Student Name _____

Nervous System: Nervous Tissue and Brain

chapter 10

Answer Key: Textbook page references are provided as a guide for answering these questions. A complete answer key was provided for your instructor.

OBJECTIVES

1. Define the two divisions of the nervous system.
2. List three general functions of the nervous system.
3. Discuss the cellular composition of the nervous system, including:
   - Compare the structure and functions of the neuroglia and neuron.
   - Explain the function of the myelin sheath.
   - Explain how a neuron transmits information.
4. Describe the structure and function of a synapse.
5. Describe the functions of the four major areas of the brain and the four lobes of the cerebrum.
6. Describe how the skull, meninges, cerebrospinal fluid, and blood–brain barrier protect the central nervous system.

Part I: Mastering the Basics

MATCHING

Organization of the Nervous System

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. Some terms may be used more than once. See text, pp. 172-173.

A. central nervous system (CNS)
B. peripheral nervous system
C. motor nerves
D. sensory nerves
E. integrative function

1. _____ Nerves that carry out the plans made by the CNS

2. _____ Part of the nervous system that contains the brain and spinal cord

3. _____ Also described as *afferent nerves*

4. _____ Nerves that gather information from the environment and carry it to the CNS

5. _____ Part of the nervous system consisting of nerves that connect the brain and the spinal cord with the rest of the body

6. _____ Also described as *efferent nerves*

7. _____ The processing and interpretation of information by the cells of the CNS; the decision-making capability

MATCHING

Nerve Cells

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. See text, pp. 173-175.

A. neurons
B. astrocyte
C. ependymal cell
D. Schwann cells
E. ganglia
F. nuclei
G. microglia
H. neuroglia (glia)

1. _____ Common type of glial cell that supports and protects the neurons; helps form the blood–brain barrier

2. _____ Nerve tissue that is called *nerve glue*; composed of astrocytes, microglia, oligodendrocytes, and ependymal cells

3. _____ Nerve cells that transmit information as electrical signals

4. _____ Type of glial cell that lines the inside cavities of the brain; helps form the cerebrospinal fluid

5. _____ Glial cells that engage in phagocytosis of pathogens and damaged tissue

6. _____ Glial cells that form the myelin sheath in the peripheral nervous system

7. _____ Clusters of cell bodies located within the CNS

8. _____ Clusters of cell bodies located in the peripheral nervous system

MATCHING

Parts of a Neuron

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. Some terms may be used more than once. See text, pp. 173-174, 180.

A. cell body
B. axon
C. axon terminal
D. nodes of Ranvier
E. neurilemma
F. myelin sheath
G. dendrites
H. acetylcholine (ACh)

1. _____ Part of the neuron that transmits information away from the cell body

2. _____ Part of the neuron that contains the nucleus; dendrites bring information to this structure, and the axon carries information away from this structure.

3. _____ White fatty material that surrounds the axon; increases the rate at which the electrical signal travels along the axon

4. _____ Short segments of the axonal membrane that are not covered by myelin sheath

5. _____ Part of the axon where the neurotransmitters are stored

6. _____ Treelike part of the neuron that receives information from another neuron; transmits that information toward the cell body

7. _____ Layer of cells that covers the axons of peripheral neurons; concerned with nerve regeneration

8. _____ Makes white matter white

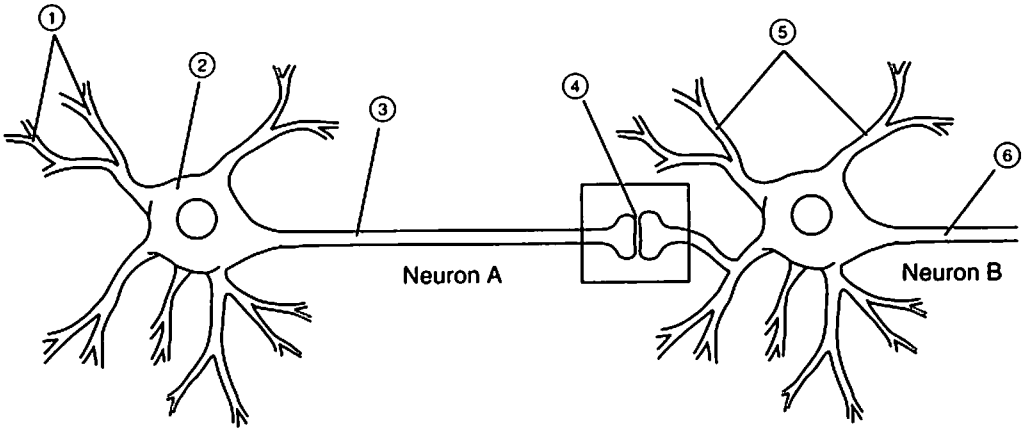
9. _____ Allows for saltatory conduction of the nerve impulse

10. _____ A common neurotransmitter

READ THE DIAGRAM

Two Neurons and a Synapse

Directions: Referring to the illustration, write the numbers in the blanks. See text, p. 181.



1. _____ The cell body of neuron A

2. _____ The axon of neuron B

3. _____ The synapse

4. _____ The dendrites of neuron B

5. _____ The axon of neuron A

6. _____ The dendrites of neuron A

7. _____ Structure that carries the electrical signal to the cell body of neuron A

8. _____ Point at which neuron A communicates with neuron B

9. _____ Structure that carries the action potential away from the cell body of neuron B

10. _____ and _____ are dendrites.

11. _____ and _____ are axons.

COLORING AND DRAWING

Directions: For the figure on p. 76, color the appropriate areas as indicated below.

1. Color the dendrites of neuron A *red.*
2. Color the axon of neuron B *yellow.*
3. Color the presynaptic membrane *blue.*
4. Color the postsynaptic membrane *green.*

DRAW IN

Directions: For the figure on p. 76, draw in the structures indicated below.

1. The storage of the neurotransmitter within the vesicles of the axon terminal
2. The myelin sheath and nodes of Ranvier on the axon of neuron A
3. An arrow that indicates the direction of movement of the nerve impulse (action potential)

MATCHING

Nerve Impulse

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. Some terms may be used more than once. See text, pp. 175-178.

A. depolarization
B. resting membrane potential (RMP)
C. action potential
D. repolarization

1. _____ The inside of the neuron becomes positively charged.
2. _____ The inside of the unstimulated neuron is negative; electrical charge is caused by the outward leak of potassium (K^+).
3. _____ The depolarized neuron returns to the resting state.
4. _____ The first phase of the action potential caused by an inward movement of sodium (Na^+)
5. _____ The changes in electrical charge across the membrane during depolarization and repolarization; also called the *nerve impulse*
6. _____ The second phase of the action potential that is caused by the outward movement of potassium (K^+)

MATCHING

Bumps and Grooves

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. Some terms may be used more than once. See text, pp. 182-184.

A. central sulcus
B. sulcus
C. fissure
D. lateral sulcus
E. gyrus
F. precentral gyrus
G. postcentral gyrus
H. longitudinal fissure

1. _____ Convolution located on the frontal lobe immediately anterior to the central sulcus
2. _____ A bump or elevation on the surface of the cerebrum
3. _____ A shallow groove found on the surface of the brain
4. _____ A deep groove found on the surface of the brain
5. _____ Also called a *convolution*
6. _____ Convolution that is located on the parietal lobe immediately posterior to the central sulcus
7. _____ Sulcus that separates the frontal lobe from the parietal lobes
8. _____ Groove that separates the temporal lobe from the frontal and parietal lobes
9. _____ Deep groove that separates the left and right hemispheres
10. _____ Sulcus that separates the primary motor cortex from the primary somatosensory cortex

MATCHING

Parts of the Brain

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. Some terms may be used more than once. See text, pp. 182-190.

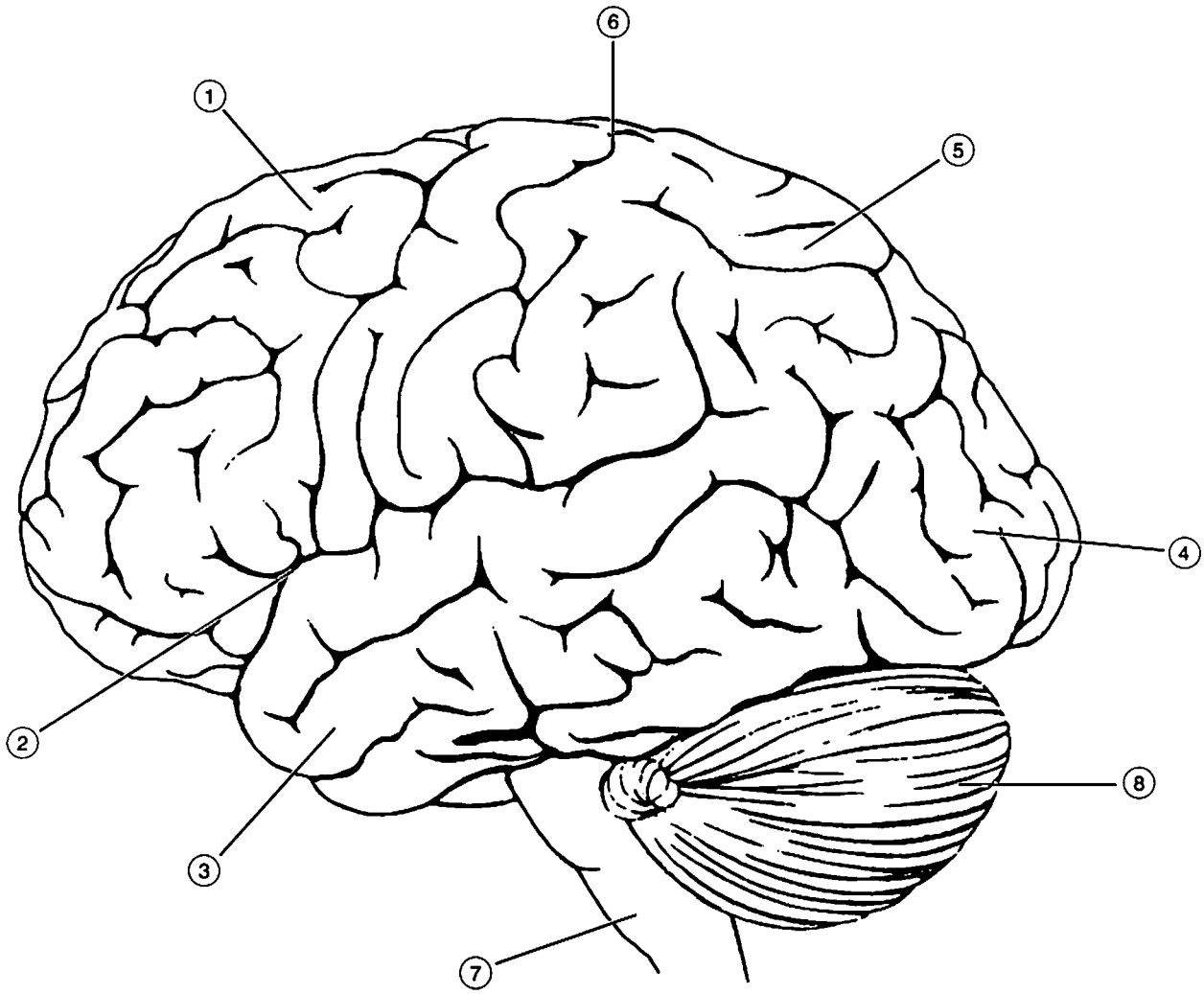
A. cerebrum
B. brain stem
C. diencephalon
D. pons
E. cerebellum
F. frontal lobe
G. parietal lobe
H. temporal lobe
I. limbic system
J. reticular formation
K. occipital lobe
L. hypothalamus
M. thalamus
N. medulla oblongata
O. corpus callosum

1. _____ Largest part of the brain
2. _____ Called the *emotional brain*
3. _____ We first become aware of pain at this level of the diencephalon; however, this structure does not allow us to determine the type of pain or locate the source of the pain.
4. _____ Part of the brain stem that connects the brain to the spinal cord
5. _____ The central sulcus separates the frontal lobe from this lobe.
6. _____ Composed of the midbrain, pons, and medulla oblongata
7. _____ Part of the diencephalon that controls the pituitary gland; also helps control the autonomic nervous system, water balance, and body temperature
8. _____ Part of the brain that is divided into the right and left hemispheres
9. _____ Composed of the thalamus and the hypothalamus
10. _____ This structure means *bridge;* it helps regulate breathing rate and rhythm.
11. _____ Bands of white matter that join the right and left cerebral hemispheres
12. _____ The precentral gyrus of this cerebral lobe is the major motor cortex; nerve impulses that originate in the motor area control voluntary muscle activity.
13. _____ The postcentral gyrus of this cerebral lobe is the primary somatosensory area.
14. _____ Plays a key role in personality development, emotional and behavioral expression, and performance of high-level thinking and learning tasks
15. _____ Cerebral lobe that contains the primary auditory cortex (hearing) and the olfactory cortex (smell)
16. _____ Part of the brain stem called the *vital center* because it regulates vital processes such as blood pressure, heart rate, and respirations
17. _____ Part of the brain stem that contains the vomiting center
18. _____ Cerebral lobe that contains the frontal eye fields
19. _____ Cerebral lobe that controls motor speech
20. _____ Crossing of most motor fibers occurs here
21. _____ A motor homunculus lives in this cerebral lobe.
22. _____ A sensory homunculus lives in this cerebral lobe.
23. _____ Cerebral lobe that is primarily concerned with vision
24. _____ Part of the diencephalon that acts as a relay and sorting station for most sensory fibers
25. _____ This widespread group of cells is concerned with the sleep-wake cycle and consciousness; signals passing from this structure to the cerebral cortex keep us awake.
26. _____ Cerebral lobe that contains Broca's area
27. _____ Damage to this cerebral lobe causes cortical blindness.
28. _____ Part of the brain stem that contains the emetic center
29. _____ Brain structure that protrudes from under the occipital lobe; concerned primarily with the coordination of skeletal muscle activity
30. _____ Damage to this cerebral lobe causes cortical deafness
31. _____ Part of the brain stem that receives information from the chemoreceptor trigger zone (CTZ)
32. _____ Composed of the frontal, parietal, occipital, and temporal lobes
33. _____ Cerebral lobe that functions as the CEO (chief executive officer)

READ THE DIAGRAM

Brain

Directions: Referring to the diagram, fill in the space with the correct numbers. Some numbers may be used more than once. See text, pp. 182-188.



1. _____ Part of the brain stem
2. _____ Called the *vital center* because it regulates respirations, blood pressure, and heart rate
3. _____ Central sulcus that separates the frontal lobe from this lobe
4. _____ The precentral gyrus of this cerebral lobe is the major motor cortex.
5. _____ The postcentral gyrus of this cerebral lobe is the primary somatosensory area.
6. _____ Fissure or groove that separates the primary motor cortex from the primary somatosensory area
7. _____ Cerebral lobe that is concerned primarily with vision
8. _____ Cerebral lobe that is concerned primarily with hearing
9. _____ The lateral sulcus separates the temporal lobe from this anterior cerebral lobe.
10. _____ This cerebral lobe contains Broca's area.
11. _____ This "little brain" protrudes from under the occipital lobe and is concerned with skeletal muscle coordination.
12. _____ The pyramidal tract arises from this cerebral lobe; the tract carries electrical signals to skeletal muscles, causing voluntary muscle contraction.

13. _____ Destruction of this cerebral lobe causes cortical blindness.

14. _____ Destruction of this cerebral lobe causes cortical deafness.

15. _____ This sulcus separates the frontal and parietal lobes from the temporal lobe.

16. _____ Contains the emetic center

17. _____ CEO

COLORING

Xs, Ys, and Zs . . . Yap Yap Yap

Directions: Color or mark the appropriate areas on the illustration on the previous page as indicated below.

1. Color the frontal lobe *red.*
2. Color the occipital lobe *yellow.*
3. Color the parietal lobe *green.*
4. Color the temporal lobe *blue.*
5. Draw a black circle around Wernicke's area.
6. Put a string of *X*s along the precentral gyrus.
7. Put a string of *Y*s along the postcentral gyrus.
8. Put a string of *Z*s along the gyrus that forms a motor homunculus.
9. Label Broca's area as *Yap Yap Yap.*
10. Put an *E* on the frontal eye fields.

MATCHING

Protection of the Brain and Spinal Cord

Directions: Match the following terms to the most appropriate definition by writing the correct letter in the space provided. See text, pp. 190-193.

A. bone
B. blood–brain barrier
C. meninges
D. pia mater
E. dural sinuses
F. ventricles
G. choroid plexus
H. dura mater
I. central canal
J. arachnoid mater
K. subarachnoid
L. arachnoid villi

1. _____ Tough outermost layer of the meninges; means *hard mother*

2. _____ Cerebrospinal fluid is formed from these blood vessels and ependymal cells that line the ventricular walls.

3. _____ The astrocytes help form this capillary structure that prevents harmful substances in the blood from diffusing into the brain and spinal cord.

4. _____ Cranium and vertebral column

5. _____ Cerebrospinal fluid circulates around the brain and spinal cord within this space.

6. _____ Cavities that are filled with blood and help drain the cerebrospinal fluid

7. _____ Called the *lateral, third,* and *fourth*

8. _____ The soft innermost layer of the meninges; means *soft mother*

9. _____ Finger-like structures that project into the dural sinuses to allow drainage of the cerebrospinal fluid

10. _____ Hole in the center of the spinal cord through which cerebrospinal fluid flows from the ventricles of the brain to the lower end of the spinal cord

11. _____ The middle layer of the meninges; means *spider* because the layer looks like a spider web

12. _____ Composed of the dura mater, arachnoid mater, and pia mater

13. _____ Meningeal layer that forms the tentorium

ORDERING

Cerebrospinal Fluid

Directions: Trace the formation of cerebrospinal fluid from its formation across the choroid plexus in the lateral ventricles to its absorption into the cerebral veins. Use the words listed below. See text, pp. 190-193.

fourth ventricle	arachnoid villi
third ventricle	central canal or foramina
dural sinuses	subarachnoid space

1. choroid plexus of the lateral ventricles
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. cerebral veins

SIMILARS AND DISSIMILARS

Directions: Circle the word in each group that is least similar to the others. Indicate the similarity of the three words on the line below each question.

1. astrocytes neurons ependymal oligodendrocytes cells

_____

2. cell body dendrites sulcus axon

_____

3. neurilemma myelin sheath synapse nodes of Ranvier

_____

4. depolarization action potential reflex arc repolarization

_____

5. pia convolution arachnoid dura

_____

6. axon lateral third fourth

_____

7. pons cerebrum medulla oblongata midbrain

_____

8. frontal brain stem parietal temporal

_____

9. temporal parietal occipital hypothalamus

_____

10. hypothalamus central sulcus thalamus diencephalon

_____

11. Broca's area occipital lobe frontal eye fields frontal lobe

_____

12. acetylcholine synapse cerebrospinal fluid ACh receptors

_____

13. central sulcus longitudinal fissure corpus callosum lateral sulcus

_____

14. Na^+ influx depolarization pia mater K^+ efflux

_____

15. serotonin dopamine cerebrospinal fluid (CSF) GABA

_____

16. cerebellum cerebrum primary visual cortex occipital

_____

17. gyrus sulcus cerebral "speed bump" convolution

_____

18. temporal ependymal hearing primary auditory cortex

_____

19.	basal ganglia	tentorium	shaking palsy	dopamine deficient
20.	choroid plexus	ependyma	GABA	CSF
21.	frontal lobe	vomiting center	respiratory control center	medulla oblongata
22.	motor homunculus	foramen magnum	cerebrum	frontal lobe
23.	choroid plexus	arachnoid villus	dopamine	CSF

Part II: Putting It All Together

MULTIPLE CHOICE

Directions: Choose the correct answer.

1. A nerve impulse that originates in the precentral gyrus of the cerebrum
   a. allows you to see.
   b. helps you analyze the meaning of speech.
   c. increases respiratory rate.
   d. causes skeletal muscle contraction and movement.

2. The medulla oblongata is called (the)
   a. vital center because it plays an important role in the control of respirations and cardiovascular function.
   b. emotional brain.
   c. primary somatosensory area because it receives information about breathing and heart rate.
   d. Broca's area because it controls motor speech.

3. Which of the following is most descriptive of multiple sclerosis?
   a. a disease in which the myelin sheath is gradually replaced by scar tissue
   b. a neuromuscular disorder caused by a deficiency of dopamine
   c. brain death caused by cerebral hypoxia
   d. increased intracranial pressure that causes downward displacement (herniation) of the brain stem

4. The central sulcus, lateral fissure, and longitudinal fissure
   a. separate or divide cerebral lobes.
   b. are brain stem structures.
   c. are located only on the right side of the brain.
   d. separate the cerebrum from the cerebellum.

5. The frontal, parietal, occipital, and temporal lobes
   a. are cerebral structures.
   b. comprise the brain stem.
   c. are parts of the diencephalon.
   d. perform only sensory functions.

6. A deficiency of the neurotransmitter in the basal nuclei
   a. stimulates the CTZ and emetic center.
   b. causes a type of motor impairment called *Parkinson's disease.*
   c. causes demyelination and multiple sclerosis.
   d. causes cortical blindness.

7. A rapid influx of sodium (Na^+) into a neuron
   a. makes the inside of the neuron more negative than resting membrane potential.
   b. causes repolarization.
   c. causes depolarization.
   d. prevents the firing of an action potential.

8. What is the result of damage to Broca's area?
   a. paralysis of all the extremities
   b. respiratory depression
   c. blindness
   d. impaired motor speech

9. A staggering gait and imbalance are most descriptive of
   a. damage to the occipital lobe.
   b. impaired function of the medulla oblongata.
   c. cerebellar dysfunction.
   d. stimulation of the CTZ.

10. Repolarization of a neuron occurs in response to
    a. a rapid influx of sodium.
    b. a rapid efflux of potassium.
    c. an influx of K^+.
    d. an influx of calcium.

11. The medulla oblongata, pons, and midbrain are
    a. parts of the brain stem.
    b. cerebral lobes.
    c. dopamine-secreting nuclei.
    d. auditory association areas.

12. What happens at a synapse?
    a. saltatory conduction
    b. formation of cerebrospinal fluid
    c. chemical transmission of information
    d. synthesis of myelin sheath

13. The choroid plexus is most concerned with
    a. memory.
    b. formation of cerebrospinal fluid.
    c. the drainage of cerebrospinal fluid.
    d. the integrity of the blood–brain barrier.

14. Saltatory conduction refers to the
    a. flow of the cerebrospinal fluid.
    b. "leaping" movement of the nerve impulse.
    c. pH of the cerebrospinal fluid.
    d. blood flow through the brain.

15. Which of the following is most descriptive of ganglia?
    a. cells of the blood–brain barrier
    b. cells that comprise the corpus callosum
    c. clusters of cell bodies
    d. myelinated fibers

16. The meninges
    a. include the pia, arachnoid, and dura maters.
    b. cover the axons of all peripheral nerves.
    c. form the blood–brain barrier.
    d. are mucous membranes.

17. In which structure does the cerebrospinal fluid not circulate?
    a. subarachnoid space
    b. central sulcus
    c. ventricles
    d. central canal

18. Which of the following is least descriptive of the primary auditory cortex?
    a. hearing
    b. temporal lobe
    c. precentral gyrus
    d. sensory

19. What is the usual cause of impaired mental functioning in older adults?
    a. loss of frontal lobe neurons
    b. deterioration of Broca's area
    c. demyelination of all neurons within the CNS
    d. age-related diseases such as atherosclerosis

20. Who acts like she is in another world?
    a. Dora Mater
    b. Di Encephalon
    c. Nerve Anna
    d. Hy P. O'Thalamus

CASE STUDY

T.K.O., a professional boxer, sustained a severe blow to his head in round 8. As he left his corner to begin the ninth round, he collapsed to the floor. He was rushed to the emergency department in an unconscious state and was diagnosed with a subdural hematoma. He was placed in a semi-Fowler's position and given a diuretic. Holes were drilled in his skull to relieve the intracranial pressure.

1. Where was the clot located?
    a. within a cerebral ventricle
    b. within the central sulcus
    c. under the outer layer of meninges
    d. within the central canal

2. Which of the following is true about the blood clot?
    a. It may continue to expand as water is pulled into the clot.
    b. It will probably dissolve on its own but generally causes blindness.
    c. It will stop enlarging as soon as the bleeding stops; no treatment is necessary after the bleeding stops.
    d. All blood clots in the brain are lethal, with or without treatment.

3. What caused the loss of consciousness? The
    a. blood clot was pressing on the brain and causing an elevation in intracranial pressure.
    b. hematoma was producing a brain-toxic substance.
    c. blood clot was blocking the formation of cerebrospinal fluid.
    d. hematoma caused a brain abscess because a clot is an excellent place for pathogens to grow.

Student Name _____

Part III: Challenge Yourself!

GROUPS AND PUZZLE

1. Which group is incorrect?
   a. parts of a neuron: dendrites, cell body, axon
   b. types of nerve cells: neurons, neuroglia
   c. meninges: pia mater, arachnoid mater, dura mater
   d. parts of the brain stem: corpus callosum, pons, medulla oblongata

2. Which group is incorrect?
   a. parts of a neuron: dendrites, cell body, axon
   b. types of nerve cells: neurons, neuroglia
   c. types of glia: astrocytes, ependymal cells, oligodendrocytes, gyri
   d. lobes of the cerebrum: frontal, parietal, occipital, temporal

3. Which group is incorrect?
   a. lobes of the cerebrum: frontal, parietal, occipital, temporal
   b. parts of the brain stem: midbrain, occipital lobe, medulla oblongata
   c. parts of the diencephalon: thalamus, hypothalamus
   d. electrical events: depolarization, repolarization, action potential

PUZZLE

Hint: The Itsy Bitsy Spider . . . in the CNS

Directions: Perform the following functions on the Sequence of Words that follows. When all the functions have been performed, you are left with a word or words related to the hint. Record your answer in the space provided.

Functions: Remove the following:

1. Hard mother
2. Type of glial cell concerned with the formation of cerebrospinal fluid
3. Soft mother
4. The names of the four ventricles
5. Cerebrospinal fluid circulates within here.
6. The hole in the spinal cord through which cerebrospinal fluid flows
7. The cluster of capillaries across which cerebrospinal fluid is formed
8. Blood-filled space that drains cerebrospinal fluid
9. Cerebral lobes (four)
10. Parts (three) of the brain stem

Sequence of Words

P I A M A T E R P O N S F R O N T A L E P E N D Y
M A M E D U L L A O B L O N G A T A C H O R O I D
P L E X U S P A R I E T A L D U R A M A T E R L A T
E R A L A R A C H N O I D C E N T R A L C A N A L
T E M P O R A L T H I R D O C C I P I T A L F O U R
T H S U B A R A C H N O I D S P A
C E M I D B R A I N D U R A L S I N U S

Answer: _____