

Name: _____ Block: _____ Date: _____

Biology 12 - The Nervous System

⇒ Part A: Definitions: Define the following terms, **IN YOUR OWN WORDS, IN AS FEW WORDS AS CLARITY ALLOWS.**

i.	Myelin sheath	
ii.	Schwann cell	
iii.	Node of Ranvier	
iv.	PNS	
v.	CNS	
vi.	ganglia	
vii.	nerve	
viii.	Cranial nerve	
ix.	Dorsal root ganglion	
x.	receptor	
xi.	effector	
xii.	Somatic nervous system	
xiii.	reflex arc	
xiv.	Autonomic nervous system	
xv.	meninges	
xvi.	Cerebrospinal fluid	
xvii.	Central canal	
xviii.	Spinal cord	
xix.	White matter	
xx.	Gray matter	
xxi.	ARAS	
xxii.	Limbic system	
xxiii.	EEG	
xxiv.	Cerebral cortex	

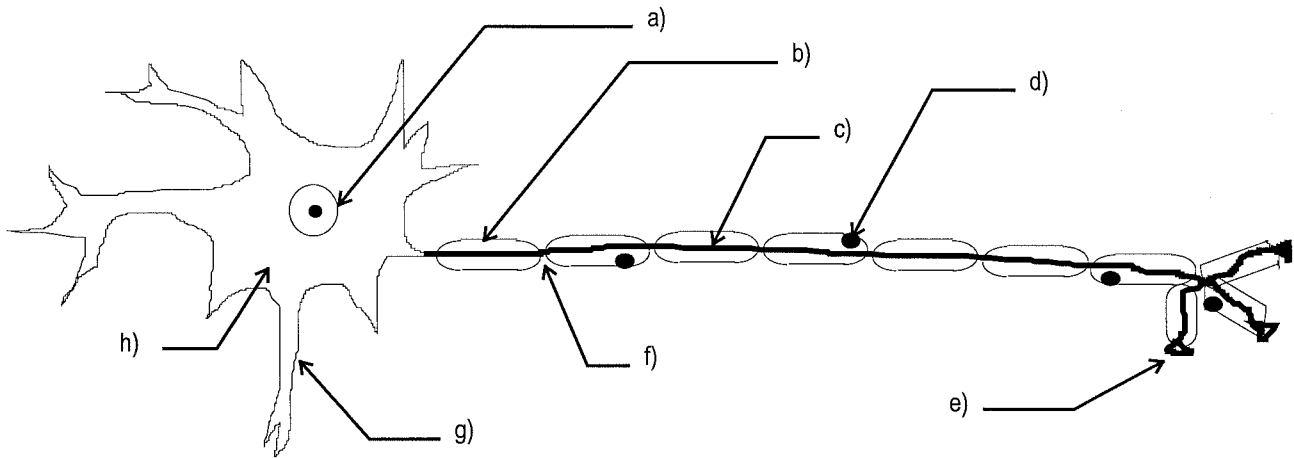
Part B - Short Answers

- The peripheral nervous system may be divided into the _____ division and the _____ division.
- A _____ neuron has a long axon and short dendrites.
- In the first part of the nerve impulse, the ion _____ moves to the inside of the neuron.
- The junction between one neuron and another is called a _____.
- Each division of the autonomic nervous system controls the same organs, but they generally have _____ effects.
- The largest portion of the human brain is the _____.
- The _____ nervous system causes the heartbeat to slow down.
- The drug amphetamine has a chemical structure similar to the neurotransmitter _____.
- The cerebral cortex can be mapped. There are _____ areas that receive impulses from sense organs and _____ areas that initiate impulses that eventually cause muscles to contract.
- The central nervous system contains the _____ and _____.
- The peripheral nervous system contains _____ and _____.

12. The somatic nervous system controls _____ muscles. The autonomic controls _____ muscle and _____.
13. The autonomic has two parts, the _____ for emergency situations, and the _____ for everyday situations.
14. List three parts of neurons and their functions below.

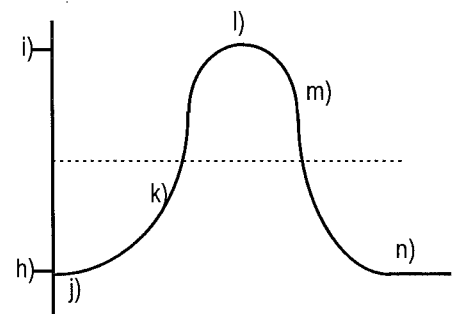
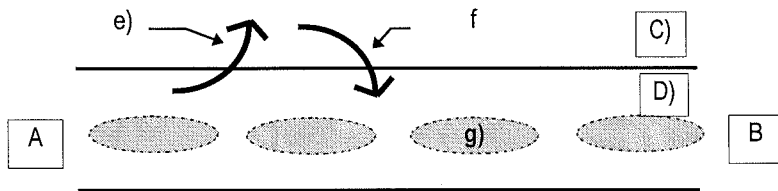
Part	Function

15. Label the neuron below.



a)	b)	c)	d)
e)	f)	g)	h)

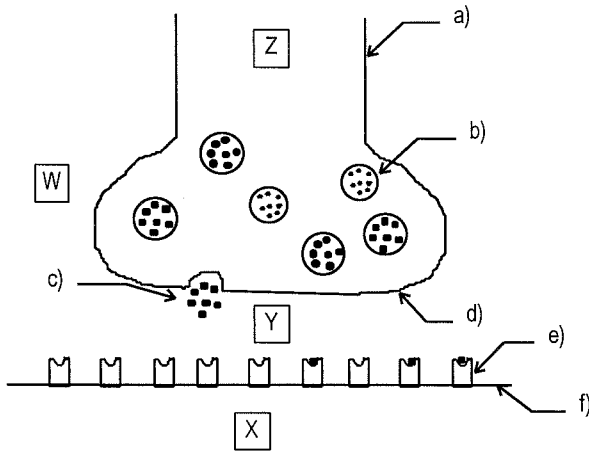
16. Again referring to the above diagram, what type of neuron is this? _____
17. What would the structures at e) be right next to? _____ or _____
18. Which structure above is most responsible for the fast speed of nerve transmission? _____
19. Which structures above would contain acetylcholine? _____
20. Across which "spaces" do nerve impulses "jump"? _____
21. List the structures, in order, that a nerve impulse would travel through this neuron. _____
22. Nerve impulses travel from neuron to neuron in one direction only, yet it is known that an impulse can be started in both directions in the middle of an axon. Which structure above is most responsible for nerve impulse transmission to be unidirectional? _____
23. Observe the diagrams below: The diagram on the left shows a section of an axon during nerve transmission. The diagram on the right shows what this would look like on an oscilloscope screen.



- i) In which direction is the impulse moving: from A to B or B to A? _____
- ii) In the first diagram, which number corresponds to moving Sodium ions? _____
- iii) In the second diagram, which number corresponds to moving Sodium ions? _____
- iv) In the first diagram, which number corresponds to moving Potassium ions? _____

- v) In the second diagram, which number corresponds to moving Potassium ions? _____
- vi) Which letter corresponds to the molecules responsible for the axoplasm having a polarity? _____
- vii) Which region, C or D, has a higher concentration of Sodium ions? _____
- viii) What is the reading on the oscilloscope, in millivolts, at h? _____ mV
- ix) What is reading on the oscilloscope at l? _____ mV
- x) Which letter best corresponds to resting potential _____
- xi) What is happening from j to l? _____
- xii) What is happening at l? _____
- xiii) What is happening at m? _____
- xiv) What is happening at n? _____

24. Observe the diagram of a synapse below.



- Label the following parts:
- a) _____
 - b) _____
 - c) _____
 - d) _____
 - e) _____
 - f) _____
 - Y) _____
 - X) _____

- 25. Which region above will contain higher amounts of Calcium ions when the neuron is at rest? _____
- 26. What direction will nerve impulses travel across this synapse? _____ to _____ to _____

Suppose "c" is an inhibitory neurotransmitter in one case, and an excitatory neurotransmitter in another case. What will be the effect of the following?

Condition	If C is inhibitory n.t.	If C is excitatory n.t.
i. A drug is given that blocks the receptors for c		
ii. A drug is given that blocks the reuptake of c by the presynaptic membrane		
iii. A drug that looks just like c is administered		
iv. A drug is given that destroys an enzyme that degrades c		
v. A drug is given that irreversibly binds to c is given		
vi. A drug is given that decreases the amount of c that is produced		

27. Prozac® is a drug that selectively blocks the reuptake of the excitatory neurotransmitter Serotonin. Explain why this drug has been used successfully to treat many people suffering from the serious disorder, clinical depression.

28. Fill in the blanks to indicate what happens during a spinal reflex arc. A stimulus is received by a _____ organ, which initiates an impulse in _____ neuron. The neuron takes the message to the cord and transmits it to the _____. This neuron passes the impulse to the _____ neuron, which takes the message from the cord and innervates a muscle causing a reaction to the stimulus.

29. Fill in the table below to indicate the functions of the parts of the brain.

Part	Function
cerebrum	
thalamus	
hypothalamus	
cerebellum	
medulla oblongata	

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⇒ Part A: Definitions: Define the following terms, **IN YOUR OWN WORDS, IN AS FEW WORDS AS CLARITY ALLOWS.**

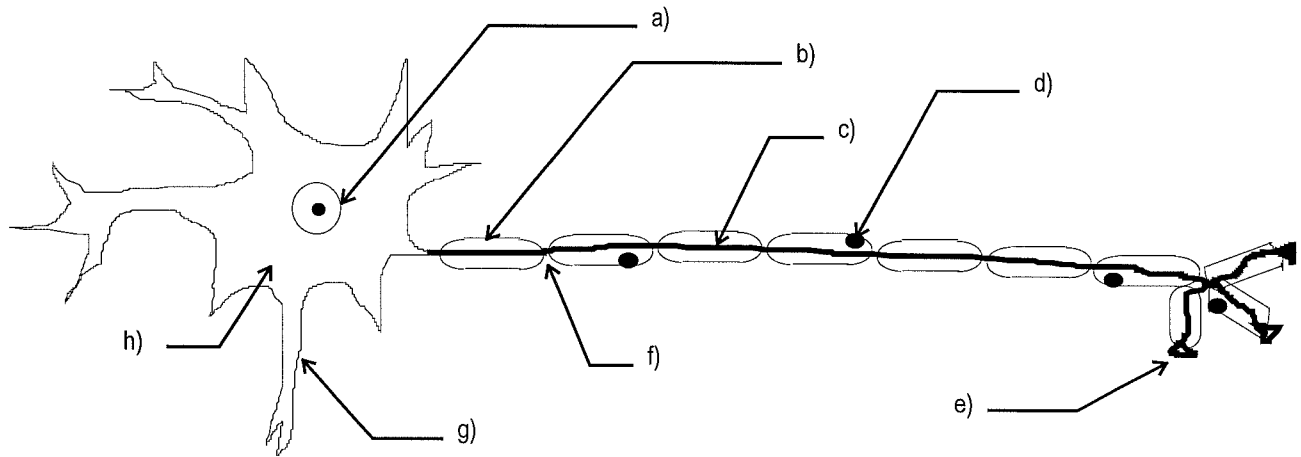
i.	Myelin sheath	fatty covering of long axons and dendrites, speeds up nerve impulses
ii.	Schwann cell	cells that produce myelin sheath
iii.	Node of Ranvier	interruptions in myelin sheath that exposes axon membrane. Nerve impulse "jumps" from node to node
iv.	PNS	peripheral nervous system: the nerves leaving spinal chord and brain
v.	CNS	central nervous system: spinal chord and brain
vi.	ganglia	collections of cell bodies
vii.	nerve	bundle of nerve fibers
viii.	Cranial nerve	one of 12 nerves that attaches to the brain
ix.	Dorsal root ganglion	collection of sensory neuron cell bodies encased in bone on dorsal side of spinal chord.
x.	receptor	receives and transmits sensory information to sensory neuron
xi.	effector	muscle or gland attached to motor neuron
xii.	Somatic nervous system	Branch of PNS, consists of nerves that connect to skeletal muscles and sensory viscera
xiii.	reflex arc	functional unit of nervous system
xiv.	Autonomic nervous system	branch of PNS, connects to smooth muscle, contains Parasymp. and Symp. branches
xv.	meninges	3 sets of membranes that covers the spinal chord and brain, cushioned with fluid
xvi.	Cerebrospinal fluid	fluid that surrounds brain and central canal of spinal chord
xvii.	Central canal	canal that runs through middle of spinal chord, filled with fluid
xviii.	Spinal cord	part of the CNS, relays information to brain and instruction to body
xix.	White matter	CNS tissue containing mostly myelinated nerve fibers and support cells
xx.	Gray matter	CNS tissue containing cell bodies and short, non-myelinated fibers
xxi.	ARAS	highway through which information from body is sorted before being sent to cerebellum
xxii.	Limbic system	ancient part of brain important in emotions, memory, learning
xxiii.	EEG	record of brain's electrical activity
xxiv.	Cerebral cortex	thin, gray, outer covering of cerebrum, most complex part of brain, consciousness resides here

Part B - Short Answers

1. The peripheral nervous system may be divided into the **SOMATIC** division and the **AUTONOMIC** division.
2. A **MOTOR** neuron has a long axon and short dendrites.
3. In the first part of the nerve impulse, the ion **SODIUM** moves to the inside of the neuron.
4. The junction between one neuron and another is called a **SYNAPSE**.
5. Each division of the autonomic nervous system controls the same organs, but they generally have **OPPOSITE** effects.
6. The largest portion of the human brain is the **CEREBRUM**.
7. The **PARASYMPATHETIC** nervous system causes the heartbeat to slow down.
8. The drug amphetamine has a chemical structure similar to the neurotransmitter **EPINEPHRINE**.
9. The cerebral cortex can be mapped. There are **SENSORY** areas that receive impulses from sense organs and **MOTOR** areas that initiate impulses that eventually cause muscles to contract.
10. The central nervous system contains the **BRAIN** and **SPINAL CHORD**.
11. The peripheral nervous system contains **NERVES** and **GANGLIA**.
12. The somatic nervous system controls **SKELETAL** muscles. The autonomic controls **SMOOTH** muscle and **GLANDS**.
13. The autonomic has two parts, the **SYMPATHETIC** for emergency situations, and the **PARASYMPATHETIC** for everyday situations.
14. List three parts of neurons and their functions below.

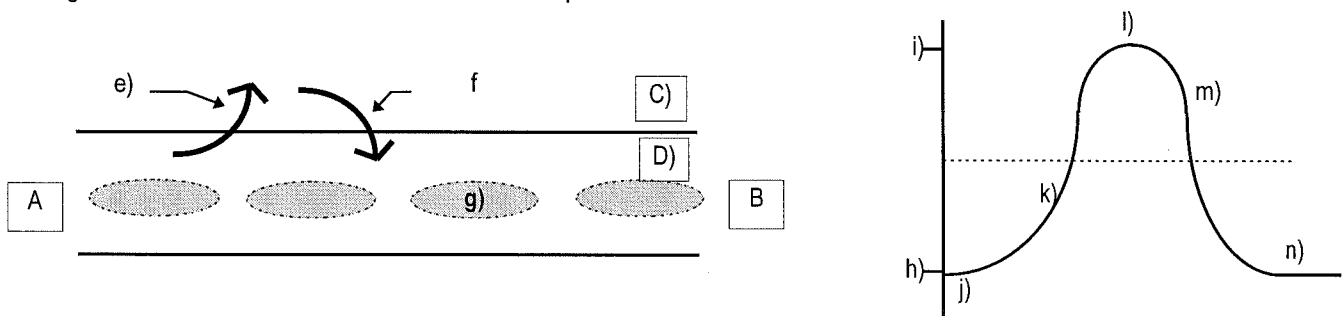
Part	Function
DENDRITE	TAKE IMPULSE TO CELL BODY
CELL BODY	CONTROL CENTER OF NEURON, CONTAINS NUCLEUS
AXON	TAKE MESSAGE AWAY FROM CELL BODY

15. Label the neuron below.



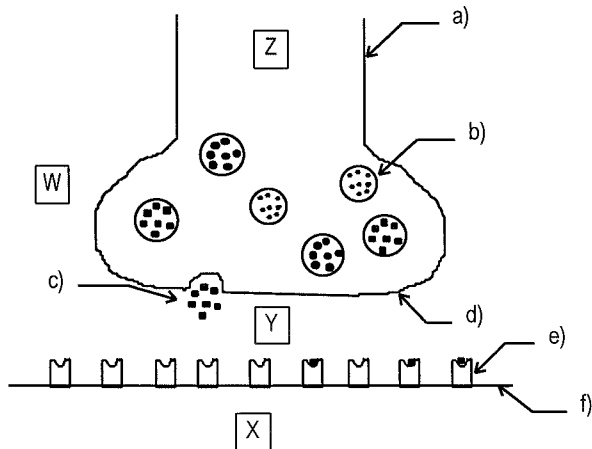
a) NUCLEUS	b) MYELIN SHEATH	c) AXON	d) SCHWANN CELL NUCLEUS
e) SYNAPTIC ENDING	f) NODE OF RANVIER	g) DENDRITE	h) CELL BODY

16. Again referring to the above diagram, what type of neuron is this? **MOTOR NEURON**
17. What would the structures at e) be right next to? **MUSCLE** or **GLAND**
18. Which structure above is most responsible for the fast speed of nerve transmission? **MYELIN SHEATH**
19. Which structures above would contain acetylcholine? **E**
20. Across which "spaces" do nerve impulses "jump"? **F**
21. List the structures, in order, that a nerve impulse would travel through this neuron. **DENDRITE, CELL BODY, AXON, SYNAPTIC ENDING**
22. Nerve impulses travel from neuron to neuron in one direction only, yet it is known that an impulse can be started in both directions in the middle of an axon. Which structure above is most responsible for nerve impulse transmission to be unidirectional? **E**
23. Observe the diagrams below: The diagram on the left shows a section of an axon during nerve transmission. The diagram on the right shows what this would look like on an oscilloscope screen.



- i) In which direction is the impulse moving: from A to B or B to A? **A TO B**
- ii) In the first diagram, which number corresponds to moving Sodium ions? **F**
- iii) In the second diagram, which number corresponds to moving Sodium ions? **K**
- iv) In the first diagram, which number corresponds to moving Potassium ions? **E**
- v) In the second diagram, which number corresponds to moving Potassium ions? **M**
- vi) Which letter corresponds to the molecules responsible for the axoplasm having a polarity? **G**
- vii) Which region, C or D, has a higher concentration of Sodium ions? **C**
- viii) What is the reading on the oscilloscope, in millivolts, at h? **-60 mV**
- ix) What is reading on the oscilloscope at l? **+40 mV**
- x) Which letter best corresponds to resting potential? **J**
- xi) What is happening from j to l? **DEPOLARIZATION (SODIUM IONS FLOOD INTO AXON)**
- xii) What is happening at l? **SODIUM GATES CLOSE, POTASSIUM GATES OPEN**
- xiii) What is happening at m? **REPOLARIZATION (POTASSIUM IONS DIFFUSE OUT OF AXON)**
- xiv) What is happening at n? **RECOVERY PHASE: NA+ AND K+ RETURNED TO RESTING POTENTIAL CONCENTRATIONS**

24. Observe the diagram of a synapse below.



- Label the following parts:
- a) AXON
 - b) SYNAPTIC VESICLE
 - c) NEUROTRANSMITTER
 - d) PRESYNAPTIC MEMBRANE
 - e) RECEPTOR
 - f) POSTSYNAPTIC MEMBRANE
 - Y) SYNAPTIC CLEFT
 - X) DENDRITE

25. Which region above will contain higher amounts of Calcium ions when the neuron is at rest? W
26. What direction will nerve impulses travel across this synapse? Z to Y to E to X
- Suppose "c" is an inhibitory neurotransmitter in one case, and an excitatory neurotransmitter in another case. What will be the effect of the following?

Condition	If C is inhibitory n.t.	If C is excitatory n.t.
i. A drug is given that blocks the receptors for c	<u>STIMULATION</u>	<u>DEPRESSION</u>
ii. A drug is given that blocks the reuptake of c by the presynaptic membrane	<u>DEPRESSION</u>	<u>STIMULATION</u>
iii. A drug that looks just like c is administered	<u>DEPRESSION</u>	<u>STIMULATION</u>
iv. A drug is given that destroys an enzyme that degrades c	<u>DEPRESSION</u>	<u>STIMULATION</u>
v. A drug is given that irreversibly binds to c is given	<u>STIMULATION</u>	<u>DEPRESSION</u>
vi. A drug is given that decreases the amount of c that is produced	<u>STIMULATION</u>	<u>DEPRESSION</u>

27. Prozac® is a drug that selectively blocks the reuptake of the excitatory neurotransmitter Serotonin. Explain why this drug has been used successfully to treat many people suffering from the serious disorder, clinical depression.

BY BLOCKING THE REUPTAKE OF SEROTONIN, MORE OF THE NEUROTRANSMITTER WILL BE PRESENT IN THE SYNAPTIC CLEFT AT ANY ONE TIME. AS DEPRESSION CAN BE CAUSED (IT IS HYPOTHESIZED) BY A LACK OF SEROTONIN IN EMOTIONAL CENTERS OF THE BRAIN, INCREASING THE AMOUNT OF SEROTONIN IN THESE AREAS SHOULD RELIEVE THE SYMPTOMS OF DEPRESSION.

28. Fill in the blanks to indicate what happens during a spinal reflex arc. A stimulus is received by a SENSORY organ, which initiates an impulse in SENSORY neuron. The neuron takes the message to the cord and transmits it to the INTERNEURON. This neuron passes the impulse to the MOTOR neuron, which takes the message from the cord and innervates a muscle causing a reaction to the stimulus.

29. Fill in the table below to indicate the functions of the parts of the brain.

Part	Function
cerebrum	<u>CONSCIOUSNESS, WILL, MEMORY, JUDGMENT, HIGHER MENTAL ABILITIES ETC.</u>
thalamus	<u>GATEKEEPER TO CEREBRUM - INTEGRATES SENSORY DATA AND DECIDES WHAT GOES TO CEREBRUM</u>
hypothalamus	<u>HOMEOSTASIS, CONTROLS PITUITARY, PRODUCES HORMONES ADH AND OXYTOCIN</u>
cerebellum	<u>MOTOR COORDINATION</u>
medulla oblongata	<u>CONTROL OF INTERNAL ORGANS E.G. HEART RATE, BREATHING RATE</u>