________________.

3. Studies of cases in which vision has been restored to a person who was blind from birth show that, upon seeing tactilely familiar objects for the first time, the person ____________ (can/cannot) recognize them.

4. Studies of sensory restriction demonstrate that visual experiences during ____________ are crucial for perceptual development. Such experiences suggest that there is a ____________ for normal sensory and perceptual development.

5. Humans given glasses that shift or invert the visual field ____________ (will/will not) adapt to the distorted perception. This is called ____________.

6. Animals such as chicks ____________ (adapt/do not adapt) to distorting lenses.

**Objective 19:** Define perceptual set, and explain why the same stimulus can evoke different perceptions in different contexts.

7. A mental predisposition that influences perception is called a ____________

8. How a stimulus is perceived depends on our perceptual ____________ and the ____________ in which it is experienced.

9. The context of a stimulus creates a ____________ (top-down/bottom-up) expectation that influences our perception as we match our ____________ (top-down/bottom-up) signal against it.

10. Our perception is also influenced by ____________ about gender and the ____________ context of our experiences.

11. To best understand perception, we need multiple levels of analysis because perception is a ____________ phenomenon.

**Objective 20:** Describe the role human factors psychologists play in creating user-friendly machines and physical environments.

12. Psychologists who study the importance of considering perceptual principles in the design of machines, appliances, and work settings are called ____________ psychologists.

13. Victims of the "curse of knowledge," technology developers who assume that others share their ____________, may create designs that are unclear to others.

14. Another example of failure to consider the human factor in design is the "__________" technology that provides embarrassing headsets that amplify sound for people with hearing loss.

**Is There Extrasensory Perception?** (pp. 282–285)

**Objective 21:** Identify the three most testable forms of ESP, and explain why most research psychologists remain skeptical of ESP claims.

1. Perception outside the range of normal sensation is called ____________

2. Psychologists who study ESP are called ____________.
3. The form of ESP in which people claim to be capable of reading others’ minds is called ________________. A person who “senses” that a friend is in danger might claim to have the ESP ability of ________________. An ability to “see” into the future is called ________________. A person who claims to be able to levitate and move objects is claiming the power of ________________.

4. Analyses of psychic visions and premonitions reveal ________________ (high/chance-level) accuracy. Nevertheless, some people continue to believe in their accuracy because vague predictions often are later ________________ to match events that have already occurred. In addition, people are more likely to recall or ________________ dreams that seem to have come true.

5. Critics point out that a major difficulty for parapsychology is that ESP phenomena are not consistently ________________.

6. Researchers who tried to reduce external distractions between a "sender" and a "receiver" in an ESP experiment reported performance levels that ________________ (beat/did not beat) chance levels. Follow-up studies ________________ (failed to replicate the results/found equally high levels of performance).

**PROGRESS TEST 1**

**Multiple-Choice Questions**

Circle your answers to the following questions and check them with the answers beginning on page 153. If your answer is incorrect, read the explanation for why it is correct and then consult the appropriate pages of the text (in parentheses following the correct answer).

1. Which of the following is true?
   a. The absolute threshold for any stimulus is a constant.
   b. The absolute threshold for any stimulus varies somewhat.
   c. The absolute threshold is defined as the minimum amount of stimulation necessary for a stimulus to be detected 75 percent of the time.
   d. The absolute threshold is defined as the minimum amount of stimulation necessary for a stimulus to be detected 60 percent of the time.

2. If you can just notice the difference between 10- and 11-pound weights, which of the following weights could you differentiate from a 100-pound weight?
   a. 101-pound weight
   b. 105-pound weight
   c. 110-pound weight
   d. There is no basis for prediction.

3. A decrease in sensory responsiveness accompanying an unchanging stimulus is called
   a. sensory fatigue.
   b. accommodation.
   c. sensory adaptation.
   d. sensory interaction.

4. The size of the pupil is controlled by the
   a. lens.
   b. retina.
   c. cornea.
   d. iris.

5. The process by which the lens changes its curvature is
   a. accommodation.
   b. sensory adaptation.
   c. feature detection.
   d. transduction.

6. The receptor of the eye that functions best in dim light is the
   a. fovea.
   b. cone
   c. bipolar cell.
   d. rod.

7. The Young-Helmholtz theory proposes that
   a. there are three different types of color-sensitive cones.
   b. retinal cells are excited by one color and inhibited by its complementary color.
   c. there are four different types of cones.
   d. rod, not cone, vision accounts for our ability to detect fine visual detail.

8. Frequency is to pitch as ________ is to ________.
   a. wavelength; loudness
   b. amplitude; loudness
   c. wavelength; intensity
   d. amplitude; intensity

9. Our experience of pain when we are injured depends on
   a. our biological makeup and the type of injury we have sustained.
   b. how well medical personnel deal with our injury.
   c. our physiology, experiences and attention, and surrounding culture.
   d. what our culture allows us to express in terms of feelings of pain.
10. According to the gate-control theory, a way to alleviate chronic pain would be to stimulate the ______ nerve fibers that ______ the spinal gate.
   a. small; open  c. large; open
   b. small; close  d. large; close

11. The trascenduction of light energy into nerve impulses takes place in the
   a. iris.  c. lens.
   b. retina.  d. optic nerve.

12. The brain breaks vision into separate dimensions such as color, depth, movement, and form, and works on each aspect simultaneously. This is called
   a. feature detection.
   b. parallel processing.
   c. accommodation.
   d. opponent processing.

13. Kinesthesia involves
   a. the bones of the middle ear.
   b. information from the bones, ears, tendons, and joints.
   c. membranes within the cochlea.
   d. the body’s sense of balance.

14. One light may appear reddish and another greenish if they differ in
   a. wavelength.
   b. amplitude.
   c. opponent processes.
   d. brightness.

15. Which of the following explains why a rose appears equally red in bright and dim light?
   a. the Young-Helmholtz theory
   b. the opponent-process theory
   c. feature detection
   d. color constancy

16. Which of the following is an example of sensory adaptation?
   a. finding the cold water of a swimming pool warmer after you have been in it a while
   b. developing an increased sensitivity to salt the more you use it in foods
   c. becoming very irritated at the continuing sound of a dripping faucet
   d. All of these are examples.

17. Most color-deficient people will probably
   a. lack functioning red- or green-sensitive cones.
   b. see the world in only black and white.
   c. also suffer from poor vision.
   d. have above-average vision to compensate for the deficit.

18. The historical movement associated with the statement “The whole may exceed the sum of its parts” is
   a. parapsychology.
   b. behavioral psychology.
   c. functional psychology.
   d. Gestalt psychology.

19. Figures tend to be perceived as whole, complete objects, even if spaces or gaps exist in the representation, thus demonstrating the principle of
   a. connectedness.
   b. similarity.
   c. continuity.
   d. closure.

20. The figure-ground relationship has demonstrated that
   a. perception is largely innate.
   b. perception is simply a point-for-point representation of sensation.
   c. the same stimulus can trigger more than one perception.
   d. different people see different things when viewing a scene.

21. When we stare at an object, each eye receives a slightly different image, providing a depth cue known as
   a. interposition.
   b. linear perspective.
   c. relative motion.
   d. retinal disparity.

22. As we move, viewed objects cast changing shapes on our retinas, although we do not perceive the objects as changing. This is part of the phenomenon of
   a. perceptual constancy.
   b. relative motion.
   c. linear perspective.
   d. continuity.

23. A person claiming to be able to read another’s mind is claiming to have the ESP ability of
   a. psychokinesis.
   b. precognition.
   c. clairvoyance.
   d. telepathy.

24. Which philosopher maintained that knowledge comes from inborn ways of organizing our sensory experiences?
   a. Locke
   b. Kant
   c. Gibson
   d. Walk

25. Kittens and monkeys reared seeing only diffuse, unpatterned light
   a. later had difficulty distinguishing color and brightness.
b. later had difficulty perceiving color and brightness, but eventually regained normal sensitivity.
c. later had difficulty perceiving the shape of objects.
d. showed no impairment in perception, indicating that neural feature detectors develop even in the absence of normal sensory experiences.

26. Adults who are born blind but later have their vision restored
   a. are almost immediately able to recognize familiar objects.
   b. typically fail to recognize familiar objects.
   c. are unable to follow moving objects with their eyes.
   d. have excellent eye-hand coordination.

27. _______ processing refers to how the physical characteristics of stimuli influence their interpretation.
   a. Top-down
   b. Bottom-up
   c. Parapsychological
   d. Psychophysical

28. Which of the following is NOT a monocular depth cue?
   a. light and shadow
   b. relative height
   c. retinal disparity
   d. interposition

29. The Moon illusion occurs in part because distance cues at the horizon make the Moon seem
   a. farther away and therefore larger.
   b. closer and therefore larger.
   c. farther away and therefore smaller.
   d. closer and therefore smaller.

30. Figure is to ground as _____ is to ______.
   a. night; day
   b. top; bottom
   c. cloud; sky
   d. sensation; perception

31. The study of perception is primarily concerned with how we
   a. detect sights, sounds, and other stimuli.
   b. sense environmental stimuli.
   c. develop sensitivity to illusions.
   d. interpret sensory stimuli.

32. Which of the following influences perception?
   a. biological maturation
   b. the context in which stimuli are perceived
   c. expectations
   d. all of these factors

33. Jack claims that he often has dreams that predict future events. He claims to have the power of
   a. telepathy.
   b. clairvoyance.
   c. precognition.
   d. psychokinesis.

34. Researchers who investigated telepathy found that
   a. when external distractions are reduced, both the “sender” and the “receiver” become much more accurate in demonstrating ESP.
   b. only “senders” become much more accurate.
   c. only “receivers” become much more accurate.
   d. over many studies, none of these events occur.

35. The frequency theory of hearing is better than place theory at explaining our sensation of
   a. the lowest pitches.
   b. pitches of intermediate range.
   c. the highest pitches.
   d. all of these pitches.

36. Dr. Martin is using natural mapping to redesign the instrument gauges of automobiles to be more user-friendly. Dr. Martin is evidently a(n)
   a. psychophysicist.
   b. cognitive psychologist.
   c. human factors psychologist.
   d. experimental psychologist.
Chapter 6  Sensation and Perception

Matching Items

Match each of the structures with its function or description.

Structures or Conditions

1. lens
2. iris
3. pupil
4. rods
5. cones
6. middle ear
7. inner ear
8. large nerve fiber
9. small nerve fiber
10. semicircular canals
11. sensors in joints

Functions or Descriptions

a. amplifies sounds
b. closes pain gate
c. vestibular sense
d. controls pupil
e. accommodation
f. opens pain gate
g. admits light
h. vision in dim light
i. transduction of sound
j. kinesthesis
k. color vision

PROGRESS TEST 2

Progress Test 2 should be completed during a final chapter review. Answer the following questions after you thoroughly understand the correct answers for the section reviews and Progress Test 1.

Multiple-Choice Questions

1. Which of the following is NOT one of the basic tastes?
   a. sweet
   b. salty
   c. umami
   d. bland

2. Of the four distinct skin senses, the only one that has definable receptors is
   a. warmth.
   b. cold.
   c. pain.
   d. pressure.

3. The process by which sensory information is converted into neural energy is:
   a. sensory adaptation.
   b. feature detection.
   c. sensory interaction.
   d. transduction.

4. The receptors for taste are located in the
   a. taste buds.
   b. cochlea.
   c. fovea.
   d. cortex.

5. The inner ear contains receptors for
   a. audition and kinesthesis.
   b. kinesthesis and the vestibular sense.
   c. audition and the vestibular sense.
   d. audition, kinesthesis, and the vestibular sense.

6. According to the opponent-process theory
   a. there are three types of color-sensitive cones.
   b. the process of color vision begins in the cortex.
   c. neurons involved in color vision are stimulated by one color’s wavelength and inhibited by another’s.
   d. all of these statements are true.

7. What enables you to feel yourself wiggling your toes even with your eyes closed?
   a. vestibular sense
   b. kinesthesis
   c. the skin senses
   d. sensory interaction

8. Hubel and Wiesel discovered feature detectors in the visual
   a. fovea.
   b. optic nerve.
   c. iris.
   d. cortex.

9. Weber’s law states that
   a. the absolute threshold for any stimulus is a constant.
   b. the jnd for any stimulus is a constant.
   c. the absolute threshold for any stimulus is a constant proportion.
   d. the jnd for any stimulus is a constant proportion.

10. The principle that one sense may influence another is
    a. transduction.
    b. sensory adaptation.
    c. Weber’s law.
    d. sensory interaction.
11. Which of the following is the correct order of the structures through which light passes after entering the eye?
   a. lens, pupil, cornea, retina
   b. pupil, cornea, lens, retina
   c. pupil, lens, cornea, retina
   d. cornea, pupil, lens, retina

12. In the opponent-process theory, the three pairs of processes are
   a. red-green, blue-yellow, black-white.
   b. red-blue, green-yellow, black-white.
   c. red-yellow, blue-green, black-white.
   d. dependent upon the individual’s experience.

13. Wavelength is to _________ as _________ is to brightness.
   a. hue; intensity
   b. intensity; hue
   c. frequency; amplitude
   d. brightness; hue

14. Concerning the evidence for subliminal stimulation, which of the following is the best answer?
   a. The brain processes some information without our awareness.
   b. Stimuli too weak to cross our thresholds for awareness may trigger a response in our sense receptors.
   c. Because the “absolute” threshold is a statistical average, we are able to detect weaker stimuli some of the time.
   d. All of these statements are true.

15. Which of the following is the most accurate description of how we process color?
   a. Throughout the visual system, color processing is divided into separate red, green, and blue systems.
   b. Red-green, blue-yellow, and black-white opponent processes operate throughout the visual system.
   c. Color processing occurs in two stages: (1) a three-color system in the retina and (2) opponent-process cells en route to the visual cortex.
   d. Color processing occurs in two stages: (1) an opponent-process system in the retina and (2) a three-color system en route to the visual cortex.

16. One reason that your ability to detect fine visual details is greatest when scenes are focused on the fovea of your retina is that
   a. there are more feature detectors in the fovea than in the peripheral regions of the retina.
   b. cones in the fovea are nearer to the optic nerve than those in peripheral regions of the retina.
   c. many rods, which are clustered in the fovea, have individual bipolar cells to relay their information to the cortex.
   d. many cones, which are clustered in the fovea, have individual bipolar cells to relay their information to the cortex.

17. Given normal sensory ability, a person standing atop a mountain on a dark, clear night can see a candle flame atop a mountain 30 miles away. This is a description of vision's
   a. difference threshold. c. absolute threshold.
   b. jnd. d. feature detection.

18. The tendency to organize stimuli into smooth, uninterrupted patterns is called
   a. closure. c. similarity.
   b. continuity. d. proximity.

19. Which of the following statements is consistent with the Gestalt theory of perception?
   a. Perception develops largely through learning.
   b. Perception is the product of heredity.
   c. The mind organizes sensations into meaningful perceptions.
   d. Perception results directly from sensation.

20. Experiments with distorted visual environments demonstrate that
   a. adaptation rarely takes place.
   b. animals adapt readily, but humans do not.
   c. humans adapt readily, while lower animals typically do not.
   d. adaptation is possible during a critical period in infancy but not thereafter.

21. The phenomenon that refers to the ways in which an individual’s expectations influence perception is called
   a. perceptual set. c. interposition.
   b. retinal disparity. d. kinesthesia.

22. According to the philosopher _______, we learn to perceive the world.
   a. Locke c. Gibson
   b. Kant d. Walk
23. The phenomenon of size constancy is based on
the close connection between an object's perceived ________, and its perceived ________.
   a. size; shape   c. size; brightness
   b. size; distance d. shape; distance

24. Which of the following statements best describes
the effects of sensory restriction?
   a. It produces functional blindness when experienced for any length of time at any age.
   b. It has greater effects on humans than on animals.
   c. It has more damaging effects when experienced during infancy.
   d. It has greater effects on adults than on children.

25. Thanks to ________, TiVo and DVR have solved
the television recording problem caused by the complexity of VCRs.
   a. parapsychologists
   b. human factors psychologists
   c. psychokineticsists
   d. Gestalt psychologists

26. Psychologists who study ESP are called
   a. clairvoyants.   c. parapsychologists.
   b. telepaths.      d. levitators.

27. The depth cue that occurs when we watch stable
objects at different distances as we are moving is
   a. linear perspective.  c. relative clarity.
   b. interposition.     d. relative motion.

28. Which of the following statements concerning
ESP is true?
   a. Most ESP researchers are quacks.
   b. There have been a large number of reliable demonstrations of ESP.
   c. Most research psychologists are skeptical of the claims of defenders of ESP.
   d. There have been reliable laboratory demonstrations of ESP, but the results are no different from those that would occur by chance.

29. Each time you see your car, it projects a different
image on the retinas of your eyes, yet you do not perceive it as changing. This is because of
   a. perceptual set.
   b. retinal disparity.
   c. perceptual constancy.
   d. figure-ground.

30. The term *gestalt* means
   a. grouping.  c. perception.
   b. sensation. d. whole.

31. Studies of the visual cliff have provided evidence
that much of depth perception is
   a. innate.
   b. learned.
   c. innate in lower animals, learned in humans.
   d. innate in humans, learned in lower animals.

32. All of the following are laws of perceptual organization EXCEPT
   a. proximity.   c. continuity.
   b. closure.     d. retinal disparity.

33. You probably perceive the diagram above as
three separate objects due to the principle of
   a. proximity.   c. closure.
   b. continuity.  d. connectedness.

34. ________ processing refers to how our knowledge and expectations influence perception.
   a. Top-down   c. Parapsychological
   b. Bottom-up  d. Psychophysical

35. The place theory of pitch perception cannot account for how we hear
   a. low-pitched sounds.
   b. middle-pitched sounds.
   c. high-pitched sounds.
   d. chords (three or more pitches simultaneously).

36. Sensorineural hearing loss is caused by
   a. wax buildup in the outer ear.
   b. damage to the eardrum.
   c. blockage in the middle ear because of infection.
   d. damage to the cochlea.

*True–False Items*

Indicate whether each statement is true or false by placing T or F in the blank next to the item.

<table>
<thead>
<tr>
<th></th>
<th>1. Once we perceive an item as a figure, it is impossible to see it as ground.</th>
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<tr>
<td></td>
<td>2. Laboratory experiments have laid to rest all criticisms of ESP.</td>
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<td>3. Six-month-old infants will cross a visual cliff if their mother calls.</td>
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<tr>
<td></td>
<td>4. Unlike other animals, humans have no critical period for visual stimulation.</td>
</tr>
</tbody>
</table>
5. Immanuel Kant argued that experience determined how we perceive the world.

6. It is just as easy to touch two pencil tips together with only one eye open as it is with both eyes open.

7. After a period of time, humans are able to adjust to living in a world made upside down by distorting goggles.

8. As our distance from an object changes, the object’s size seems to change.

9. Perception is influenced by psychological factors such as set and expectation as well as by physiological events.

10. John Locke argued that perception is inborn.

11. When you know something, it’s hard to mentally simulate what it’s like not to know it.

**PSYCHOLOGY APPLIED**

Answer these questions the day before an exam as a final check on your understanding of the chapter’s terms and concepts.

**Multiple-Choice Questions**

1. In shopping for a new stereo, you discover that you cannot differentiate between the sounds of models X and Y. The difference between X and Y is below your
   a. absolute threshold.  c. receptor threshold.
   b. subliminal threshold.  d. difference threshold.

2. To maximize your sensitivity to fine visual detail you should
   a. stare off to one side of the object you are attempting to see.
   b. close one eye.
   c. decrease the intensity of the light falling upon the object.
   d. stare directly at the object.

3. The phantom limb sensation indicates that
   a. pain is a purely sensory phenomenon.
   b. the central nervous system plays only a minor role in the experience of pain.
   c. pain involves the brain’s interpretation of neural activity.
   d. all of these are true.

4. While competing in the Olympic trials, marathoner Kirsten O’Brien suffered a stress fracture in her left leg. That she did not experience significant pain until the race was over is probably attributable to the fact that during the race
   a. the pain gate in her spinal cord was closed by information coming from her brain.
   b. her body’s production of endorphins decreased.
   c. an increase in the activity of small pain fibers closed the pain gate.
   d. a decrease in the activity of large pain fibers closed the pain gate.

5. Which of the following is an example of sensory interaction?
   a. finding that despite its delicious aroma, a weird-looking meal tastes awful
   b. finding that food tastes bland when you have a bad cold
   c. finding it difficult to maintain your balance when you have an ear infection
   d. All of these are examples.

6. In comparing the human eye to a camera, the film would be located in the eye’s
   a. pupil.  c. cornea.
   b. lens.  d. retina.

7. Sensation is to ________ as perception is to ________.
   a. recognizing a stimulus; interpreting a stimulus
   b. detecting a stimulus; recognizing a stimulus
   c. interpreting a stimulus; detecting a stimulus
   d. seeing; hearing

8. I am a cell in the thalamus that is excited by red and inhibited by green. I am a(n)
   a. feature detector.  c. bipolar cell.
   b. cone.  d. opponent-process cell.

9. Which of the following correctly lists the order of structures through which sound travels after entering the ear?
   a. auditory canal, eardrum, middle ear, cochlea
   b. eardrum, auditory canal, middle ear, cochlea
   c. eardrum, middle ear, cochlea, auditory canal
   d. cochlea, eardrum, middle ear, auditory canal
10. Dr. Frankenstein has forgotten to give his monster an important part; as a result, the monster cannot transduce sound. Dr. Frankenstein omitted the
   a. eardrum.        c. semicircular canals.
   b. middle ear.     d. basilar membrane.

11. Which of the following is true of cones?
   a. Cones enable color vision.
   b. Cones are highly concentrated in the foveal region of the retina.
   c. Cones have a higher absolute threshold for brightness than rods.
   d. All of these statements are true.

12. Assuming that the visual systems of humans and other mammals function similarly, you would expect that the retina of a nocturnal mammal (one active only at night) would contain
   a. mostly cones.
   b. mostly rods.
   c. an equal number of rods and cones.
   d. more bipolar cells than an animal active only during the day.

13. As the football game continued into the night, LeVar noticed that he was having difficulty distinguishing the colors of the players’ uniforms. This is because the ________, which enable color vision, have a ________ absolute threshold for brightness than the available light intensity.
   a. rods; higher  c. rods; lower
   b. cones; higher  d. cones; lower

14. After staring at a very intense red stimulus for a few minutes, Carrie shifted her gaze to a beige wall and “saw” the color ______. Carrie’s experience provides support for the ______ theory.
   a. green; trichromatic
   b. blue; opponent-process
   c. green; opponent-process
   d. blue; trichromatic

15. Seventy-year-old Mrs. Martinez finds that she must spice her food heavily or she cannot taste it. Unfortunately, her son often finds her cooking inedible because it is so spicy. What is the likely explanation for their taste differences?
   a. Women have higher taste thresholds than men.
   b. Men have higher taste thresholds than women.
   c. Being 70 years old, Mrs. Martinez probably has fewer taste buds than her son.
   d. All of these are likely explanations.

16. When admiring the texture of a piece of fabric, Calvin usually runs his fingertips over the cloth’s surface. He does this because
   a. if the cloth were held motionless, sensory adaptation to its feel would quickly occur.
   b. the sense of touch does not adapt.
   c. a relatively small amount of brain tissue is devoted to processing touch from the fingertips.
   d. of all these reasons.

17. Superman’s eyes used ________, while his brain used ________.
   a. perception; sensation
   b. top-down processing; bottom-up processing
   c. bottom-up processing; top-down processing
   d. sensory adaptation; subliminal perception

18. How does pain differ from other senses?
   a. It has no special receptors.
   b. It has no single stimulus.
   c. It is influenced by both physical and psychological phenomena.
   d. All of these statements are true.

19. Tamiko hates the bitter taste of her cough syrup. Which of the following would she find most helpful in minimizing the syrup’s bad taste?
   a. tasting something very sweet before taking the cough syrup
   b. keeping the syrup in her mouth for several seconds before swallowing it
   c. holding her nose while taking the cough syrup
   d. gulping the cough syrup so that it misses her tongue

20. Although carpenter Smith perceived a briefly viewed object as a screwdriver, police officer Wesson perceived the same object as a knife. This illustrates that perception is guided by
   a. linear perspective.  c. retinal disparity.
   b. shape constancy.  d. perceptual set.

21. The fact that a white object under dim illumination appears lighter than a gray object under bright illumination is called
   a. relative luminance.
   b. perceptual adaptation.
   c. color contrast.
   d. lightness constancy.
22. When two familiar objects of equal size cast unequal retinal images, the object that casts the smaller retinal image will be perceived as being
a. closer than the other object.
b. more distant than the other object.
c. larger than the other object.
d. smaller than the other object.

23. Concluding her presentation on sensation and perception, Kelly notes that
a. perception is bottom-up processing.
b. sensation is top-down processing.
c. without sensation there is no perception.
d. sensation and perception blend into one continuous process.

24. As her friend Milo walks toward her, Noriko perceives his size as remaining constant because his perceived distance _______ at the same time that her retinal image of him _______.
a. increases; decreases  
b. increases; increases  
c. decreases; decreases  
d. decreases; increases

25. In the absence of perceptual constancy
a. objects would appear to change size as their distance from us changed.
b. depth perception would be based exclusively on monocular cues.
c. depth perception would be based exclusively on binocular cues.
d. depth perception would be impossible.

26. How do we perceive a pole that partially covers a wall?
a. as farther away  
b. as nearer  
c. as larger  
d. There is not enough information to determine the object’s size or distance.

27. An artist paints a tree orchard so that the parallel rows of trees converge at the top of the canvas. Which cue has the artist used to convey distance?
a. interposition  
b. retinal disparity  
c. linear perspective  
d. figure-ground

28. Objects higher in our field of vision are perceived as _______ due to the principle of _______.
a. nearer; relative height  
b. nearer; linear perspective  
c. farther away; relative height  
d. farther away; linear perspective

29. Your friend tosses you a frisbee. You know that it is getting closer instead of larger because of
a. shape constancy.  
b. size constancy.  
c. relative motion.  
d. all of the above.

30. Regina claims that she can bend spoons, levitate furniture, and perform many other “mind over matter” feats. Regina apparently believes she has the power of
a. telepathy.  
b. clairvoyance.  
c. precognition.  
d. psychokinesis.

31. Which of the following is true of the predictions of leading psychics?
a. They are often ambiguous prophecies later interpreted to match actual events.
b. They are no more accurate than guesses made by others.
c. They are nearly always inaccurate.
d. All of these statements are true.

32. Studying the road map before her trip, Colleen had no trouble following the route of the highway she planned to travel. Colleen’s ability illustrates the principle of
a. closure.  
b. similarity.  
c. continuity.  
d. proximity.

Essay Questions

1. A dancer in a chorus line uses many sensory cues when performing. Discuss three senses that dancers rely on, and explain why each is important. (Use the space below to list the points you want to make, and organize them. Then write the essay on a separate sheet of paper.)
2. In many movies from the 1930s, dancers performed seemingly meaningless movements which, when viewed from above, were transformed into intricate patterns and designs. Similarly, the formations of marching bands often create pictures and spell words. Identify and describe at least four Gestalt principles of grouping that explain the audience’s perception of the images created by these types of formations. (Use the space to the right to list the points you want to make, and organize them. Then write the essay on a separate piece of paper.)

Summing Up

Use the diagrams to identify the parts of the eye and ear, then describe how each contributes to vision or hearing. Also, briefly explain the role of each structure.

The Eye

1. 

2. 

3. 

4. 

5. 

6. 

7. 
KEY TERMS

Writing Definitions

Using your own words, on a piece of paper write a brief definition or explanation of each of the following terms.

1. sensation
2. perception
3. bottom-up processing
4. top-down processing
5. psychophysics
6. absolute threshold
7. signal detection theory
8. subliminal
9. priming
10. difference threshold
11. Weber's law
12. sensory adaptation
13. transduction
14. wavelength and hue

15. intensity
16. pupil
17. iris
18. lens
19. retina
20. accommodation
21. rods and cones
22. optic nerve
23. blind spot
24. fovea
25. feature detectors
26. parallel processing
27. Young-Helmholtz trichromatic (three-color) theory
28. opponent-process theory
29. audition
30. frequency and pitch
31. middle ear
32. cochlea
33. inner ear
34. place theory
35. frequency theory
36. conduction hearing loss
37. sensorineural hearing loss
38. cochlear implant
39. kinesthesis
40. vestibular sense
41. gate-control theory
42. sensory interaction
43. gestalt
44. figure-ground
45. grouping
46. depth perception

Cross-Check
As you learned in the Prologue, reviewing and overlearning of material are important to the learning process. After you have written the definitions of the key terms in this chapter, you should complete the crossword puzzle to ensure that you can reverse the process—recognize the term, given the definition.

ACROSS

4. Psychological characteristic of a sound that is determined by its frequency.
7. Part of the ear in which sounds are converted to nerve impulses.
9. The ear’s membrane that is lined with hair cells.
11. Study of the relationship between the physical characteristics of stimuli and our psychological experience of them.
12. Grouping principle that we fill in gaps in visual stimuli to create a complete, whole image.
13. Psychological characteristic of light that is determined by wavelength.
14. Receptors that enable color vision.
15. Information processing in which several aspects of a problem are processed simultaneously.
16. Minimum stimulation needed to detect a stimulus 50 percent of the time is the _____ threshold.
18. Another term for the difference threshold (abbreviation).