

Module 1

Nervous System

Student Name: _____

	Total Possible Marks	Your Mark
Lesson 1	13	
Lesson 2	21	
Lesson 3	19	
Lesson 5	14	
Lesson 6	16	
Lesson 7	25	
Lesson 8	15	
Total Marks	123	

Teacher Comments:

(13 marks) **Lesson 1: The Structure and Organization of the Nervous System**

This Module 1: Lesson 1 Assignment is worth 13 marks. The value of each question is stated in the left margin.

(5 marks) **Part 1: Response Assignment**

As you watch the “Electrochemical Control Systems in Humans: Regulating Physiological Process” video, pay specific attention to the following topics:

- the description and examples of homeostasis as it relates to the nervous system
- all the divisions of the nervous system and the examples of what each division does
- the neuron structure and its organization into nerves
- the biological basis of multiple sclerosis

Choose one bullet, and prepare an explanation on the topic. Attach your response to this assignment.

Score	Criteria
5 Excellent	The student demonstrates an excellent understanding of all the components of the question and fully and correctly supports those components. Statements made in the response are organized, unambiguous, and are supported explicitly but may contain a minor error or have minor omissions.
4 Good	The student demonstrates a good understanding of all the components of the question and fully and adequately supports those components. Statements made in the response are unambiguous, mostly complete, and mostly correct, but may contain errors.
3 Satisfactory	The student demonstrates a basic understanding of the components of the question. Statements made in the response may be disorganized, ambiguous, incomplete, and may lack support.
2 Limited	The student demonstrates a limited understanding of the components of the question. Statements made in the response lack details, clarity, and support.
1 Poor	The student provides a solution that contains a relevant statement that begins to answer the question.
0 Insufficient	The response is incorrect and/or totally off topic.
Communication Component	
The student produces a clear, unambiguous answer. Appropriate scientific conventions such as units, significant digits, and states are included. The response should demonstrate good organizational skills and be presented in a logical manner. (2004)	

Insert your Answer to Part 1 here:

(5 marks)

Part 2: Reflect and Connect

Choose one of the next two questions and prepare a written response.

When you saw the person across the room that you wanted to meet, you walked over to introduce yourself. Your breathing rate and your heart rate increased with the level of your nervousness. After you calmed down, your systems returned to a balanced state. You should now be able to outline the parts of the nervous system and outline how they controlled these changes.

OR

In the case of a survivor of a motor-vehicle accident who may be aware of pain in her legs but cannot move her legs, what part of the communications pathway was damaged? Justify your selection by explaining your choice. Include why you think each part of the communications pathway was or was not damaged.

When preparing your work, remember to consult the scoring guide provided above.

Insert your answer to Part 2 here:

(3 marks)

Part 3: Multiple Choice

Choose the best answer for the following questions and record your response on the line to the left of the question. Each question is worth one mark.

- _____ 1. The somatic nervous system controls
- A. peristalsis
 - B. cardiac muscles
 - C. smooth muscles
 - D. skeletal muscles
- _____ 2. Which of the following explains why most organs are supplied by two separate autonomic nerves?
- A. One acts as a reserve neuron
 - B. One is sensory and one is motor
 - C. Both are needed in emergency situations
 - D. One stimulates the organ and one inhibits it
- _____ 3. Which of the following will occur as a result of parasympathetic nervous system stimulation?
- A. Increased heart rate
 - B. Secretion of adrenalin
 - C. Increased breathing rate
 - D. Secretion of digestive enzymes

(21 marks) **Lesson 2: The Brain and Spinal Cord - The Boss and the Unthinking Boss**

This Module 1: Lesson 2 Assignment is worth 21 marks. The value of each assignment and each question is stated in the left margin.

(10 marks) **Part 1: Lab**

Using Plasticine, playdough, construction paper, or an online drawing program, **construct a model of a section through the midline of the brain**. Use a legend to **identify and describe the function** of the cerebrum, cerebellum, pons, medulla oblongata, thalamus, hypothalamus, pituitary gland (part of endocrine system), corpus callosum, spinal cord, and meninges. Attach the model (or a picture of it) to the assignment. **(5 marks)**

Once you have completed the model, go to page 393 of the textbook.

Complete Analysis questions 1 and 2 and place your answers below. **(5 marks)**

(6 marks) Part 2: Multiple Choice (Choose the Best answer and record it in the space to the left of the question)

_____ 1. The primary motor areas of the brain are located in the

- A. frontal lobe
- B. parietal lobe
- C. temporal lobe
- D. occipital lobe

_____ 2. Grey matter of the spinal cord is mostly composed of

- A. myelin
- B. interneurons
- C. cerebrospinal fluid
- D. unmyelinated axons

_____ 3. The ability to thread a needle requires fine motor co-ordination that involves which two areas of the brain?

- A. Cerebrum and cerebellum
- B. Cerebrum and hypothalamus
- C. Cerebrum and medulla oblongata
- D. Cerebellum and medulla oblongata

_____ 4. Which of the following structures or regions is incorrectly paired with its function?

- A. Corpus callosum – discrimination of sound
- B. Medulla oblongata – Coordination of basic metabolic functions
- C. Cerebellum – unconscious coordination of movement and balance
- D. Hypothalamus – production of hormones and regulation of temperature, hunger and thirst

_____ 5. Ataxia is a condition characterized by an inability to coordinate the speed, force, and direction of muscle movement. The movements of a person suffering from ataxia may resemble those of a drunken person. The person may reach for an object and miss it by placing the hand too far to the left or right and then attempt to compensate by moving the hand in the wrong direction. A person suffering from ataxia would probably have damage to the

- A. cerebellum
- B. hypothalamus
- C. medulla oblongata
- D. parasympathetic nerves

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*Use the following information to answer the next question.*

More than 4 000 Gulf War veterans complain of illness (Gulf War Syndrome). The veterans' symptoms include joint pain, shortness of breath, attention and memory problems, and chronic fatigue. During the war, most of the veterans took anti-nerve-gas pills. These pills contain pyridostigmine bromide, a drug that inhibits cholinesterase. Pyridostigmine bromide is also used to treat patients with *myasthenia gravis*, an inherited disorder characterized by weakness of skeletal muscles.

\_\_\_\_\_ 6. Considering that the symptoms of Gulf War Syndrome include attention and memory problems, it is likely that pyridostigmine bromide has an effect on the

- A. cerebrum
- B. cerebellum
- C. hypothalamus
- D. medulla oblongata

**(5 marks) Part 3: Reflect and Connect**

**Choose one** of the following two scenarios to reflect on all that you have learned about the brain and spinal cord in this lesson. You may need to do some research to better understand these injuries. Your research will allow you to more effectively apply what you have learned in this lesson. Key search terms that you might use include “shaken baby syndrome,” “brain damage in infants,” “safety helmets,” and “protective head gear.”

Refer to the rubric on page 1 of this module for scoring criteria. **Please cite two sources.**

**RC 1.** Explain the phenomenon of shaken baby syndrome, including the initial action that caused the syndrome and the symptoms, and then name and explain the parts of the nervous system that are involved in causing these symptoms. Describe a technology that could be used in detecting the condition.

**OR**

**RC 2.** Explain why many provinces have laws requiring motor and bike cyclists to wear protective head gear. Describe the type of injury that could result in an accident where no helmet was worn. Discuss two societal pros and cons related to the enforcement of legislation requiring the use of helmets.

**Insert your answer here:**



(19 marks) **Lesson 3: The Basic Units of the Nervous System—The Neuron and the Reflex Arc**

This Module 1: Lesson 3 Assignment is worth 19 marks. The value of each question is stated in the left margin.

(10 marks) **Part 1: Lab**

Complete the lab titled “Investigation 11.C: Examining Neural Tissue” on page 381 of your textbook. Use the micrograph pictures at the bottom of the page to complete your lab.

Complete questions 1, 2, 3, 4, and 5 (2 marks each) in the “Analysis” section on page 381 and place your answers in the appropriate spaces below. **You do not need to do the sketches; just answer the questions.**

1.

2.

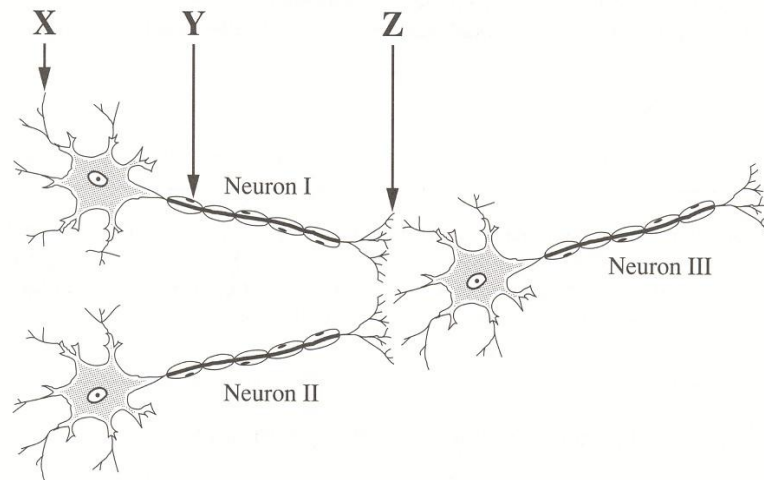
3.

4.

5.

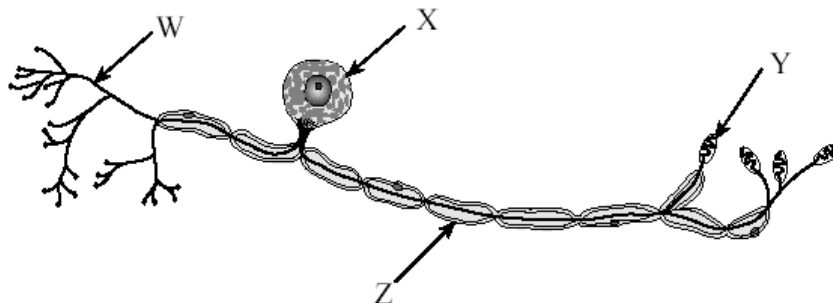
**(9 marks) Part 2: Multiple Choice** (Choose the best answer and record it in the space to the left of the question) One mark each

Use the following information to answer the first three questions.



- \_\_\_\_\_ 1. Neurotransmitters are released from
- A. site Y
  - B. site Z
  - C. sites X and Y
  - D. sites X and Z
- \_\_\_\_\_ 2. If neurons I and II are interneurons, neuron III **cannot** be a
- A. parasympathetic neuron
  - B. sympathetic neuron
  - C. sensory neuron
  - D. motor neuron
- \_\_\_\_\_ 3. In a typical reflex arc, neuron III would be part of the
- A. effector
  - B. receptor
  - C. motor pathway
  - D. sensory pathway

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Use the following picture to answer the next two questions.



Nerve impulse transmission



_____ 4. The type of neuron illustrated above is a(n)

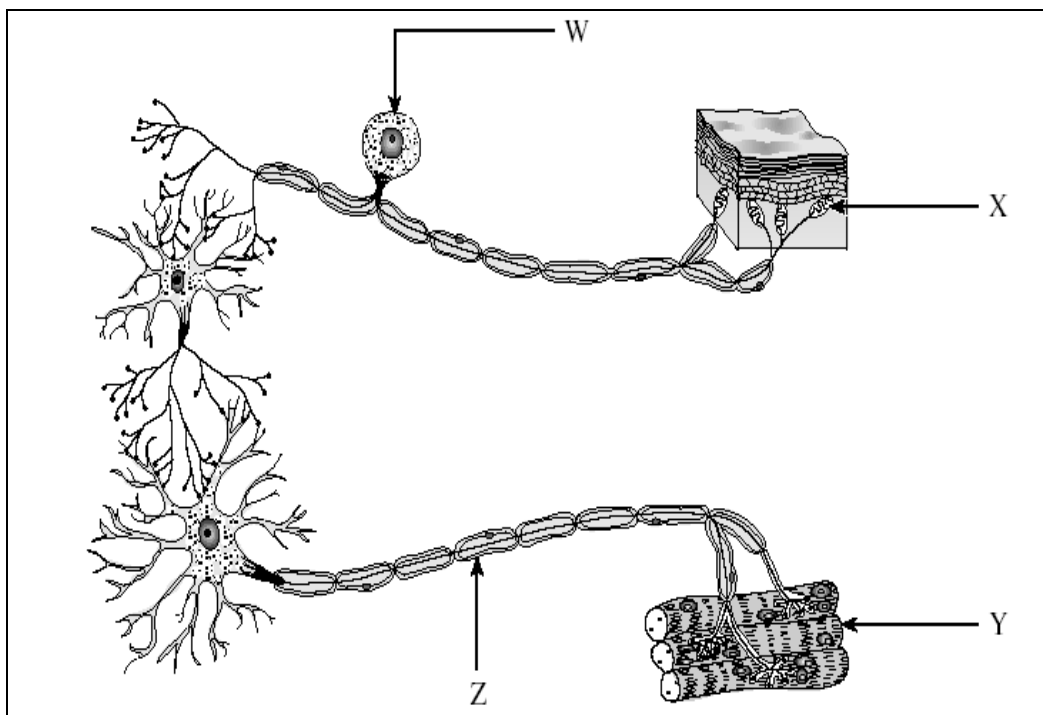
- A. interneuron
- B. sensory
- C. motor
- D. glial

_____ 5. The neuron illustrated above will send the impulse to a(n)

- A. gland
- B. interneuron
- C. sense organ
- D. muscle fibre

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Use the diagram below to insert the appropriate letter label for the next four questions.



\_\_\_\_\_ 6. Which letter indicates the structure that initiates a nerve impulse during a reflex?

\_\_\_\_\_ 7. Which letter indicates the effector in this reflex?

\_\_\_\_\_ 8. Which letter indicates the receptor in this reflex?

\_\_\_\_\_ 9. Which letter indicates the motor neuron that will complete the reflex arc?

**There is no assignment for Module 1: Lesson 4. However, you are still responsible for learning the material presented in the lesson.**

**(14 marks) Lesson 5: Photoreception—The Eye**

This Module 1: Lesson 5 Assignment is worth 14 marks. The value of each question is stated in the left margin.

**Part 1: Lab**

Complete the “Analysis” and “Conclusion” sections of the lab found on page 417 of the textbook. Place your answers in the appropriate spaces below.

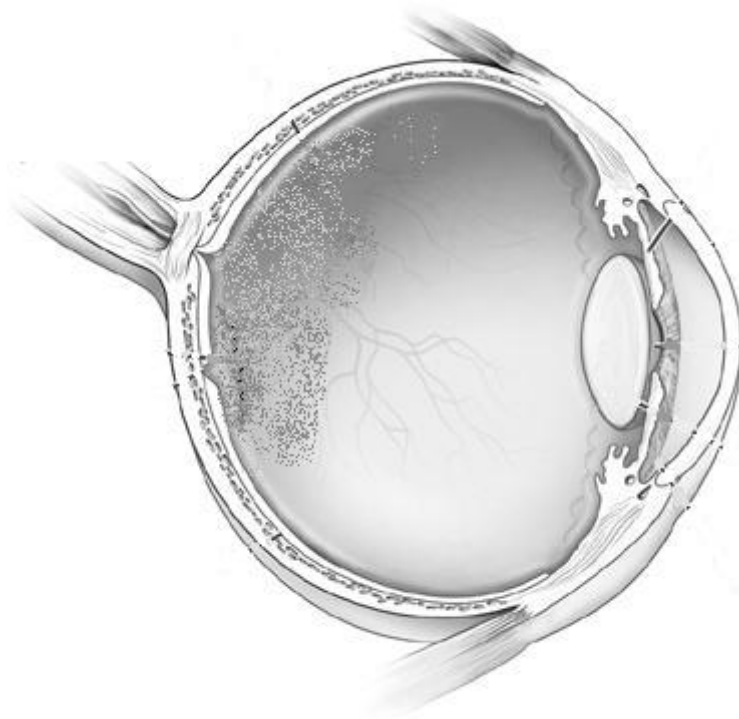
**(5 marks) 1.**

**(5 marks) 2.**

| Eye Structure       | Eye Function |
|---------------------|--------------|
| sclera              |              |
| choroid             |              |
| suspensory ligament |              |
| Iris                |              |
| pupil               |              |
| Lens                |              |
| cornea              |              |
| aqueous humour      |              |
| ciliary muscle      |              |

|                 |  |
|-----------------|--|
| vitreous humour |  |
| retina          |  |
| fovea centralis |  |
| optic disc      |  |
| optic nerve     |  |

(2 marks) 3.



(2 marks) 4.

**(16 marks) Lesson 6: Mechanoreception – The Ear**

This Module 1: Lesson 6 Assignment is worth 16 marks. The value of each question is stated in the left margin.

**Part 1: Closed Written Response Item**

This question is intended to give you practice in improving your thinking and writing skills.

Use the information below to answer the next question.

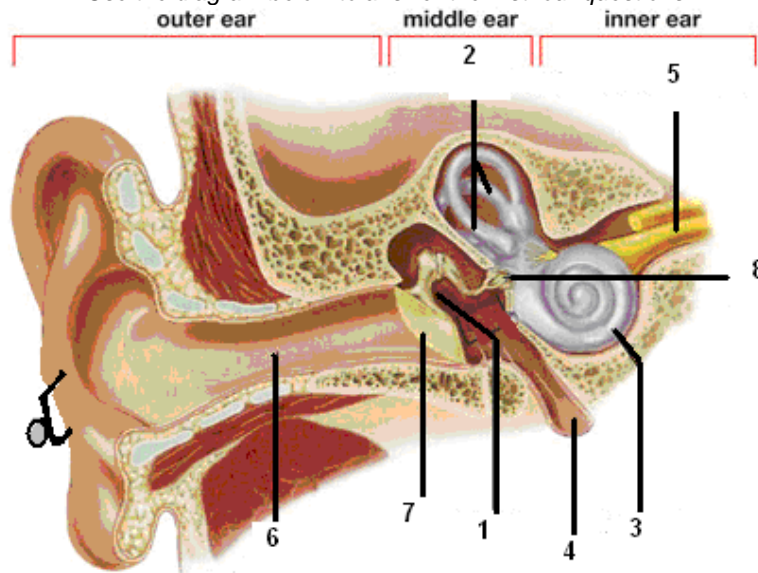
*Noise-Induced Hearing Loss (NIHL)*

*Impulse sound can result in immediate hearing loss that may be permanent. The structures of the inner ear may be severely damaged by such sounds. This kind of hearing loss may be accompanied by tinnitus, a ringing, buzzing, or roaring in the ears or head, which may subside over time. Hearing loss and tinnitus may be experienced in one or both ears, and tinnitus may recur constantly or occasionally throughout a lifetime. The structure of the hair cells is damaged by continuous exposure to loud noise. This results in hearing loss and tinnitus. Exposure to impulse and continuous noise may only cause a temporary loss of hearing. If hearing is recovered, the temporary loss of hearing is called a temporary threshold shift. The temporary threshold shift most often disappears within 16 to 48 hours after the exposure to the loud noise. Millions of North Americans, including children, adolescents, young adults, adults and elderly persons, may develop noise-induced hearing loss.*

- (1 mark)** 1. a. Identify the sensory receptors in the inner ear.
- (4 marks)** b. Explain, in detail, how sound waves that are amplified by the ossicles are translated into a nerve impulse in the inner ear. Include the name of the main nerve that directs the nerve impulse to the cerebrum.
- (2 marks)** c. Describe how continued exposure to loud noises can result in noise-induced hearing loss.
- (2 marks)** d. State two reasons why so many North Americans have NIHL and identify two strategies that people could use to reduce their chances of developing NIHL.
- (2 marks)** e. Why would a hearing aid NOT be of much use for a person with NIHL?

**(5 marks) Part 2: Multiple Choice (Choose the best answer and record it in the space to the left of the question)**

Use the diagram below to answer the first four questions.



\_\_\_\_\_ 1. When we spin around in one place and stop, we feel as though we are still moving. This feeling is caused by continued

- A. vibrations of structure 7
- B. movement of fluid in structure 2
- C. movement of fluid against structure 3
- D. transmission of nerve impulses from structure 3 to structure 5

\_\_\_\_\_ 2. The auditory nerve conducts impulses to the cerebrum from structure

- A. 7
- B. 1
- C. 2
- D. 3

\_\_\_\_\_ 3. Equalizing pressure in the middle ear when changes in air pressure occur is the function of structure

- A. 1
- B. 4
- C. 5
- D. 7

\_\_\_\_\_ 4. Hair cells that enable us to distinguish the high frequency sound of a whistle from the low frequency sound of a tuba are found in structure

- A. 1
- B. 2
- C. 3
- D. 8

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_____ 5. As sound vibrations move through the outer ear into the inner ear, the sequence of media through which the vibrations pass is

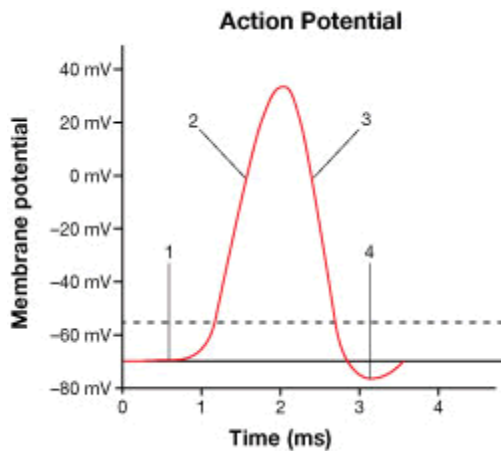
- A. gas to solid to liquid
- B. gas to liquid to solid
- C. solid to gas to liquid
- D. solid to liquid to solid

(25 marks) Lesson 7: The Nerve Impulse—Transporting the Message

This Module 1: Lesson 7 Assignment is worth 25 marks. The value of each question is stated in the left margin.

Part 1: Action Potential Handout

View the graph and label the four phases indicated by the numbers on the graph. Beside each labelled phase, explain in detail what is happening in the corresponding phase. The correct labels (**1 mark each**), and the correct detailed explanations (**2 marks each**) for each of the four phases are worth a total of 12 marks.



Inquiry into Biology (Whitby, ON: McGraw-Hill Ryerson, 2007), BLM 11.1.10A. Reproduced by permission.

(3 marks) Phase 1:

(3 marks) Phase 2:

(3 marks) Phase 3:

(3 marks) Phase 4:

Part 2: Reflect and Connect

Use the following information to answer the next question:

In a classic experiment, the strength of a neural stimulus and the resulting muscle contraction are compared. A single motor neuron that sends a message to a muscle fibre is suspended. One end is attached to the muscle fibre, and the free end of the muscle fibre is attached to a mass. If an electrical stimulus is sufficient to cause an impulse in the neuron, the muscle will contract and lift the mass. The following data were obtained from the experiment.

Strength of Stimulus (mV)	Maximum Mass Lifted by Muscle (g)
1	0
2	10
3	?
4	?

Analyze the data and answer the following questions:

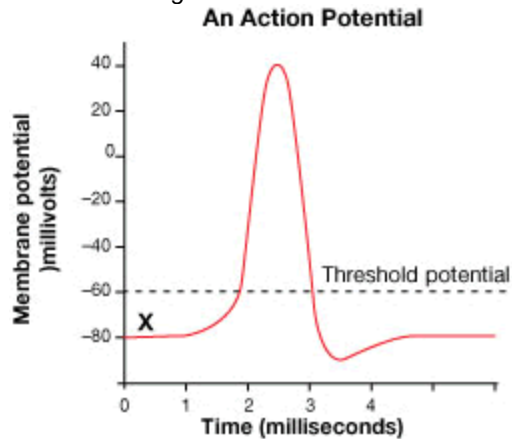
(3 marks)

1. a. Define "threshold potential" and illustrate your definition with a specific example. What is the minimum stimulus required to reach the threshold potential for the neuron in the table above?

(3 marks)

- b. Explain the all or none response. Predict the mass in the table above that could be lifted with 3 mV of stimuli and with 4 mV of stimuli.

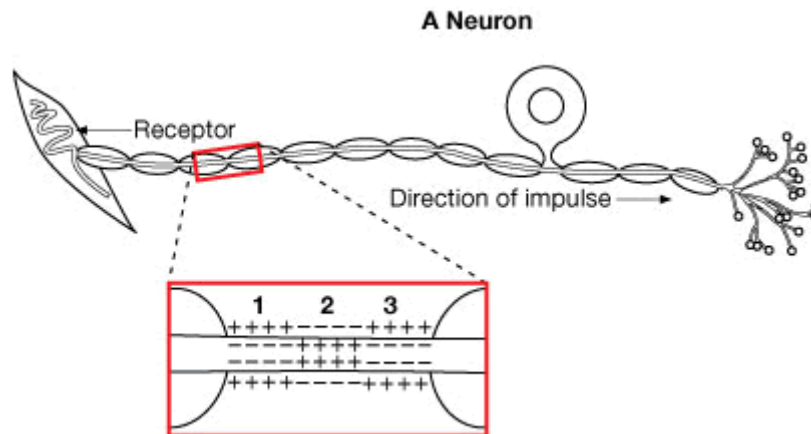
Use the following information to answer the next two questions.



Note: X denotes the electrical potential across the membrane of a particular resting neuron.

- _____ 2. Which of the following statements is true of the threshold potential?
- A. It is the same electrical potential for all neurons
 - B. It is the depolarization required to generate an action potential
 - C. It determines the time it takes for an action potential to be completed
 - D. It determines the time it takes for an impulse to travel along the axon
- _____ 3. Relative to the inside of a neuron, the extracellular fluid immediately outside a resting neuron's cell membrane is
- A. positive and the sodium ion concentration is less
 - B. negative and the sodium ion concentration is less
 - C. positive and the sodium ion concentration is greater
 - D. negative and the sodium ion concentration is greater

Use the following diagram to answer the next two questions.



- _____ 4. This neuron transmits an impulse from a receptor to the central nervous system; therefore, it is
- A. a motor neuron
 - B. a sensory neuron
 - C. an autonomic neuron
 - D. an association neuron

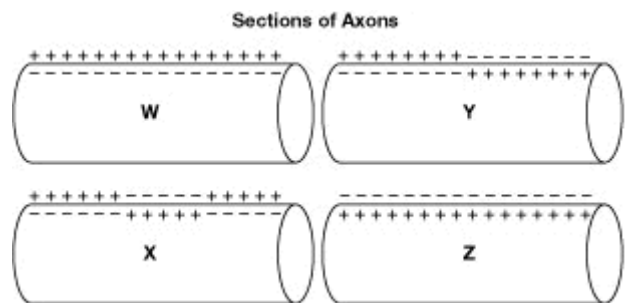
Numerical Response

- (1 mark) 5. In the diagrammed neuron above, which numbers represent segments of the axon that are, respectively, polarized, repolarized, and depolarized, during normal neural impulse conduction?

_____ **Polarized** _____ **Repolarized** _____ **Depolarized**

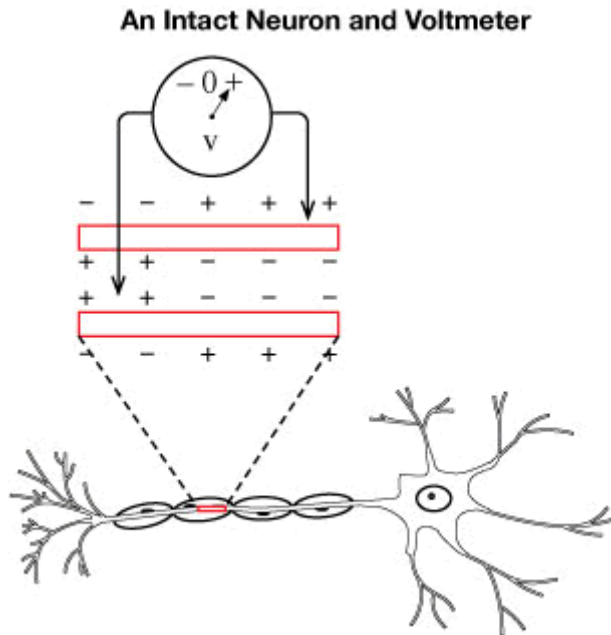
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*Use the following diagram to answer the next question.*



- \_\_\_\_\_ 6. The resting axon is labelled
- A. W
  - B. X
  - C. Y
  - D. Z

Use the following diagram to answer the next question.



- \_\_\_\_\_ 7. The voltage polarity is positive when
- A. the neuron is resting
  - B. an impulse is being transmitted
  - C. an impulse dies out before reaching the axon
  - D. the neuron has a high concentration of K<sup>+</sup> ions



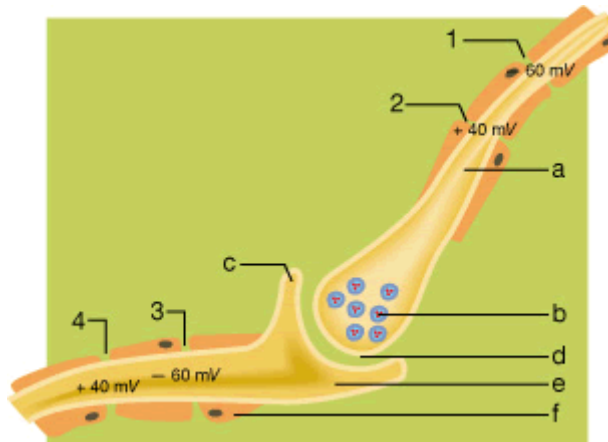
- \_\_\_\_\_ 8. When a 1.5 volt electric current was applied to a person's tongue, the person sensed a strong taste. When the electric current was removed, the taste disappeared. The electric current apparently
- A. stimulated motor impulse transmission
  - B. opened potassium gates in the neuron allowing depolarization
  - C. reached the threshold potential of sensory cells
  - D. caused depolarization by directly stimulating olfactory centres in the brain

**(15 marks) Lesson 8: Synaptic and Neuromuscular Transmission—  
Crossing the Divide**

This Module 1: Lesson 8 Assignment is worth 15 marks. The value of each question is stated in the left margin.

To help you apply your understanding of the concepts in this lesson and connect your understanding to other lessons, answer the following questions in complete sentences.

Study the diagram of a synapse between a sensory neuron and a motor neuron in a simple reflex arc. Use the information provided by the diagram to answer the questions.



**(2 marks)** 1. If the neurotransmitter substance was acetylcholine, describe two places where this synapse might be found in the body.

**(2 marks)** 2. From the diagram, identify where receptors for the neurotransmitter would be located. Explain your answer.

**(2 marks)** 3. Which letter indicates the axon of the sensory neuron? Justify your answer.

**(2 marks)** 4. Identify where an action potential is occurring. Justify your answer.

- (3 marks)** 5. What structure is represented by the letter F? What is the function of F? What effect does F have on the transmission of action potentials along the neuron?
- (2 marks)** 6. In certain diseases, the motor neurons are progressively damaged. Suggest two ways in which a person with such a disease may be affected.
- (2 marks)** 7. Explain how the action of an inhibitory neurotransmitter might affect this synapse.

**This is the end of the module. Please check your work, make sure your name is on the cover, and submit the completed module to your instructor for marking.**