

VIII Biology- 4. Nervous System

Exercise Solutions

1. Three regions of human brain- Forebrain, midbrain & hindbrain.

2.

Voluntary actions	Involuntary actions
- Under conscious control based on our needs. - Learning is required.	- Not under conscious control (automatic). - No learning is required.
- The same stimulus may lead to different response depending on different situations.	- The same stimulus always produces the same response.
- Controlled by the cerebrum .	- Controlled by the medulla oblongata or spinal cord.
- Can be quickened or slowed down.	- Can't be quickened or slowed down
- Eg: writing, speaking, reading and dancing.	- Eg: heartbeat, breathing, yawning, respiration, digestion, growing.

3. There are various organs and organ systems in a complex organism. These organ systems must be carefully controlled and coordinated for healthy survival of the organism. A lack of coordination between these systems can cause lot of troubles for the organism.

The actions of these organs and system is required to be controlled by the neural system and endocrine system of the body so as to support coordination.

Also the lack of coordination between the organs will lead to disturbance in the coordination in the organism. The control and coordination is necessary for respiration, cardiovascular system, excretion, locomotion and reproduction in living organisms.

4. Neuron/ nerve cells are the structural and functional unit of the nervous system. Each neuron consists of dendrites, axon, and soma.

5. Change the word stored as Acquired in part a of the question

- a) Dendrite
- b) Axon

6. The brain is protected by the skull (cranium), cerebrospinal fluid and 3 protective membranes (Meninges).

The spinal cord is protected similarly but with vertebrae instead of the cranium.

a) The brain is first protected by the skull (cranium). This offers physical protection and so naturally is one of the hardest bones in the body. The skull acts like a helmet for your brain, and helps to prevent damage from *mechanical stress* (things like knocks and falls). The spinal cord is also surrounded by some very hard bone, in the form of the vertebrae.

b) The three protective membranes - the meninges. These are made out of connective tissue and

provide a cushioning from the hard skull of the brain, jolting against the vertebral column (in the spinal cord) or from any damaging impacts. The three meninges are the Dura Mater (outer), The Arachnoid (middle) and the Pia Mater (inner).

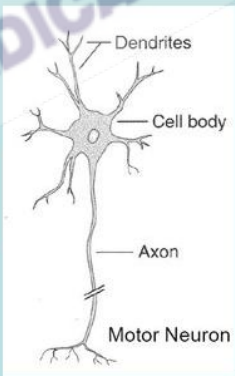
- c) There is a special fluid, called cerebrospinal (cerebro for brain, spinal for the spinal cord) that circulates the entire central nervous system. It occupies the space between the Pia Mater and Arachnoid and supplies nutrients (like blood in the rest of the body), disposes of waste and acts as a shock absorber.

7. A neuron (also known as nerve cell) is an electrically excitable cell that takes up, processes and transmits information through electrical and chemical signals. It is one of the basic elements of the nervous system. These highly specialized nerve cells are responsible for communicating information in both chemical and electrical forms. There are also several different types of neurons responsible for different tasks in the human body. Sensory neurons carry information from the sensory receptor cells throughout the body to the brain. Motor neurons transmit information from the brain to the muscles of the body. Interneurons are responsible for communicating information between different neurons in the body. In order for neurons to communicate, they need to transmit information both within the neuron and from one neuron to the next. This process utilizes both electrical signals as well as chemical messengers. The dendrites of neurons receive information from sensory receptors or other neurons. This information is then passed down to the cell body and on to the axon. Once the information has arrived at the axon, it travels down the length of the axon in the form of an electrical signal known as an action potential. Once an electrical impulse has reached the end of an axon, the information must be transmitted across the synaptic gap to the dendrites of the adjoining neuron. In some cases, the electrical signal can almost instantaneously bridge the gap between the neurons and continue along its path.

In other cases, neurotransmitters are needed to send the information from one neuron to the next. Neurotransmitters are chemical messengers that are released from the axon terminals to cross the synaptic gap and reach the receptor sites of other neurons. In a process known as reuptake, these neurotransmitters attach to the receptor site and are reabsorbed by the neuron to be reused.

8.

Differences between axons and dendrites:



Axons	Dendrites
<ul style="list-style-type: none"> • Take info away from the cell body • Smooth Surface • Generally only 1 axon per cell • Can have myelin • Branch further from the cell body 	<ul style="list-style-type: none"> • Bring info to the cell body • Rough Surface (dendritic spines) • Usually many dendrites per cell • No <u>myelin insulation</u> • Branch near the cell body

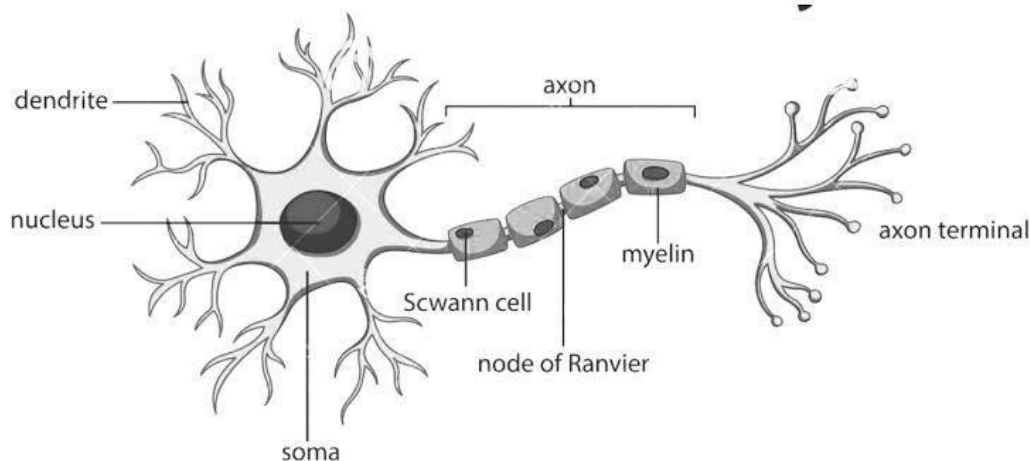
9. The Human Nervous system is divided into the Central Nervous Systems (CNS), the Peripheral Nervous System (PNS) and the Autonomic Nervous System (ANS).
10. The three protective membranes - the meninges. These are made out of connective tissue and provide a cushioning from the hard skull of the brain, jolting against the vertebral column (in the spinal cord) or from any damaging impacts. The three meninges are the Dura Mater (outer), The Arachnoid (middle) and the Pia Mater (inner).

11.

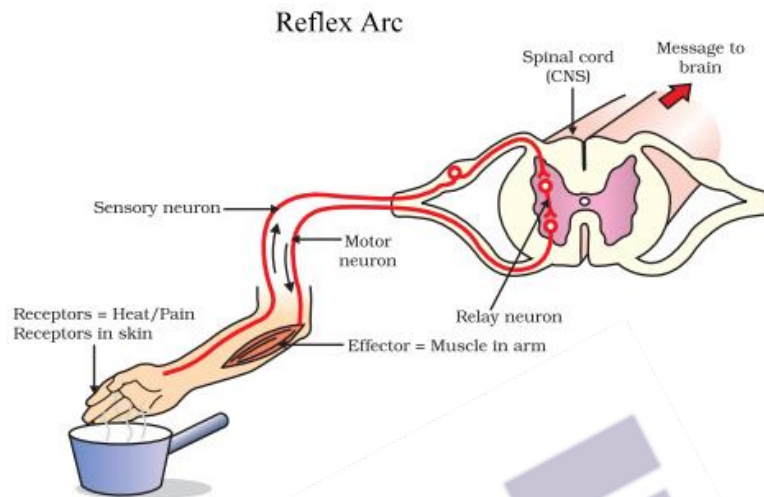
Reflex action	Walking
(a) Take place without thought.	(a) Takes place after thought.
(b) Controlled by spinal cord.	(b) Controlled by cerebellum.
(c) It is involuntary action	(c) It is a voluntary action.

12. Transmission of nerve impulses between two neurons takes place through the synapse. The axon terminal of a neuron releases specialized chemicals called neurotransmitters. Neurotransmitters that are released from the axon terminals to cross the synaptic gap and reach the receptor sites of other neurons. In a process known as reuptake, these neurotransmitters attach to the receptor site and are reabsorbed by the neuron to be reused.
13. The cerebellum (back of brain) is located at the back of the head. Its function is to coordinate voluntary muscle movements and to maintain posture, balance, and equilibrium.
14. When the smell of the incense stick reaches our nose, then the olfactory receptors present in our nose detect it send this information to the fore brain in the form of electrical signals. Fore brain interprets this information as the smell of incense stick where it is already stored.
15. Reflex actions are sudden responses. It is an involuntary action which does not involve thinking. For example, when we touch a hot object, we withdraw our hand immediately without thinking. The sensory nerves that detect the heat are connected to the nerves that move the muscles of the hand. Such a connection of detecting the signal from the nerves (input) and responding to it quickly (output) is known as a reflex arc. Reflex arcs are formed in the spinal cord but the information is still sent to the brain. This helps the brain to record this event and remember it for future use.

16.



17. Refer page 44 & 45 (Brain and spinal cord under CNS)
18. A reflex arc is a neural pathway that controls a reflex. The reflex arc describes the pathway in which the nerve impulse is carried and the response is generated and shown by the effector organ.



19. The two photosensitive cells are rods and cones. Rods are responsible for vision at low light levels (scotopic vision). They do not mediate color vision. Cones are active at higher light levels (photopic vision), are capable of color vision.

20.

Central nervous system	Peripheral nervous system
1) It consists of Brain and spinal cord.	1) It consists of nerves that arise from brain and spinal nerves.
2) Both of them have nerve cells and glial cells.	2) It has 43 pairs of nerves. Among them 12 pairs are cranial nerves and 31 pairs are spinal nerves.
3) Brain and spinal cord are continuous with each other.	3) Cranial nerves take their origin from brain and spinal nerves take their origin from spinal cord.
4) Brain and spinal cord receive information.	4) The cranial nerves carry information to the sense organs and spinal nerves from organs to spinal cord.
5) Central nervous system coordinates all neural functions.	5) These supply information required for the movement of the muscles.

MULTIPLE CHOICE QUESTIONS

LEVEL-I

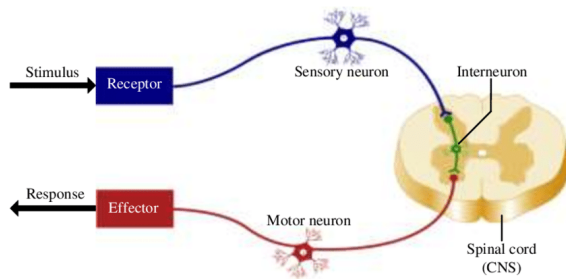
- I. A) Neuron/ nerve cells are the structural and functional unit of the nervous system.

- II. D) Neurons communicate with one another at junctions called synapses. Axon, cyton and Dendron all are parts of neuron.
- III. D) Three regions of human brain- Forebrain, midbrain & hindbrain
- IV. D) Reflex actions are sudden responses. It is an involuntary action which does not involve thinking. Sneezing, coughing and blinking of eyes all are involuntary actions.
- V. C) Medulla oblongata, also called medulla, the lowest part of the brain and the lowest portion of the brainstem. The medulla oblongata is connected by the pons to the midbrain and is continuous posteriorly with the spinal cord, with which it merges at the opening (foramen magnum) at the base of the skull.
- VI. A) Voluntary actions are under the control of cerebrum. Medulla oblongata controls involuntary actions, pons control some aspects of respiration. The cerebellum function is to coordinate voluntary muscle movements and to maintain posture, balance, and equilibrium.
- VII. C) PNS consists of 12 pairs of cranial nerves and 31 pairs of sensory nerves.
- VIII. C) 1)The cochlea is responsible for hearing, 2) the semicircular canals have function associated with balance.
- IX. A) There is a special fluid, called cerebrospinal (cerebro for brain, spinal for the spinal cord) that circulates the entire central nervous system. It occupies the space between the Pia Mater and Arachnoid and supplies nutrients (like blood in the rest of the body), disposes of waste and acts as a shock absorber.
- X. C) Medulla controls the involuntary actions and it is part of the hindbrain.
- XI. B)Nerve conduct impulse by electric signals.
- XII. D)Aqueous humour is the watery substance that fills the space between cornea and lens.
- XIII. B)Blind spot is the place on retina which has no rods and cones. Blind spot, small portion of the visual field of each eye. There are no photoreceptors (i.e., rods or cones) in the optic disk, and, therefore, there is no image detection in this area.
- XIV. A) The organ of Corti, or spiral organ, is the receptor organ for hearing and is located in the mammalian cochlea.
- XV. B)Reflex actions are sudden responses. It is an involuntary action which does not involve thinking.
- XVI. D) Schwann cell produces myelin sheath .
- XVII. B) The spinal cord is also surrounded by some very hard bone, in the form of the vertebrae which makes vertebral column.
- XVIII. C) Nerve mass in invertebrates is called ganglion.
- XIX. B) PNS consists of 12 pairs of cranial nerves and 31 pairs of sensory nerves.
- XX. A) Neuroglia, are non-neuronal cells that do not produce electrical impulses. They maintain homeostasis, form myelin, and provide support and protection for neurons.

LEVEL-II

1. B) The ciliary muscle is a circular ring of muscle that attaches all the way around the lens. This ciliary muscle can change the shape of the crystalline lens by stretching it at the edges.
2. A) Pons is part of brain stem, which connects brain to spinal cord.
3. A) The white matter is white because of the fatty substance (myelin) that surrounds the axons.
4. B) Each of the cerebral hemispheres has been divided into four lobes: frontal, parietal, temporal and occipital.
5. C) Transmission of nerve impulses between two neurons takes place through the synapse by neurotransmitter (special chemical).
6. D) Brain receives and sends signal in the form both electrical and chemical impulses.

7. C)



8. B) Medulla oblongata is involved in

controlling involuntary actions.

9. C) The size of the pupil is controlled by muscles within the iris - one muscle constricts the pupil opening (makes it smaller), and another iris muscle dilates the pupil (makes it larger).
10. B) The cornea is the transparent front part of the eye
11. A) Afferent neurons are sensory neurons that carry nerve impulses from sensory stimuli towards the central nervous system.
12. B) Nerves are made exclusively of axons.
13. A) Medulla oblongata controls involuntary actions.
14. A) The organ of Corti, or spiral organ, is the receptor organ for hearing and is located in the mammalian cochlea.
15. D) The fovea centralis is a small, central pit composed of closely packed cones in the eye. It is located in the center of the macula lutea of the retina.
16. B) The spinal cord ends at the level of vertebrae L1-L2.
17. B) Choroid is vascular layer of the eye, sclera is protective layer and retina is sensory layer.
18. D) The eustachian tube is a canal that connects the middle ear to the nasopharynx, which consists of the upper throat and the back of the nasal cavity. It controls the pressure within the middle ear, making it equal with the air pressure outside the body.
19. A) Reflex actions are sudden responses. It is an involuntary action which does not involve thinking.
20. D) All of them are neurotransmitter.
21. B) Acetylcholine is a neurotransmitter. Neurotransmitters that are released from the axon terminals to cross the synaptic gap and reach the receptor sites of other neurons. In a process known as reuptake, these neurotransmitters attach to the receptor site and are reabsorbed by the neuron to be reused.
22. C) The membranous labyrinth contains fluid called endolymph. Utriculus and sacculus which are otolith organs and maintain static equilibrium, are present in membranous labyrinth. The walls of the membranous labyrinth are lined with distributions of the cochlear nerve (hearing).
23. C) Cerebellum maintains balance and equilibrium.
24. C) Pons and medulla oblongata controls aspects of respiration.
25. B) The foramen magnum (from the Latin, meaning "great hole") is the large opening in the base of the skull through which the spinal cord exits.
26. C) Tympanic membrane, also called eardrum, thin layer of tissue in the human ear that receives sound vibrations from the outer air and transmits them to the auditory ossicles, which are tiny bones in the tympanic (middle-ear) cavity.
27. C) The three protective membranes - the meninges. These are made out of connective tissue and provide a cushioning from the hard skull of the brain, jolting against the vertebral column (in the spinal cord) or from any damaging impacts. The three meninges are the Dura Mater (outer), The Arachnoid (middle) and the Pia Mater (inner).
28. D) Synapse is a junction between two neurons.

29. D)The diencephalon is a division of the forebrain. It consists of structures that are on either side of the third ventricle, including the thalamus, the hypothalamus, the epithalamus and the subthalamus.
30. B) Afferent neurons are sensory neurons that carry nerve impulses from sensory stimuli (receptors) towards the central nervous system.
31. B) Vibration of stapes footplate at the oval window. The oval window (or fenestra vestibuli) is a membrane-covered opening that leads from the middle ear to the vestibule of the inner ear.
32. B) Vitreous humour is behind the lens.
33. **C**) The ossicles are, in order from the eardrum to the inner ear (from superficial to deep): the malleus, incus, and stapes, terms that in Latin are translated as "the hammer, anvil, and stirrup".
34. D) Reflex actions are involuntary.
35. D) In the auditory system, sound vibrations (mechanical energy) are transduced into electrical energy by hair cells in the inner ear. Sound vibrations from an object cause vibrations in air molecules, which in turn, vibrate the ear drum. The movement of the eardrum causes the bones of the middle ear (the ossicles) to vibrate. These vibrations then pass into the cochlea, the organ of hearing. Within the cochlea, the hair cells on the sensory epithelium of the organ of Corti bend and cause movement of the basilar membrane. The membrane undulates in different sized waves according to the frequency of the sound. Hair cells are then able to convert this movement (mechanical energy) into electrical signals (graded receptor potentials) which travel along auditory nerves to hearing centres in the brain.
36. D)Node of Ranvier, periodic gap in the insulating sheath (myelin) on the axon of certain neurons that serves to facilitate the rapid conduction of nerve impulses.

