Chapter 2: Nerve Cells and Nerve Impulses

TRUE/FALSE

1. Dendrites contain the nuclei, ribosomes, mitochondria, and other structures found in most cells.

   ANS: F PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

2. A small gap is usually present between neurons.

   ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

3. Neurons receive information and transmit it to other cells.

   ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
   MSC: www

4. Axons are covered with an insulating material called a myelin sheath.

   ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

5. An afferent axon brings information into a structure.

   ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
   MSC: www

6. An efferent axon carries information away from a structure.

   ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

7. Neurons can have any number of dendrites, but no more than one axon.

   ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

8. The general rule among neurons is that the wider the branching, the fewer connections with other neurons.

ANS: F PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

9. The greater the surface area of a dendrite, the more information it can receive from other neurons.

ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

10. Neurons are distinguished from other cells by their shape.

ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

11. Glial cells serve many functions.

ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System MSC: www

12. There are more glial cells than neurons in the human brain.

ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

13. Glial cells transmit information across long distances.

ANS: F PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

14. Astrocytes remove waste material created when neurons die and control the amount of blood flow to each brain area.

ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

15. Oligodendrocytes in the periphery are specialized types of glia.

ANS: F PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System MSC: www

16. Schwann cells build the myelin sheaths in the periphery of the body.

ANS: T PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

17. Most chemicals can easily cross the cell membrane of a neuron.

ANS: F PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

18. The blood-brain barrier is made up of closely packed glial cells.

ANS: F PTS: 1 DIF: factual REF: The Blood-Brain Barrier OBJ: 3 TOP: 2.1 The Cells of the Nervous System

19. One disadvantage of the blood-brain barrier is that it keeps out most forms of nutrition.

ANS: T PTS: 1 DIF: factual REF: The Blood-Brain Barrier OBJ: 3 TOP: 2.1 The Cells of the Nervous System MSC: www

20. The primary source of energy used by the brain is fat.

ANS: F PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

21. At rest, the inside of a neuron's membrane is more negative than the outside.

ANS: T PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse MSC: www

22. The difference in voltage in a resting neuron is called the resting potential.

ANS: T PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

23. Increasing the electrical gradient for potassium would reduce the tendency for potassium ions to exit the neuron.

ANS: T PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse MSC: www

24. The sodium-potassium pump is what normally brings the membrane back to its original state of polarization after the peak of the action potential.

ANS: F PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse MSC: www

25. If a drug was given that temporarily inactivated the sodium-potassium pumps, action potentials would cease immediately.

ANS: F PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 2 TOP: 2.2 The Nerve Impulse

26. A prolonged increase in the permeability of the membrane to sodium ions would interfere with a neuron's ability to have an action potential.

ANS: T PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 2 TOP: 2.2 The Nerve Impulse

27. Additional stimulation beyond the threshold of excitation will result in a greater depolarization of the membrane during an action potential.

ANS: F PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

28. Dendrites and cell bodies are capable of producing action potentials.

ANS: F PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

29. In a myelinated axon, sodium channels are absent in the nodes of Ranvier.

ANS: F PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

MULTIPLE CHOICE

1. The two kinds of cells in the nervous system are:
   a. neurons and glia
   b. dendrites and axons
   c. ribosomes and lysosomes
   d. neurons and axons

ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
OBJ: 1 TOP: 2.1 The Cells of the Nervous System
MSC: www

2. What are the two kinds of cells in the nervous system?
   a. neurons and glia
   b. dendrites and axons
   c. ribosomes and lysosomes
   d. neurons and axons

ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

3. Santiago Ramon y Cajal demonstrated that:
   a. at rest, the neuron has a negative charge inside its membrane.
   b. neurons are separate from one another.
   c. neurons communicate at specialized junctions called synapses.
   d. action potentials follow the all-or-none law.

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
MSC: www

4. Who was the first researcher to demonstrate that neurons are separate from one another?
   a. Curt P. Richter
   b. Santiago Ramon y Cajal
   c. Charles S. Sherrington
   d. Jose Delgado

   ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

5. Prior to the work of Santiago Ramon y Cajal, what did many investigators believe?
   a. Nerves conducted impulses at the speed of light.
   b. Transmission across a synapse was just as fast as transmission along an axon.
   c. The tip of an axon physically merged with the next neuron.
   d. All neurons were of similar size and shape.

   ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

6. Which of the following contributed most to Cajal's ability to find that neurons are separate from one another?
   a. Charles Sherrington's study of reflexes
   b. Camillo Golgi's cell staining method
   c. Perves & Hadley's dye injection method
   d. Galileo's invention of the telescope

   ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

7. The cell membrane is composed of two layers of:
   a. protein.
   b. fat.
   c. carbohydrate.
   d. plasma.

   ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
   KEY: NEW

8. Neurons differ most strongly from other body cells in their:
   a. temperature.
   b. shape.
   c. osmotic pressure.
   d. mitochondria.

   ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

9. The ____ of neurons most strongly differentiate them from other cells in the body.
   a. temperature.
   b. shape.
   c. osmotic pressure.
   d. mitochondria.

   ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

10. What structure is composed of two layers of fat molecules that are free to flow around one another?
    a. the endoplasmic reticulum
    b. a ribosome
    c. a mitochondrion
    d. the membrane

    ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

11. Water, oxygen and ____ most freely flow across a cell membrane.
    a. calcium
    b. positively charged ions
    c. magnesium
    d. carbon dioxide

    ANS: D PTS: 1 DIF: factual REF: The Blood-Brain Barrier OBJ: 3 TOP: 2.1 The Cells of the Nervous System

12. Which chemicals flow most freely across a cell membrane?
    a. proteins, fats, and carbohydrates
    b. positively charged ions
    c. water, oxygen, and carbon dioxide
    d. calcium and magnesium

    ANS: C PTS: 1 DIF: factual REF: The Blood-Brain Barrier OBJ: 3 TOP: 2.1 The Cells of the Nervous System

13. Chemicals than cannot flow freely across a cell membrane enter a neuron through:
    a. a Golgi complex.
    b. specialized protein channels.
    c. the endoplasmic reticulum.
    d. gaps in the myelin sheath.

    ANS: B PTS: 1 DIF: factual REF: The Blood-Brain Barrier OBJ: 3 TOP: 2.1 The Cells of the Nervous System

14. The structure that contains the chromosomes is called the:
    a. endoplasmic reticulum.
    b. nucleus.
    c. mitochondrion.
    d. ribosome.

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
MSC: www

15. Which of the following is most likely to cross the cell membrane by simple diffusion?
    a. large proteins
    b. small, charged ions
    c. small, uncharged molecules
    d. large, charged ions

ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

16. Small, charged molecules can cross the cell membrane through:
    a. diffusion.
    b. ribosomes.
    c. mitochondria.
    d. protein channels.

ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

17. Protein channels allow ____ to cross the cell membrane.
    a. large charged molecules
    b. small charged molecules
    c. large uncharged molecules
    d. small uncharged molecules

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
KEY: NEW

18. Where do the metabolic activities occur that provide energy for all of the other activities of the cell?
    a. Mitochondria
    b. Ribosomes
    c. Lysosomes
    d. Golgi complexes

ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

19. Ribosomes are the part of a cell that:
    a. performs metabolic activities.
    b. breaks down harmful chemicals.
    c. transports proteins.
    d. synthesizes new proteins.

ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

20. The sites at which the cell synthesizes new protein molecules are called:
    a. mitochondria.
    b. endoplasmic reticula.
    c. ribosomes.
    d. plasma membranes.

    ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

21. The endoplasmic reticulum is a:
    a. network of thin tubes that transport newly synthesized proteins.
    b. site where the cell synthesizes new protein molecules.
    c. structure that separates the inside of the cell from the outside.
    d. structure that contains the chromosomes.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

22. The main feature that distinguishes a neuron from other animal cells is that a neuron has:
    a. a larger nucleus.
    b. a distinctive shape.
    c. the ability to metabolize a variety of fuels.
    d. a high internal concentration of sodium ions.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

23. One of the most distinctive features of neurons compared to other types of cells is their:
    a. shape.
    b. number of mitochondria.
    c. lack of a cell membrane.
    d. size.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

24. What receives excitation from other neurons and conducts impulses to muscle or gland cells?
    a. sensory neurons
    b. motor neurons
    c. dendrites
    d. dendritic spines

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

25. Dendrites ____.
    a. contain the nucleus, ribosomes, and other structures found in most cells
    b. are branching fibers that get narrower near their ends
    c. is a thin fiber of constant diameter
    d. are an insulating material that cover an axon

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

26. The branching fibers that form the information-receiving pole of the nerve cells are called:
    a. motor neurons.
    b. dendrites.
    c. sensory neurons.
    d. axons.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
    MSC: www

27. The surface of a dendrite is lined with specialized junctions through which the dendrite receives information from other neurons. What are these junctions called?
    a. synaptic receptors
    b. axons
    c. synaptic hillocks
    d. glia

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

28. Which of the following is NOT a characteristic of a dendrite?
    a. It tapers as it gets further from the cell body.
    b. It is in contact with the dendrites of other neurons.
    c. Its surface may be lined with synaptic receptors.
    d. It receives information from other neurons or the environment.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

29. The tree-like branches of a neuron that receive information from other neurons are called:
    a. axons.
    b. dendrites.
    c. soma.
    d. myelin.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

30. Some dendrites contain additional short outgrowths. What are these outgrowths called?
    a. hillocks
    b. dendritic spines
    c. dendritic roots
    d. myelin sheaths

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
    OBJ: 1 TOP: 2.1 The Cells of the Nervous System

31. Many dendrites contain short outgrowths called spines that:
    a. increase the surface area available for synapses.
    b. increase the speed of transmission.
    c. eliminate cell waste products.
    d. increase the symmetry of the cell.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
    KEY: NEW

32. Dendrites often contain additional short outgrowths. These are believed to:
    a. increase the surface area available for synapses.
    b. increase the speed of transmission.
    c. eliminate cell waste products.
    d. help the cell maintain its shape.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

33. A greater amount of branching on dendrites allows them to:
    a. manufacture more mitochondria.
    b. have a larger surface area available for receiving information from other neurons.
    c. increase their membrane permeability.
    d. lower their resting potential.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

34. Incoming synapses are primarily found on:
    a. dendrites only.
    b. cell bodies only.
    c. axons only.
    d. dendrites and cell bodies.

    ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

35. The information sender of the neuron, which conveys an impulse toward either other neurons or a gland or muscle, is called the:
    a. axon.
    b. dendrite.
    c. soma.
    d. myelin.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

36. Which of the following is the correct order of transmission of information within a neuron?
    a. cell body, dendrite, axon
    b. dendrite, axon, cell body
    c. axon, cell body, dendrite
    d. dendrite, cell body, axon

ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
MSC: www

37. Compared to dendrites, axons usually:
    a. form the information-receiving pole of the neuron.
    b. are shorter than the dendrites.
    c. are covered with myelin.
    d. taper in diameter toward their periphery.

ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

38. The insulating material which covers many vertebrate axons is called the:
    a. dendrite.
    b. myelin sheath.
    c. cell body or soma.
    d. presynaptic terminal.

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
OBJ: 1 TOP: 2.1 The Cells of the Nervous System

39. Myelin covers:
    a. all axons
    b. most dendrites
    c. some axons in vertebrates and none in invertebrates
    d. all vertebrate axons and some invertebrate axons

ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
OBJ: 1 TOP: 2.1 The Cells of the Nervous System

40. What does myelin cover?
    a. all axons
    b. most dendrites
    c. some axons in vertebrates and none in invertebrates
    d. all vertebrate axons and some invertebrate axons

ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
OBJ: 1 TOP: 2.1 The Cells of the Nervous System

41. Nodes of Ranvier are:
    a. gaps in the myelin of axons.
    b. the same as the myelin sheath.
    c. the spiny outgrowths on dendrites.
    d. responsible for cell metabolism.

ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
MSC: www

42. Gaps in the insulating material that surrounds axons are known as:
    a. interpeduncular nuclei.
    b. nodes of Ranvier.
    c. myelin synapses.
    d. presynaptic terminals.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

43. A presynaptic terminal is also known as:
    a. an end bulb
    b. a node of Ranvier
    c. myelin
    d. a spine

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

44. Which of the following is NOT true of axons?
    a. They can vary greatly in length.
    b. They carry information toward the soma.
    c. They release chemicals that cross the synapse.
    d. Some of them are covered with myelin sheaths.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

45. What is the point from which an axon releases chemicals into the synapse?
    a. the myelin sheath
    b. the presynaptic terminal
    c. a dendritic spine
    d. the endoplasmic reticulum

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

46. An axon has many branches, each of which swells at its tip. These are known as:
    a. presynaptic terminals.
    b. efferent axons.
    c. afferent axons.
    d. intrinsic neurons.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

47. Chemicals are released by axons:
    a. into the presynaptic terminal.
    b. into the junction between neurons.
    c. through the efferent terminals.
    d. to the mitochondria.

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
MSC: www

48. An axon releases chemicals:
    a. into the presynaptic terminal.
    b. into the junction between neurons.
    c. through the efferent terminals.
    d. to the mitochondria.

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

49. A neuron can have any number of ____, but no more than one ____.
    a. dendrites; axon
    b. axons; dendrite
    c. cell bodies; axon
    d. cell bodies; dendrite

ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System
KEY: NEW

50. Neurons typically have one ____, but many ____.
    a. dendrite; axons
    b. axon; dendrites
    c. cell body; axons
    d. dendrite; cell bodies

ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

51. Which of the following is NOT a characteristic of an axon?
    a. It can be up to a meter long.
    b. It has a constant diameter.
    c. It carries information toward the cell body.
    d. It may be covered with a myelin sheath.

ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

52. As a general rule, where do axons convey information?
    a. toward dendrites of their own cell
    b. toward their own cell body
    c. away from their own cell body
    d. to surrounding glia

ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

53. If you were to accidentally touch a hot stove with your hand, you would quickly pull your hand away. The information carried to the muscles in your arm to make them contract was carried by:
    a. efferent neurons.
    b. afferent neurons.
    c. intrinsic neurons.
    d. sensory neurons.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

54. If all of a neuron's dendrites or axons were contained within the spinal cord, it would be considered a(n) ____ neuron.
    a. efferent
    b. afferent
    c. intrinsic
    d. Purkinje

    ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

55. What would a neuron in the pons be called that receives information only from other cells in the pons and sends information only to other cells in the pons?
    a. afferent
    b. efferent
    c. intrinsic
    d. inter-synaptic

    ANS: C PTS: 1 DIF: conceptual REF: Anatomy of Neurons and Glia OBJ: 1 TOP: 2.1 The Cells of the Nervous System

56. Which of these is true of glial cells?
    a. They are larger than neurons
    b. They transmit information over long distances.
    c. They do not transmit information over long distances.
    d. They are less numerous then neurons.

    ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System KEY: NEW MSC: www

57. Which of the following is a characteristic of glial cells in the human brain?
    a. They are larger than neurons.
    b. They are capable of transmitting impulses when neurons fail to do so.
    c. They are more numerous than neurons.
    d. They are like neurons, except that they lack axons.

    ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

58. Glial cells:
    a. are less numerous than neurons in the human brain.
    b. transmit information over long distances within the central nervous system.
    c. occupy about ten times more space in the brain than do neurons.
    d. occupy about the same total space as do neurons.

    ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

59. Which function is NOT performed by glia?
    a. removing waste materials
    b. building myelin sheaths
    c. transmitting information
    d. guiding the growth of axons and dendrites

    ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

60. One type of glia helps synchronize the activity of axons. They are called:
    a. oligodendrocytes.
    b. astrocytes.
    c. radial glia.
    d. Schwann cells.

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

61. Which of the following is NOT true of astrocytes?
    a. They wrap around the presynaptic terminals of several axons.
    b. They help synchronize the activity of the axons.
    c. They remove waste material.
    d. They make up the myelin sheaths in the periphery of the body.

    ANS: D PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

62. Which type of glia remove waste material in the nervous system?
    a. astrocytes
    b. Schwann cells
    c. oligodendrocytes
    d. radial glia

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

63. What type of glial cells myelinate axons in the brain and spinal cord?
    a. oligodendrocytes
    b. Schwann cells
    c. radial glia
    d. astrocytes

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

64. Which type of glia release chemicals that modify the activity of neighboring neurons?
    a. astrocytes
    b. Schwann cells
    c. oligodendrocytes
    d. radial glia

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

65. Which type of glia builds myelin sheaths around axons in the periphery of the body?
    a. astrocytes
    b. Schwann cells
    c. oligodendrocytes
    d. radial glia

    ANS: B PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System
    MSC: www

66. ____ in the brain and spinal cord and ____ in the periphery are specialized types of glia that build the myelin sheaths that surround neurons.
    a. Oligodendrocytes; Schwann cells
    b. Schwann cells; oligodendrocytes
    c. Microglia; oligodendrocytes
    d. Radial glia; Schwann cells

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

67. Glial cells whose function most closely resembles that of the immune system are called:
    a. oligodendrocytes.
    b. Schwann cells.
    c. microglia.
    d. radial glia.

    ANS: C PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

68. Radial glia:
    a. guide the migration of neurons during embryonic development.
    b. synchronize the activity of axons.
    c. wrap around the presynaptic terminals of several axons.
    d. build the myelin sheaths that surround and insulate certain axons.

    ANS: A PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia OBJ: 2 TOP: 2.1 The Cells of the Nervous System

69. Of the following, the most important consideration in developing a drug that will act in the brain is:
    a. if the drug can be inexpensively manufactured.
    b. if the drug will cross the blood-brain barrier.
    c. how long the drug will act.
    d. the number of people who will use the drug.

    ANS: B PTS: 1 DIF: conceptual REF: The Blood-Brain Barrier
    OBJ: 3 TOP: 2.1 The Cells of the Nervous System

70. The risk of having part of the brain unprotected by the blood-brain barrier is that:
    a. it is invisible to brain imaging techniques.
    b. it takes longer for drugs to work.
    c. viruses or toxic chemicals are more likely to damage it.
    d. the blood is poorly oxygenated.

    ANS: C PTS: 1 DIF: factual REF: The Blood-Brain Barrier
    OBJ: 3 TOP: 2.1 The Cells of the Nervous System

71. What is the mechanism that prevents or slows some chemicals from entering the brain, while allowing others to enter?
    a. a threshold
    b. a blood-brain barrier
    c. an endoplasmic wall
    d. a differential-drug inhibitor

    ANS: B PTS: 1 DIF: factual REF: The Blood-Brain Barrier
    OBJ: 3 TOP: 2.1 The Cells of the Nervous System

72. In the brain, an arrangement of endothelial cells:
    a. has gaps large enough to allow the passage of molecules.
    b. synthesizes neurotransmitters.
    c. does not allow most molecules to pass because the cells are so tightly packed.
    d. has gaps that are filled with enzymes that attack most blood chemicals.

    ANS: C PTS: 1 DIF: factual REF: The Blood-Brain Barrier
    OBJ: 3 TOP: 2.1 The Cells of the Nervous System

73. What happens to a virus that manages to cross the blood-brain barrier and enter the brain?
    a. It is destroyed by natural killer cells.
    b. It gets trapped in a neuron, then both are destroyed by natural killer cells.
    c. It gets trapped in a glial cell, then both are destroyed by natural killer cells.
    d. It stays in the nervous system throughout the person's life.

    ANS: D PTS: 1 DIF: factual REF: The Blood-Brain Barrier
    OBJ: 3 TOP: 2.1 The Cells of the Nervous System

74. Which of the following is an important function of the blood-brain barrier?
    a. It enables more nutrients to reach the brain.
    b. It maintains an electrical gradient.
    c. It aids in the production of neurotransmitters.
    d. It protects the brain from most viruses.

ANS: A PTS: 1 DIF: factual REF: The Blood-Brain Barrier
OBJ: 3 TOP: 2.1 The Cells of the Nervous System

75. Which of the following molecules would be able to passively cross the blood-brain barrier?
    a. small, uncharged molecules
    b. large, charged molecules
    c. glucose
    d. amino acids

ANS: A PTS: 1 DIF: factual REF: The Blood-Brain Barrier
OBJ: 3 TOP: 2.1 The Cells of the Nervous System

76. Molecules that can cross the blood-brain barrier are usually:
    a. large, uncharged molecules, such as lactose.
    b. large, charged molecules.
    c. neurotransmitters, such as dopamine.
    d. molecules that can dissolve in the fats of the capillary walls.

ANS: D PTS: 1 DIF: factual REF: The Blood-Brain Barrier
OBJ: 3 TOP: 2.1 The Cells of the Nervous System

77. The major disadvantage of a blood-brain barrier is that:
    a. many chemicals can easily diffuse into the brain.
    b. it requires so much glucose to maintain it.
    c. certain required chemicals must be actively transported.
    d. viruses can't escape.

ANS: C PTS: 1 DIF: factual REF: The Blood-Brain Barrier
OBJ: 3 TOP: 2.1 The Cells of the Nervous System

78. Glucose enters the brain via which type of transport?
    a. indirect transport
    b. direct transport
    c. passive transport
    d. active transport

ANS: D PTS: 1 DIF: factual REF: The Blood-Brain Barrier
OBJ: 3 TOP: 2.1 The Cells of the Nervous System
KEY: NEW

79. Compared to passive transport, the major disadvantage of active transport is that it:
    a. cannot transport chemicals out of the brain.
    b. requires expenditure of energy.
    c. transports glucose into the brain.
    d. transports viruses into the brain.

ANS: B PTS: 1 DIF: factual REF: The Blood-Brain Barrier
OBJ: 3 TOP: 2.1 The Cells of the Nervous System

81. What is the main source of nutrition for vertebrate neurons?
    a. Fats
    b. Glucose
    c. Sodium
    d. Complex carbohydrates

    ANS: B PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

82. Why do neurons rely so heavily on glucose as their source of nutrition?
    a. Neurons lack the enzymes necessary to metabolize other fuels.
    b. Glucose is the only fuel that can be used even in the absence of vitamins.
    c. Glucose is not used extensively by other parts of the body.
    d. Other fuels do not readily cross the blood-brain barrier.

    ANS: D PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

83. What are two requirements for the brain to metabolize glucose?
    a. thiamine and oxygen
    b. vitamin C and nitrogen
    c. niacin and bicarbonate
    d. riboflavin and iron

    ANS: A PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

84. Why does the brain need thiamine?
    a. to enable glucose to cross the blood-brain barrier
    b. as a source of fuel in case there is not enough glucose
    c. as a building block for making proteins
    d. to enable it to metabolize glucose

    ANS: D PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

85. If the brain does not have enough thiamine, what is it unable to do?
    a. maintain its blood-brain barrier
    b. pump glucose across the blood-brain barrier
    c. produce certain neurotransmitters
    d. metabolize glucose

    ANS: D PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

86. Which group is most likely to suffer from a thiamine deficiency?
    a. alcoholics
    b. heroin addicts
    c. diabetics
    d. infants

    ANS: A PTS: 1 DIF: factual REF: Nourishment in

Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

87. What leads to Korsakoff's syndrome?
    a. thiamine deficiency resulting from alcoholism
    b. glucose deficiency resulting from alcoholism
    c. viruses that manage to cross the blood-brain barrier
    d. glial cells that over-reproduce and increase pressure in the brain

    ANS: A PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

88. Korsakoff's syndrome:
    a. is marked by severe memory impairments.
    b. results from too much thiamine.
    c. results from lack of oxygen to the brain.
    d. is due to a breakdown of the blood-brain barrier.

    ANS: A PTS: 1 DIF: factual REF: Nourishment in Vertebrate Neurons OBJ: 3 TOP: 2.1 The Cells of the Nervous System

89. The membrane of a neuron is specialized to:
    a. keep all types of intercellular chemicals from moving out of the neuron.
    b. keep all types of extracellular chemicals from moving into the neuron.
    c. control the exchange of chemicals between the inside and outside of the cell.
    d. produce chains of fatty acids and proteins.

    ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

90. The membrane of a neuron is composed of ____ with ____ embedded in them.
    a. carbohydrates; purines
    b. fat molecules; proteins
    c. proteins; neurotransmitters
    d. benzene molecules; carbohydrates

    ANS: B PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

91. What is the difference in voltage called that typically exists between the inside and the outside of a neuron?
    a. concentration gradient
    b. generator potential
    c. resting potential
    d. shock value

    ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 2 TOP: 2.2 The Nerve Impulse

92. When stating that the neuron's membrane is polarized, you are referring to a difference in electrical potential between:
    a. the axons and the dendrites.
    b. the axon hillock and the cell body.
    c. sodium ions and potassium ions.

d. the inside and the outside of the membrane.

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 2 TOP: 2.2 The Nerve Impulse

93. The resting potential is mainly the result of:
    a. negatively charged proteins inside the cell.
    b. positively charged proteins inside the cell.
    c. negatively charged proteins outside the cell.
    d. positively charged proteins outside the cell.

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse
KEY: NEW

94. The resting potential of a neuron refers to:
    a. the net positive charge on the inside of the neuron.
    b. ions which rest in one place in the cell.
    c. the movement of ions to the outside of the neuron.
    d. the net negative charge on the inside of the neuron.

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

95. What is the approximate resting potential of the inside of a neuron's membrane, relative to the outside?
    a. -70 millivolts
    b. +10 millivolts
    c. 0 millivolts
    d. +90 millivolts

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse
KEY: NEW MSC: www

96. The selectivity of a neuron membrane is analogous to:
    a. the blood-brain barrier.
    b. the action potential.
    c. the resting potential.
    d. myelin.

ANS: A PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse
KEY: NEW

97. Allowing only certain people to cross the street, and only at certain times, is comparable to a neuron’s ____ with respect to ions.
    a. threshold of excitation
    b. all-or-none law
    c. resting potential
    d. selective permeability

ANS: D PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse
KEY: NEW

98. When a neuron's membrane is at rest, which of the following molecules crosses through it MOST slowly?
a. potassium
b. sodium
c. water
d. carbon dioxide

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

99. When the neuronal membrane is at rest, the potassium channels:
a. permit potassium ions to pass quickly and easily.
b. permit potassium ions to pass slowly.
c. prohibit any movement of potassium ions.
d. help to open up the sodium channels.

ANS: B PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

100. When the neuronal membrane is at rest, the sodium channels:
a. permit sodium ions to pass quickly and easily.
b. permit potassium ions to cross instead of sodium.
c. are closed.
d. fluctuate rapidly between open and closed.

ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

101. Which of the following describes selective permeability?
a. Ions can only travel in certain directions across the membrane.
b. Only certain molecules are allowed to cross the membrane freely.
c. Only certain types of stimulation will result in an action potential.
d. All molecules must pass through designated channels.

ANS: B PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

102. When a neuron’s membrane is at rest, the concentration gradient tends to move sodium ____ the cell and the electrical gradient tends to move it ____ the cell.
a. into, into
b. into, out of
c. out of, into
d. out of, out of

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

103. When a neuron's membrane is at rest, the concentration gradient tends to move potassium ____ the cell and the electrical gradient tends to move it ____ the cell.
a. into, into
b. into, out of
c. out of, into
d. out of, out of

ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

104. The sodium-potassium pump repeatedly transports ____ sodium ions out of the cell while drawing ____ potassium ions into it.
a. three; two
b. two; three
c. one; three
d. one; two

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

105. The sodium-potassium pump repeatedly transports three ____ ions out of the cell while drawing two ____ ions into it.
a. calcium; potassium
b. potassium; calcium
c. potassium; sodium
d. sodium; potassium

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse
MSC: www

106. Electrical gradients lead to what kind of movements?
a. the general movement of ions into the neuron
b. the general movement of ions out of the neuron
c. the movement of ions to areas having the same electrical charges
d. the movement of ions to areas having the opposite electrical charges

ANS: D PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

107. Under which conditions would the sodium-potassium pump be far less effective in creating a concentration gradient?
a. if dendrites were generally longer than axons
b. if the glia-to-neuron ratio were higher
c. if selective permeability of the membrane did not exist
d. if it were an active transport system that required energy

ANS: C PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

108. The net effect of each cycle of the sodium-potassium pump is to:
   a. decrease the number of positively charged ions within the cell.
   b. increase the number of positively charged ions within the cell.
   c. decrease the number of positively charged ions outside the cell.
   d. increase the number of negatively charged ions within the cell.

   ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

109. What is one major cause for the resting potential of a neuron's membrane?
   a. a difference in size between axons and dendrites
   b. a high permeability of the membrane to water molecules
   c. the refractory period of the membrane
   d. the sodium-potassium pump

   ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse
   MSC: www

110. The sodium-potassium pump pumps sodium ions ____ and potassium ions ____.
   a. into the cell; into the cell
   b. into the cell; out of the cell
   c. out of the cell; out of the cell
   d. out of the cell; into the cell

   ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

111. The concentration gradient refers to:
   a. the fact that the concentration of ions is greater on the inside of a neuron.
   b. the fact that the concentration of ions is greater on the outside of a neuron.
   c. the difference in distribution for various ions between the inside and outside of the membrane.
   d. the negatively charged proteins inside the cell.

   ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

112. What is meant by the term "concentration gradient" with respect to neurons?
   a. Sodium is more concentrated in the dendrites and potassium in the axon.
   b. Negative charges are more concentrated outside the cell.
   c. Sodium and potassium ions are more concentrated on opposite sides of the membrane.
   d. Potassium is more concentrated in the dendrites and sodium in the axon.

   ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

113. Concentration gradients lead to what kind of movements?
   a. the general movement of ions into the neuron
   b. the general movement of ions out of the neuron
   c. the movement of ions to areas of their highest concentrations
   d. the movement of ions to areas of their lowest concentrations

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

114. Which of the following events would increase the concentration gradient of sodium?
a. decreased permeability to potassium ions
b. increased activity of the sodium potassium pump
c. increased membrane permeability to sodium ions
d. increased membrane permeability to chloride ions

ANS: B PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

115. The concentration gradient for potassium tends to:
a. draw potassium into the cell.
b. push chloride out of the cell.
c. push sodium out of the cell.
d. push potassium out of the cell.

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

116. Which of the following is NOT true for sodium ions when the cell is at resting potential?
a. Sodium ions remain outside the cell because the sodium- potassium pump drives them out.
b. Sodium gates are tightly closed.
c. Sodium tends to be driven into the neuron by the concentration gradient.
d. Sodium tends to be driven out of the neuron by the electrical gradient.

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

117. When the neuron is at rest, what is responsible for moving potassium ions OUT of the cell?
a. a concentration gradient
b. an electrical gradient
c. both a concentration gradient and an electrical gradient
d. the sodium-potassium pump

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

118. When the neuron is at rest, what is responsible for moving potassium ions into the cell?
a. concentration gradient
b. an electrical gradient
c. the sodium-potassium pump
d. both the sodium-potassium pump and electrical gradient

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

119. When a membrane is at rest, what attracts potassium ions to the inside of the cell?
a. an electrical gradient
b. a concentration gradient
c. both an electrical gradient and a concentration gradient
d. neither an electrical gradient nor a concentration gradient

ANS: A PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

120. When a membrane is at rest, what attracts sodium ions to the inside of the cell?
a. an electrical gradient
b. a concentration gradient
c. both an electrical gradient and a concentration gradient
d. neither an electrical gradient nor a concentration gradient

ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

121. When the neuron is at rest, what is responsible for moving sodium ions out of the cell?
a. a concentration gradient
b. an electrical gradient
c. both a concentration gradient and an electrical gradient
d. the sodium-potassium pump

ANS: D PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

122. Which of the following is an advantage of having a resting potential?
a. The toxic effects of sodium are minimized inside the cell.
b. No energy is required to maintain it.
c. The cell is prepared to respond quickly to a stimulus.
d. All of the ions are maintained in equal concentrations throughout the cytoplasm.

ANS: C PTS: 1 DIF: factual REF: The Resting Potential of the Neuron
OBJ: 1 TOP: 2.2 The Nerve Impulse

123. Negatively charged ions like ____ are mostly located outside the cell.
a. sodium
b. chloride
c. calcium
d. potassium

ANS: B PTS: 1 DIF: factual REF: The Resting Potential of the Neuron OBJ: 1 TOP: 2.2 The Nerve Impulse

124. Ordinarily, stimulation of a neuron takes place:
a. through hyperpolarization.
b. at the synapse.
c. in the mitochondria.
d. in the endoplasmic reticulum.

ANS: B PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

125. What is the result if a stimulus shifts the potential inside a neuron from the resting potential to a more negative potential?
    a. Hyperpolarization
    b. Depolarization
    c. an action potential
    d. a threshold

    ANS: A PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

126. Hyperpolarization is:
    a. increased polarization.
    b. decreased polarization.
    c. the threshold of the cell.
    d. the resting potential of the cell.

    ANS: A PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

127. Which of the following would produce a hyperpolarization of a neuron?
    a. applying a negative charge inside the neuron with a microelectrode
    b. applying a positive charge inside the neuron with a microelectrode
    c. increasing the membrane's permeability to sodium
    d. decreasing the membrane's permeability to potassium

    ANS: A PTS: 1 DIF: conceptual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

128. What is the result if a stimulus shifts the potential inside a neuron from the resting potential to a potential slightly closer to zero?
    a. hyperpolarization
    b. depolarization
    c. selective permeability
    d. a refractory period

    ANS: B PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

129. The neuron will produce an action potential only if the depolarization exceeds what level?
    a. the threshold of excitation
    b. the resting potential
    c. hyperpolarization
    d. the refractory period

    ANS: A PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

130. A membrane produces an action potential whenever the potential across it reaches what level?
    a. the resting potential
    b. -90 mV
    c. the threshold of excitation
    d. the refractory period

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

131. If there is a depolarizing effect on a neuron, the result will be that the neuron will fire:
a. no matter how slight the effect.
b. forever.
c. only if it reaches threshold.
d. only if the cell is in its relative refractory period.

ANS: C PTS: 1 DIF: conceptual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

132. The sodium gates in the axon are usually closed. Which of the following opens them?
a. depolarization of the membrane
b. increased concentration of socium outside the cell
c. increased concentration of sodium inside the cell
d. increased activity of the sodium-potassium pump

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

133. What tends to open the sodium gates across a neuron's membrane?
a. hyperpolarization of the membrane
b. depolarization of the membrane
c. increase in the sodium concentration outside the neuron
d. passing the peak of the action potential and entering the refractory period

ANS: B PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

134. What happens to the ion gates when the membrane of a neuron starts to be depolarized?
a. Potassium gates close.
b. Chloride gates open.
c. Sodium gates close.
d. Sodium gates open.

ANS: D PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

135. Stimulus A depolarizes a neuron just barely above the threshold. Stimulus B depolarizes a neuron to 10 mV beyond threshold. What can we expect to happen?
a. Stimulus B will produce an action potential that is conducted at a faster speed than A.
b. Stimulus B will produce an action potential of greater magnitude than stimulus A.
c. Stimulus B will produce an action potential but stimulus A will not.
d. Stimulus A and stimulus B will produce the same response in the neurons.

ANS: D PTS: 1 DIF: conceptual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

136. If depolarization is less than the cell's threshold:
    a. sodium is prevented from crossing the membrane.
    b. potassium is prevented from crossing the membrane.
    c. sodium crosses the membrane only slightly more than usual.
    d. the cell will still produce an action potential.

    ANS: C PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

137. Which of the following actions would depolarize a neuron?
    a. decreasing membrane permeability to calcium
    b. increasing membrane permeability to potassium
    c. decreasing membrane permeability to sodium
    d. increasing membrane permeability to sodium

    ANS: D PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

138. Stimulation of a neuron beyond a certain level is called the:
    a. firing threshold
    b. hillock threshold
    c. threshold of excitation
    d. threshold of inhibition

    ANS: C PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

139. The action potential of a neuron depends mostly on what movement of ions?
    a. sodium ions entering the cell
    b. sodium ions leaving the cell
    c. potassium ions entering the cell
    d. potassium ions leaving the cell

    ANS: A PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

140. In the normal course of an action potential:
    a. sodium channel remain open for long periods of time.
    b. the concentration of sodium equalizes across the membrane.
    c. sodium remains much more concentrated outside than inside the neuron.
    d. subthreshold stimulation intensifies the action potential.

    ANS: C PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

141. Voltage-activated channels are channels for which a change in the voltage across the membrane alters their:
    a. permeability.
    b. length.
    c. number.
    d. threshold.

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

142. At the peak of the action potential, the electrical gradient of potassium:
a. is the same as during the resting potential.
b. pulls sodium into the cell.
c. pushes potassium out of the cell.
d. pulls potassium into the cell.

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

143. When the potential across a membrane reaches threshold, the sodium channels:
a. open to let sodium enter the cell rapidly.
b. close to prevent sodium from entering the cell.
c. open to let sodium exit the cell rapidly.
d. close to prevent sodium from exiting the cell.

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

144. Suppose we applied a drug to a neuron that caused its sodium gates to suddenly open wide. What would happen?
a. hyperpolarization of the membrane
b. an increase in the threshold
c. an action potential
d. nothing, because potassium gates would compensate

ANS: C PTS: 1 DIF: conceptual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

145. During the entire course of events from the start of an action potential until the membrane returns to its resting potential, what is the net movement of ions?
a. sodium in, potassium in
b. sodium out, potassium out
c. sodium in, potassium out
d. sodium out, potassium in

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

146. A drug that blocks the sodium gates of a neuron's membrane would:
a. decrease the threshold.
b. block the action potential.
c. cause repeated action potentials.
d. eliminate the refractory period.

ANS: B PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

147. After the peak of an action potential, what prevents sodium ions from continuing to enter the cell?
a. There is no longer a concentration gradient for sodium.
b. The sodium-potassium pump greatly increases its rate of activity.
c. All the available sodium ions have already entered the cell.
d. The sodium gates in the membrane close.

ANS: D PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

148. At what point do the sodium gates begin to close, shutting out further entry of sodium into the cell?
a. at the peak of the action potential
b. when the threshold is reached
c. at the end of the relative refractory period
d. when the concentration gradient for sodium is eliminated

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

149. Just after the peak of the action potential, what movement of ions restores the membrane to approximately the resting potential?
a. Sodium ions enter the cell.
b. Potassium ions enter the cell.
c. Potassium ions leave the cell.
d. Sodium ions travel down the axon.

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

150. What causes potassium ions to leave the axon just after the peak of the action potential?
a. a continuing concentration gradient and the opening of the potassium gates
b. an increase in the concentration gradient across the membrane
c. increased tendency of the sodium-potassium pump to pump potassium out
d. binding of potassium ions to proteins that leave at this time

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

151. A drug that decreases the flow of potassium through the potassium gates of the membrane would:
a. block action potentials.
b. increase the threshold of the membrane.
c. slow the return of the membrane to its resting potential.
d. cause the membrane to be hyperpolarized.

ANS: C PTS: 1 DIF: conceptual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

152. A drug would prevent an action potential if it:
a. lowers the threshold of the membrane.
b. blocks the movement of potassium across the membrane.
c. blocks the movement of sodium across the membrane.
d. increases the movement of sodium across the membrane.

ANS: C PTS: 1 DIF: conceptual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

153. Local anesthetic drugs attach to the sodium channels of the membrane, which:
a. allows sodium ions to enter and stop action potential.
b. prevents potassium ions from entering and stopping action potential.
c. allows potassium ions to enter and stop action potential.
d. prevents sodium ions from entering and stopping action potential.

ANS: D PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse KEY: NEW

154. Local anesthetic drugs, such as Novocain, work by:
a. opening the potassium gates.
b. blocking the sodium gates.
c. inactivating the sodium-potassium pump.
d. decreasing blood flow to certain areas of the brain.

ANS: B PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

155. Which of the following represents the all-or-none law?
a. Every depolarization produces an action potential.
b. Every hyperpolarization produces an action potential.
c. The size of the action potential is independent of the strength of the stimulus that initiated it.
d. Every depolarization reaches the threshold, even if it fails to produce an action potential.

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

156. The all-or-none law states that:
a. a neuron produces an action potential of maximal strength, or none at all.
b. all neurons fire or none at all.
c. all neurons in a pathway fire at the same time, or none do.
d. all ions move in the same direction, or none do.

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

157. The all-or-none law applies to:
a. cell bodies of neurons.
b. dendrites.
c. axons.
d. all parts of a neuron.

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

158. The presence of an all-or-none law suggests that neurons can only convey different messages by changing their:
a. rate or pattern of action potentials.
b. size of action potentials.
c. speed of action potentials.
d. sodium-potassium pump activity.

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse MSC: www

159. According to the all-or-none law:
a. all neurons produce an action potential at the same time or none at all.
b. all of the extracellular sodium enters the axon, or none at all.
c. once an axon reaches threshold, the amplitude and velocity of an action potential are nearly equal each time.
d. neurons are either active all the time or not at all.

ANS: C PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

160. The primary feature of a neuron that prevents the action potential from traveling back from where it just passed is the:
a. concentration gradient.
b. refractory period.
c. sodium potassium pump.
d. phospholipid bilayer.

ANS: B PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

161. Under what conditions is it impossible for a stimulus to produce an action potential?
a. if the membrane is in its absolute refractory period
b. if it occurs at the same time as a hyperpolarizing stimulus
c. if sodium ions are more concentrated outside the cell than inside
d. if the potassium gates have been blocked

ANS: A PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

162. Which feature of a neuron limits the number of action potentials it can produce per second?
a. the threshold
b. the refractory period
c. saltatory conduction
d. the length of the axon

ANS: B PTS: 1 DIF: factual REF: The Action Potential
OBJ: 3 TOP: 2.2 The Nerve Impulse

163. A neuron's sodium gates are firmly closed and the membrane cannot produce an action potential during:
    a. the absolute refractory period.
    b. the relative refractory period.
    c. depolarization.
    d. saltatory conduction.

    ANS: A PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

164. During the relative refractory period:
    a. the sodium gates are firmly closed.
    b. the sodium gates are reverting to their usual state.
    c. the sodium gates are wide open.
    d. the potassium gates are firmly closed.

    ANS: B PTS: 1 DIF: factual REF: The Action Potential
    OBJ: 3 TOP: 2.2 The Nerve Impulse

165. Where do most action potentials begin?
    a. in the dendrites
    b. in the cell body
    c. at the axon hillock
    d. at the tip of the axon

    ANS: C PTS: 1 DIF: factual REF: Propagation of the Action Potential OBJ: 4 TOP: 2.2 The Nerve Impulse

166. What happens once an action potential starts?
    a. It is conducted the rest of the way as an electrical current.
    b. It needs additional stimulation to keep it going along the axon.
    c. It increases in speed as it goes.
    d. It is regenerated at other points along the axon.

    ANS: D PTS: 1 DIF: factual REF: Propagation of the Action Potential OBJ: 4 TOP: 2.2 The Nerve Impulse

167. What will affect the speed of an action potential?
    a. the strength of the stimulus
    b. the time since the last action potential
    c. the length of the axon
    d. the resistance of the membrane

    ANS: D PTS: 1 DIF: factual REF: Propagation of the Action Potential OBJ: 4 TOP: 2.2 The Nerve Impulse
    MSC: www

168. What will NOT affect the speed of an action potential?
    a. the presence of myelin
    b. the diameter of the axon
    c. the length of the axon
    d. the number of sodium gates

    ANS: C PTS: 1 DIF: conceptual REF: Propagation of the Action Potential OBJ: 4 TOP: 2.2 The Nerve Impulse

169. How is the speed of an action potential down an unmyelinated axon BEST described?
    a. the speed of electricity, regardless of the size of the axon
    b. less than 1 meter per second, regardless of the size of the axon
    c. faster in thin axons than in thick ones
    d. faster in thick axons than in thin ones

    ANS: D PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction
    OBJ: 4 TOP: 2.2 The Nerve Impulse

170. The presence of myelin and the diameter of the axon:
    a. affect the strength and frequency of the stimulus
    b. affect the speed of an action potential
    c. affect the strength of an action potential
    d. affect the frequency of an action potential

    ANS: B PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

171. Which two factors affect the speed of an action potential?
    a. the strength and frequency of the stimulus
    b. the location of the cell body and the length of the axon
    c. the length and diameter of the axon
    d. the presence of myelin and the diameter of the axon

    ANS: D PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse KEY: NEW

172. The function of a myelin sheath is to:
    a. prevent action potentials from traveling in the wrong direction.
    b. increase the velocity of transmission along an axon.
    c. increase the magnitude of an action potential.
    d. provide a store of nutrients for the neuron.

    ANS: B PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

173. If you were to stub your toe and feel the pressure a second or two before you feel the pain, then which of the following statements is most likely true?
    a. Pain sensitive neurons are large and myelinated.
    b. Pain sensitive neurons are longer.
    c. Pressure sensitive neurons are small and lightly myelinated.
    d. Pressure sensitive neurons are large and myelinated.

ANS: D PTS: 1 DIF: conceptual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

174. What are the nodes of Ranvier?
a. gates in the membrane that admit all ions freely
b. gaps in the myelin sheath
c. branching points in an axon
d. places where dendrites join the cell body

ANS: B PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse MSC: www

175. The myelin sheath is interrupted periodically by short sections of axon called:
a. axon gaps
b. nodes of Cajal
c. axon nodes
d. nodes of Ranvier

ANS: D PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

176. In a myelinated axon, where are sodium gates abundant?
a. in the areas covered by myelin
b. at the nodes of Ranvier
c. throughout the axon
d. only in the axon hillock

ANS: B PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

177. To what does saltatory conduction refer?
a. the production of an action potential by the movement of sodium ions
b. the transmission of an impulse along a myelinated axon
c. the transmission of impulses along dendrites
d. the transmission of an impulse between one neuron and another

ANS: B PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

178. Saltatory conduction ____ the velocity of action potentials and ____ the amount of energy used by the neuron.
a. decreases; decreases
b. decreases; increases
c. increases; decreases
d. increases; increases

ANS: C PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

179. How does saltatory conduction affect energy use in a neuron?
    a. It eliminates the need for action potentials.
    b. It increases the duration of the refractory period.
    c. It reduces the frequency of action potentials.
    d. It reduces the work load for the sodium-potassium pump.

    ANS: D PTS: 1 DIF: conceptual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

180. What disease is related to the destruction of myelin sheaths?
    a. multiple sclerosis
    b. cystic fibrosis
    c. myasthenia gravis
    d. Parkinson's disease

    ANS: A PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

181. In what way is a myelinated axon that has lost its myelin (through disease) different from an axon that was never myelinated?
    a. It has a smaller diameter.
    b. It lacks sodium gates along parts of its surface.
    c. It has a longer refractory period.
    d. It has a much higher threshold.

    ANS: B PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse Conduction

182. Multiple sclerosis is one of several:
    a. blood-brain disorders
    b. neuron diseases
    c. demyelinating diseases
    d. movement disorders

    ANS: C PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

183. Which of the following is NOT governed by the all-or-none law?
    a. unmyelinated axons
    b. myelinated axons
    c. motor neurons
    d. local neurons

    ANS: D PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction OBJ: 4 TOP: 2.2 The Nerve Impulse

184. In what direction does a local neuron transmit information?
    a. through its dendrites to cell body to axon
    b. through its axon to cell body to dendrites
    c. only toward the cell body
    d. equally well in any direction

ANS: D PTS: 1 DIF: factual REF: Local Neurons
OBJ: 5 TOP: 2.2 The Nerve Impulse

185. Which of the following describes the transmission of information in a local neuron?
a. The signal decreases in strength as it travels.
b. The signal increases in strength as it travels.
c. The signal strength remains constant as it travels.
d. Local neurons do not transmit any information.

ANS: A PTS: 1 DIF: factual REF: Local Neurons
OBJ: 5 TOP: 2.2 The Nerve Impulse

186. Why are local neurons more difficult to study?
a. There are so few of them that they are difficult to find.
b. They are so small.
c. They exist only in humans, so there are ethical considerations.
d. They die if separated from other neurons.

ANS: B PTS: 1 DIF: factual REF: Local Neurons
OBJ: 5 TOP: 2.2 The Nerve Impulse

187. Which of the following is TRUE of local neurons?
a. They exchange information with distant neurons.
b. They abide by the all-or-none principle.
c. The change in membrane potential increases as it travels.
d. They have short dendrites and axons.

ANS: D PTS: 1 DIF: factual REF: Local Neurons
OBJ: 5 TOP: 2.2 The Nerve Impulse

188. A local neuron:
a. has an axon approximately a meter long.
b. conveys information to other neurons across great distances.
c. is a small neuron with no axon or a very short one.
d. has an axon with many branches far from the cell body.

ANS: C PTS: 1 DIF: factual REF: Local Neurons
OBJ: 5 TOP: 2.2 The Nerve Impulse

SHORT ANSWER

1. List the parts of a neuron.

ANS:
Dendrites, a soma (cell body), an axon, and presynaptic terminals.

PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
OBJ: 1 TOP: 2.1 The Cells of the Nervous System

2. Briefly describe glial cells.

   ANS:
   They are the other major components of the nervous system. They do not transmit information over long distances as neurons do, although they do exchange chemicals with adjacent neurons.

   PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
   OBJ: 2 TOP: 2.1 The Cells of the Nervous System

3. Briefly describe the structure of the blood-brain barrier and why it is important.

   ANS:
   Tightly joined endothelial cells form the capillary walls in the brain, making the blood-brain barrier. This protects the brain from harmful viruses, bacteria, and chemicals that might otherwise be able to enter the brain and cause damage.

   PTS: 1 DIF: factual REF: The Blood-Brain Barrier
   OBJ: 3 TOP: 2.1 The Cells of the Nervous System

4. The electrical gradient of a neuron membrane refers to what?

   ANS:
   A difference in electrical charge between the inside and outside of the cell.

   PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron
   OBJ: 1 TOP: 2.1 The Nerve Impulse

5. What would happen to the resting potential if a neuron's membrane was always completely permeable to charged ions?

   ANS:
   The freedom of movement would allow the ions to equalize on either side of the membrane, causing the resting potential to disappear.

   PTS: 1 DIF: conceptual REF: The Resting Potential of the Neuron
   OBJ: 1 TOP: 2.1 The Nerve Impulse

6. Briefly describe the all-or-none law of action potentials.

   ANS:
   Once a neuron reaches the threshold of activation, the action potential is conducted all of the way down the axon without loss of intensity. Furthermore, the magnitude of the action potential is roughly the same every time and is independent of the intensity of the stimulus that initiated it.

   PTS: 1 DIF: factual REF: The Action Potential
   OBJ: 3 TOP: 2.1 The Nerve Impulse

7. What is saltatory conduction?

   ANS:
   The jumping of action potentials from node to node .

   PTS: 1 DIF: factual REF: The Myelin Sheath and Saltatory Conduction
   OBJ: 4 TOP: 2.1 The Nerve Impulse

ESSAY

1. Briefly describe how the brain transports essential chemicals.

   ANS:
   Answers will vary.

   PTS: 1 DIF: factual REF: Anatomy of Neurons and Glia
   OBJ: 2 TOP: 2.1 The Cells of the Nervous System

2. Describe the aspects of the resting potential.

   ANS:
   Answers will vary.

   PTS: 1 DIF: factual REF: The Resting Potential of the Neuron
   OBJ: 1 TOP: 2.1 The Nerve Impulse
   MSC: www

3. Why do neurons have a resting potential?

   ANS:
   Answers will vary.

   PTS: 1 DIF: conceptual REF: The Nerve Impulse
   OBJ: 6 TOP: 2.2 Nerve Cells and Nerve Impulses

4. Briefly describe the function of voltage-gated channels.

   ANS:
   Answers will vary.

   PTS: 1 DIF: conceptual REF: 41 The Action Potential
   OBJ: 3 TOP: 2.1 The Nerve Impulse
   MSC: www

5. Briefly describe the refractory period of a neuron.

   ANS:

Answers will vary.

PTS: 1 DIF: conceptual REF: The Action Potential
OBJ: 3 TOP: 2.1 The Nerve Impulse