

Campbell's Biology: Concepts and Connections, 7e (Reece et al.)
Chapter 28 Nervous Systems

28.1 Multiple-Choice Questions

- 1) The central communication conduit between the brain and the rest of the body is the
- A) brain stem.
 - B) nerve bundle.
 - C) spinal cord.
 - D) nervous system.

Answer: C

Topic: 28.1

Skill: Knowledge/Comprehension

- 2) The two major anatomical divisions of the nervous system are the
- A) sympathetic nervous system and parasympathetic nervous system.
 - B) central nervous system and peripheral nervous system.
 - C) sensory nervous system and motor nervous system.
 - D) voluntary nervous system and involuntary nervous system.

Answer: B

Topic: 28.1

Skill: Knowledge/Comprehension

- 3) Nervous system effector cells
- A) are white cells found in the circulatory system.
 - B) consist of sensory cells.
 - C) include muscle cells and gland cells.
 - D) provide automatic responses to stimuli.

Answer: C

Topic: 28.1

Skill: Knowledge/Comprehension

- 4) Which of the following statements regarding the nervous system is *true*?
- A) Sensory neurons convey signals from the CNS to sensory receptors.
 - B) Motor neurons convey signals from the CNS to effector cells.
 - C) The PNS is composed entirely of nerves.
 - D) The CNS and the brain are the same thing.

Answer: B

Topic: 28.1

Skill: Knowledge/Comprehension

- 5) The functional unit of the nervous system is the
- A) cell body.
 - B) neuron.
 - C) axon.
 - D) synapse.

Answer: B

Topic: 28.2

Skill: Knowledge/Comprehension

6) What part of a neuron carries signals toward the part of the cell that houses the nucleus?

- A) node of Ranvier
- B) axon
- C) cell body
- D) dendrite

Answer: D

Topic: 28.2

Skill: Knowledge/Comprehension

7) The speed of impulse conduction along an axon may be increased by

- A) a myelin sheath
- B) a graded potential.
- C) neurotransmitters.
- D) EPSPs.

Answer: A

Topic: 28.2

Skill: Knowledge/Comprehension

8) Multiple sclerosis results from an autoimmune disease that primarily involves

- A) destruction of the hippocampus.
- B) destruction of the myelin sheath.
- C) destruction of regions of the motor cortex.
- D) deterioration of parts of the spinal cord.

Answer: B

Topic: 28.2

Skill: Knowledge/Comprehension

9) Which of the following statements about resting potential is *true*?

- A) A resting membrane allows much more sodium than potassium to diffuse across.
- B) The concentration of sodium is much higher inside the cell than outside.
- C) The resting potential exists because of differences in glucose concentration inside and outside the cell.
- D) The sodium-potassium pump contributes to the resting membrane potential.

Answer: D

Topic: 28.3

Skill: Knowledge/Comprehension

10) Once an action potential is triggered, there is a

- A) reversal of the membrane polarity, with the interior of the cell becoming positively charged.
- B) reversal of the membrane polarity, with the interior of the cell becoming negatively charged.
- C) sudden rush of potassium into the neuron.
- D) sudden impermeability of the membrane to the transport of ions.

Answer: A

Topic: 28.4

Skill: Knowledge/Comprehension

- 11) Once the threshold potential is reached,
A) K^+ channels open.
B) Na^+ channels close.
C) an action potential is inevitable.
D) the interior of the cell becomes negative with respect to the outside.

Answer: C

Topic: 28.4

Skill: Knowledge/Comprehension

- 12) Action potentials normally travel along an axon
A) toward the cell body.
B) away from the cell body.
C) either towards or away from the cell body
D) away from the synapse.

Answer: B

Topic: 28.5

Skill: Knowledge/Comprehension

- 13) Action potentials relay different intensities of information due to the
A) amplitude of action potentials relative to the strength of the stimulus.
B) frequency of action potentials relative to the strength of the stimulus.
C) duration of action potentials relative to the strength of the stimulus.
D) shape of action potentials relative to the strength of the stimulus.

Answer: B

Topic: 28.5

Skill: Knowledge/Comprehension

- 14) The gap between the transmitting and receiving neurons in a chemical synapse is known as the
A) synaptic node.
B) synaptic gap.
C) gap junction.
D) synaptic cleft.

Answer: D

Topic: 28.6

Skill: Knowledge/Comprehension

- 15) During transmission across a typical chemical synapse,
A) neurotransmitter molecules are stored in the synaptic cleft.
B) action potentials trigger chemical changes that make the synaptic vesicles fuse with each other.
C) vesicles containing neurotransmitter diffuse to the receiving cell's plasma membrane.
D) neurotransmitter molecules bind to receptors in the receiving cell's plasma membrane.

Answer: D

Topic: 28.6

Skill: Knowledge/Comprehension

- 16) The signal that crosses a synapse is stopped when
- A) a second action potential traveling down the signaling cell sounds a "retreat" and the neurotransmitters return to the signaling cell
 - B) the responding cell runs out of sodium and is no longer able to respond to the stimulus.
 - C) the responding cell runs out of potassium and is no longer able to respond to the stimulus.
 - D) the neurotransmitter is enzymatically broken down or transported back to the signaling cell.

Answer: D

Topic: 28.6

Skill: Knowledge/Comprehension

- 17) Neurotransmitters that open Na^+ channels and trigger action potentials in receiving cells are called

- A) inhibitory.
- B) cross-linked.
- C) excitatory.
- D) obligatory.

Answer: C

Topic: 28.7

Skill: Knowledge/Comprehension

- 18) The effect of a sending neuron on a receiving neuron is typically greater when _____ neurotransmitters bind to the receiving neuron and the synapse is _____ the base of the receiving cell's axon.

- A) more . . . close to
- B) fewer . . . close to
- C) more . . . far from
- D) fewer . . . far from

Answer: A

Topic: 28.7

Skill: Knowledge/Comprehension

- 19) Botulinum toxin (Botox) produced by certain bacteria will

- A) prevent enzymatic breakdown of neurotransmitters.
- B) cause continual contraction of smooth muscle.
- C) initiate an increase in the strength of a transmitted signal.
- D) inhibit the release of acetylcholine.

Answer: D

Topic: 28.8

Skill: Knowledge/Comprehension

- 20) One neurotransmitter associated with sleep, mood, attention, and learning is

- A) acetylcholine.
- B) NO.
- C) epinephrine.
- D) serotonin.

Answer: D

Topic: 28.8

Skill: Knowledge/Comprehension

21) Parkinson's disease is associated with a deficiency in

- A) dopamine.
- B) serotonin.
- C) acetylcholine.
- D) endorphins.

Answer: A

Topic: 28.8

Skill: Knowledge/Comprehension

22) Valium, a prescription drug used to treat depression, works by

- A) binding and activating acetylcholine receptors.
- B) increasing the inhibitory effect of GABA.
- C) increasing the release and availability of norepinephrine and dopamine at synapses.
- D) activating receptors for GABA.

Answer: D

Topic: 28.9

Skill: Knowledge/Comprehension

23) Morphine, codeine, and heroin are all opiates that function by

- A) binding to acetylcholine receptors.
- B) blocking the removal of serotonin from synapses.
- C) binding to GABA receptors.
- D) binding to endorphin receptors.

Answer: D

Topic: 28.9

Skill: Knowledge/Comprehension

24) The uniformity in the way nerve cells function within the animal kingdom

- A) indicates that the PNS evolved before the CNS.
- B) is evidence that the neuron was an early evolutionary adaptation.
- C) is proof of neurotransmitter efficiency.
- D) must have prevented the development of diversity.

Answer: B

Topic: 28.10

Skill: Knowledge/Comprehension

25) One of the most important branch points in the evolution of animals and their nervous systems was the appearance of

- A) radical symmetry.
- B) bilateral symmetry.
- C) the spinal column.
- D) specialized cells for transmitting signals.

Answer: B

Topic: 28.10

Skill: Knowledge/Comprehension

26) The simplest animals to display cephalization and centralization of the nervous system are

- A) sponges.
- B) flatworms.
- C) cnidarians.
- D) echinoderms.

Answer: B

Topic: 28.10

Skill: Knowledge/Comprehension

27) The brain and sensory system of a bilaterally symmetric organism function most like

- A) the engine of a motorboat.
- B) the pilot of an airplane.
- C) the passengers on a train.
- D) a member of a marching band.

Answer: B

Topic: 28.10

Skill: Knowledge/Comprehension

28) Natural selection tends to correlate the structures of a nervous system with an animal's interaction with the environment. A good example are sessile or slow-moving mollusks such as clams, which

- A) have little or no cephalization and simple sense organs.
- B) use chemical synapses to process complex information.
- C) have a well-developed brain that functions as a master control center.
- D) use their circulatory system as a mechanism for distributing nerve impulses.

Answer: A

Topic: 28.10

Skill: Knowledge/Comprehension

29) Which of the following statements regarding the brain is *true*?

- A) Ventricles in the brain are filled with interstitial fluid.
- B) The blood-brain barrier helps to maintain a stable chemical environment for the brain.
- C) Layers of connective tissue, called epithelium, surround and protect the brain and spinal cord.
- D) White matter is mainly dendrites.

Answer: B

Topic: 28.11

Skill: Knowledge/Comprehension

30) The relationship between spinal nerves and the spinal cord is most like the relationship between

- A) the hairs on a person's head.
- B) the vertical and horizontal threads woven together to form a piece of cloth.
- C) an interstate highway and the many roads that intersect with it via on- and off-ramps.
- D) a bowl of spaghetti and the sauce that is poured onto it.

Answer: C

Topic: 28.11

Skill: Knowledge/Comprehension

31) Which division of the human nervous system carries signals to skeletal muscles?

- A) autonomic nervous system
- B) parasympathetic nervous system
- C) sympathetic nervous system
- D) motor system

Answer: D

Topic: 28.12

Skill: Knowledge/Comprehension

32) The autonomic nervous system

- A) integrates sensory inputs to the brain.
- B) carries signals to and from skeletal muscles.
- C) regulates the internal environment of the body.
- D) is part of the central nervous system.

Answer: C

Topic: 28.12

Skill: Knowledge/Comprehension

33) Which of the following results from stimulation by the parasympathetic nervous system?

- A) increased heart rate
- B) inhibition of the digestive organs
- C) inhibition of urination
- D) stimulation of saliva secretion

Answer: D

Topic: 28.12

Skill: Knowledge/Comprehension

34) Which of the following results from stimulation by the sympathetic nervous system?

- A) release of glucose from the liver
- B) decreased heart rate
- C) stimulation of the digestive organs
- D) constriction of the bronchi

Answer: A

Topic: 28.12

Skill: Knowledge/Comprehension

35) The enteric division of the autonomic nervous system consists of neurons in the digestive tract, the gallbladder, and the

- A) heart.
- B) lymphatic system.
- C) pancreas.
- D) thyroid gland.

Answer: C

Topic: 28.12

Skill: Knowledge/Comprehension

36) When you are very nervous, perhaps before you must speak in front of your college class, you notice that your mouth is dry and your heart is racing. This is most likely due to stimulation by the

- A) enteric division of your autonomic nervous system.
- B) sympathetic division of your autonomic nervous system.
- C) parasympathetic division of your autonomic nervous system.
- D) motor division of your parasympathetic nervous system.

Answer: B

Topic: 28.12

Skill: Application/Analysis

37) In all vertebrates, the brain consists of the

- A) cerebrum, forebrain, and hindbrain.
- B) cerebrum, midbrain, and hindbrain.
- C) forebrain, midbrain, and hindbrain.
- D) cerebrum, cerebellum, and hindbrain.

Answer: C

Topic: 28.13

Skill: Knowledge/Comprehension

38) The sophisticated behavior of mammals and birds is directly related to

- A) their relatively large cerebrum.
- B) the presence of a hindbrain.
- C) their relatively large midbrain.
- D) the presence of a forebrain.

Answer: A

Topic: 28.13

Skill: Knowledge/Comprehension

39) The brain of humans is strongly oriented toward the interpretation of

- A) smell.
- B) vision.
- C) hearing.
- D) touch.

Answer: B

Topic: 28.13

Skill: Knowledge/Comprehension

40) A physician friend of yours is telling you about a patient with a head injury who suddenly stopped breathing. Your friend explains that the bony rim was pressing against the breathing center. You guess that the "bony rim" (whatever that is) must have been exerting pressure in the region of the

- A) basal ganglia and hippocampus.
- B) cerebellum and cerebrum.
- C) thalamus and hypothalamus.
- D) medulla oblongata and pons.

Answer: D

Topic: 28.14

Skill: Application/Analysis

41) You start to fall but then catch yourself, regaining your balance. Which of the following brain regions is responsible for the rapid coordination of muscle activity that kept you from falling?

- A) motor cortex
- B) thalamus
- C) cerebellum
- D) pons

Answer: C

Topic: 28.14

Skill: Application/Analysis

42) What part of the brain sorts incoming information, such as touch signals from your hand, into categories before relaying it to the cerebral cortex?

- A) thalamus
- B) hypothalamus
- C) pons
- D) hippocampus

Answer: A

Topic: 28.14

Skill: Knowledge/Comprehension

43) Which of the following brain regions controls the secretion of pituitary hormones and exerts direct control over many other aspects of homeostasis?

- A) thalamus
- B) hypothalamus
- C) hippocampus
- D) cerebellum

Answer: B

Topic: 28.14

Skill: Knowledge/Comprehension

44) Our biological clock, which regulates the sleep-wake cycle, is housed within the

- A) cerebrum.
- B) hypothalamus.
- C) cerebellum.
- D) brain stem.

Answer: B

Topic: 28.14

Skill: Knowledge/Comprehension

45) The human cerebral cortex accounts for what percentage of the total mass of the brain?

- A) 20%
- B) 40%
- C) 60%
- D) 80%

Answer: D

Topic: 28.15

Skill: Knowledge/Comprehension

46) Which of the following statements regarding brain activity is *true*?

- A) Recent research has revealed that the 1848 accident involving Phineas Gage caused damage to his hindbrain.
- B) People usually die following a hemispherectomy.
- C) People cannot function when the communication channels between the hemispheres are cut.
- D) New techniques, such as PET scans and fMRIs, allow researchers to associate specific parts of the brain with certain activities.

Answer: D

Topic: 28.16

Skill: Knowledge/Comprehension

47) fMRI technology can provide significant insights into brain function by

- A) measuring areas of electronegativity.
- B) detecting damaged areas of the brain.
- C) measuring changes in blood oxygen usage at sites of brain activity.
- D) showing the pathways of nerve impulses.

Answer: C

Topic: 28.17

Skill: Knowledge/Comprehension

48) The network of neurons that extends through the core of the brainstem and selects information that reaches the cerebral cortex during sleep is the

- A) medulla.
- B) limbic system.
- C) reticular formation.
- D) brainstem core.

Answer: C

Topic: 28.18

Skill: Knowledge/Comprehension

49) During REM sleep, an EEG shows

- A) a flat trace with very few waves.
- B) mainly alpha waves.
- C) sleep waves.
- D) an irregular, rapidly changing pattern.

Answer: D

Topic: 28.18

Skill: Knowledge/Comprehension

50) Our emotions, learning, and memory depend upon the

- A) limbic system.
- B) parietal lobes.
- C) frontal lobes.
- D) occipital lobes.

Answer: A

Topic: 28.19

Skill: Knowledge/Comprehension

51) What part of the brain allows us to recognize the emotional content of facial expressions and also helps lay down emotional memories?

- A) hippocampus
- B) amygdala
- C) prefrontal cortex
- D) corpus callosum

Answer: B

Topic: 28.19

Skill: Knowledge/Comprehension

52) Schizophrenia

- A) can best be described as feeling a sense of worthlessness.
- B) is often associated with hallucinations and paranoid delusions.
- C) causes changes in body weight and sleeping patterns.
- D) is best defined as a type of mental deterioration or dementia.

Answer: B

Topic: 28.20

Skill: Knowledge/Comprehension

53) Treatments for depression often include drugs that help correct imbalances in the levels of

- A) serotonin.
- B) acetylcholine.
- C) nitric oxide.
- D) epinephrine.

Answer: A

Topic: 28.20

Skill: Knowledge/Comprehension

54) Which of the following statements about Alzheimer's disease is *true*?

- A) Alzheimer's disease is suspected if a patient cannot retain his or her balance.
- B) Alzheimer's disease is age-related, increasing in frequency as people age.
- C) Alzheimer's disease often reverses or improves with time.
- D) Alzheimer's disease frequently involves positive changes in personality.

Answer: B

Topic: 28.20

Skill: Knowledge/Comprehension

55) Which of the following statements about Parkinson's disease is *true*?

- A) Parkinson's disease can be cured with injections of serotonin.
- B) Parkinson's disease results from the death of neurons in the cerebellum.
- C) Parkinson's disease is a motor disorder, affecting physical movements of the body.
- D) Parkinson's disease is age-related, decreasing in frequency as people age.

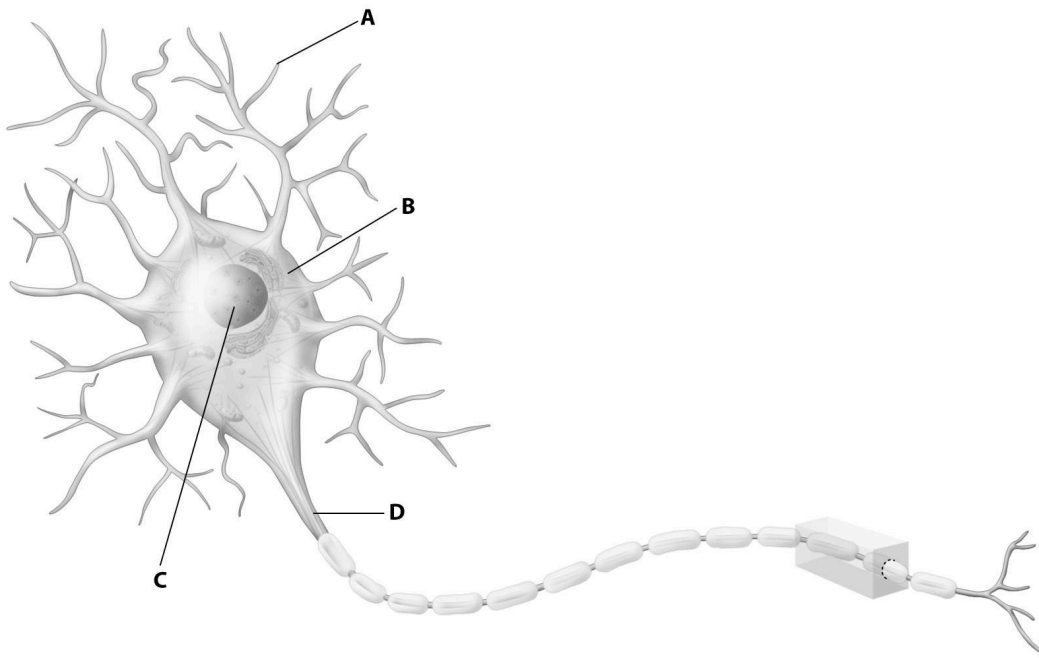
Answer: C

Topic: 28.20

Skill: Knowledge/Comprehension

28.2 Art Questions

1) Which part of this diagram of a neuron depicts the axon?



A) part A

B) part B

C) part C

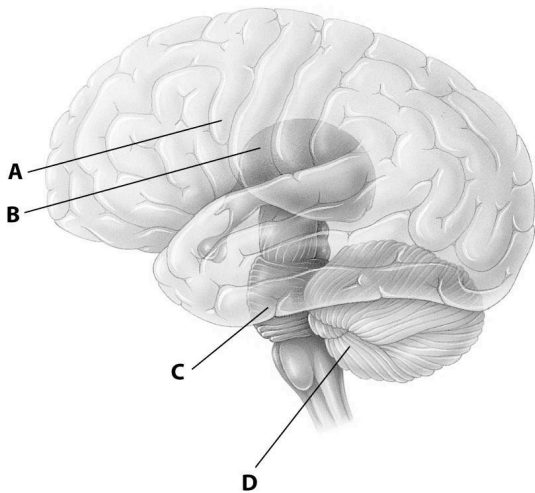
D) part D

Answer: D

Topic: 28.2

Skill: Knowledge/Comprehension

2) Which part of this diagram of the human brain depicts the cerebellum?



A) part A

B) part B

C) part C

D) part D

Answer: D

Topic: 28.14

Skill: Knowledge/Comprehension

28.3 Scenario Questions

After reading the paragraph, answer the question(s) that follow.

You recently sprayed your apartment with insecticide to remove an infestation of cockroaches. In your kitchen, you noticed some roaches lying on their backs twitching furiously before they died. This aroused your curiosity, so you decided to investigate exactly how the insecticide works on the nervous system.

In your research, you discover that the insecticide you used contains a permanent acetylcholinesterase inhibitor. Acetylcholine is a neurotransmitter that stimulates skeletal muscle to contract. Acetylcholinesterase removes acetylcholine from the synapse after the signal is received. Exposure to high pesticide concentrations has a similar effect on humans and can also be caused by exposure to the nerve gas Sarin and other chemical agents.

1) Why did the insecticide cause uncontrollable twitching in the roaches?

A) Acetylcholine was released, but the insecticide prevented it from diffusing across the synapse.

B) Acetylcholine was released, but the insecticide prevented it from binding to the receptor sites of the postsynaptic neurons.

C) The insecticide caused continuous stimulation of the muscles.

D) The insecticide prevented acetylcholinesterase from being removed from the synapse.

Answer: C

Topic: 28.6, 28.7, 28.8, 28.9

Skill: Application/Analysis

2) Since pesticides affect humans in a manner similar to that of roaches, it would be valid to conclude that

A) acetylcholinesterase affects the DNA of all animals.

B) the mechanism of stimulating skeletal muscle contraction must be similar in humans and roaches.

C) pesticides are more harmful to roaches than humans.

D) the terminal end of the axon releases acetylcholine in roaches, but not in humans.

Answer: B

Topic: 28.6, 28.7, 28.8, 28.9

Skill: Application/Analysis