Question No. 1 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #01

The human spinal cord is the major conduit of information in the body. The spinal cord transfers neuronal information between the brain and the peripheral nervous system quickly. Which of the following statements about the spinal cord is correct?

A. The spinal cord begins at the brainstem and extends to the 11th thoracic vertebrae.
B. The spinal cord has the following main regions: cervical, thoracic, lumbar and sacral.
C. The spinal cord has a separate compartment from that of the brain for its cerebral spinal fluid.
D. A, B, and C are correct.
E. None of the above

Feedback

A. Incorrect!
The spinal cord extends to the 2nd lumbar vertebral level.

B. Correct!
The spinal cord has the following main regions: cervical, thoracic, lumbar and sacral.

C. Incorrect!
The spinal cord and the brain share the same cerebral spinal fluid.

D. Incorrect!
Answer A and C are incorrect.

E. Incorrect!
There is one correct answer above.

Solution

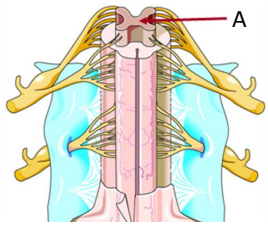
The spinal cord is a long, thin (1-inch) collection of nerves from the brain that extends to approximately the 2nd lumbar vertebra. The spinal cord is bathed in cerebral spinal fluid and transmits information from the periphery to the brain and back. It is divided into 4 main regions: (A) cervical spinal cord, (B) thoracic spinal cord (C) lumbar and (D) sacral spinal cord.

Question No. 2 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #02

Which portion of the spinal cord is labeled in the image below?



A. Anterior median fissure
B. Gray matter
C. Spinal nerve root
D. Dorsal ramus
E. White matter

Feedback

A. Incorrect!
The anterior median fissure extends along the anterior aspect of the spinal cord.

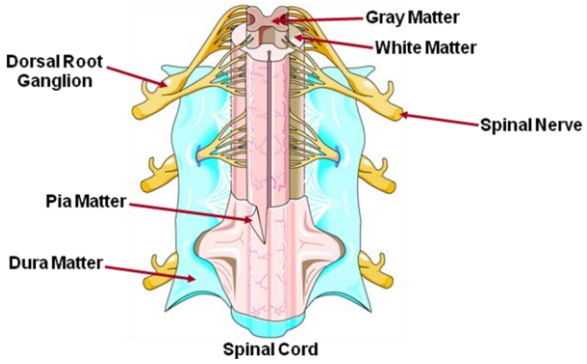
B. Correct!
The spinal cord gray matter is labeled in the image.

C. Incorrect!
The spinal nerve is made up of the dorsal root and the ventral root, which both exit the spinal cord.

D. Incorrect!
The dorsal ramus is one of the two major pathways of the spinal nerve; this originates outside of the spinal cord.

E. Incorrect!
The spinal cord white matter surrounds the butterfly-shaped inner gray matter.

Solution



The spinal cord is a neural tube divided into 30 spinal segments, each with its own pair of nerves (one on each side). Each segment receives impulses from the sensory receptors of the part of the body adjacent to it and sends back impulses to the muscles of that part of the body. Each segment functions relatively independently. However, the fibers from the adjacent segments interconnect the segments and coordinate their activity. The segments are named by the vertebrae next to it; therefore, there is a cervical, thoracic, lumbar, and sacral region of spinal cord segments.

Question No. 3 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.	
 **Question #03**	Overlying the spinal cord is a special covering, known as the meninges. Which of the following statements about the meninges is correct? A. The dura mater is a soft, innermost layer that directly covers the spinal cord. B. The meninges are made up of 5 different layers. C. Between the arachnoid mater and the pia mater is the arachnoid space. D. The arachnoid space is between the arachnoid mater and the dura mater. E. The pia mater is the outermost protective layer, made up of tough connective tissue.
 **Feedback**	A. Incorrect! The dura mater is the outermost layer of the meninges.
	B. Incorrect! The meninges are made up of three layers: dura mater, arachnid mater and the pia mater.
	C. Correct! The arachnoid space is between the arachnoid mater and the pia mater.
	D. Incorrect! The arachnoid space is between the arachnoid mater and the pia mater.
	E. Incorrect! The pia mater is the outermost layer of the meninges.
 **Solution**	The spinal cord is covered by special meninges, made up of three layers: dura mater, arachnoid mater, and the pia mater. These layers offer protection for the spinal cord, as well as being the passageway for blood vessels to the area. These layers extend up to and are continuous with the similar meninges of the brain. The outermost covering of the spinal cord and brain is the dura mater. This is a tough, fibrous covering, which is made up of dense, irregular connective tissue within layers of simple squamous epithelium. The dura mater contains the cerebral spinal fluid within the central nervous system. The dura mater is attached to the skull, the first and second cervical vertebrae, and the posterior longitudinal ligament. The dura mater is continuous with each spinal nerve where it exits the vertebral column. The arachnoid mater is located between the outer dura mater and the inner pia mater. Between the arachnoid mater and the pia mater is the arachnoid space in which the cerebral spinal fluid is contained. The arachnoid space, or subdural space, is almost non-existent during normal life, and it becomes more apparent in histological preparations. This arachnoid space can be accessed in the region caudal to the 2nd lumbar vertebra for epidural infusions. The pia mater is the delicate, innermost layer protecting the spinal cord. The pia mater covers the spinal cord and brain. Within the elastic and collagen fibers of the pia mater is the blood supply of the spinal cord. The pia mater is held in place through the interaction of the collagen fibers of the pia mater and the astrocyte projections that extend from the spinal cord.

Question No. 4 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #04

The spinal cord is made up of gray matter surrounded by white mater. The matter contains numerous tracts that deliver neuronal information. Which of the following statements about the white matter of the spinal cord is correct?

A. The white matter contains ascending tracts that transmit sensory information to the brain.
B. The descending tracts in the white matter of the spinal cord transmit sensory information to the brain from the periphery.
C. The corticospinal tract is an example of an ascending tract in the white matter.
D. All the tracts of the spinal cord are organized into one specific location within the white matter.
E. The corticospinal tract, which is a major component of human movement, is located entirely adjacent to the anterior median fissure.

Feedback

A. Correct!
The white matter contains ascending sensory tracts and descending motor tracts.

B. Incorrect!
The descending white matter tracts transmit motor impulses.

C. Incorrect!
The corticospinal tract is an example of a descending motor tract in the spinal cord.

D. Incorrect!
The white matter tracts are localized into two general areas, one for ascending and one for descending; however, they do occupy different regions in the white matter of the spinal cord.

E. Incorrect!
The corticospinal tract is divided into an anterior portion adjacent to the anterior median fissure and a lateral portion near the lateral aspect of the spinal cord.

Solution

The white matter contains bundles of nerve fibers that travel within the spinal cord, known as ascending and descending tracts. The ascending tracts conduct sensory impulses that enter the spinal cord, up to the brain. They are named based on the target region within the brain. Ascending tracts include: Anterior Spinothalamic - conveys touch and pressure sensations up to the thalamus; Lateral Spinothalamic – conducts pain and temperature impulses. The descending tracts convey impulses from the brain into the spinal cord grey matter and then out to the periphery. These tracts include: Corticospinal tract – conveys motor impulses from the brain to the skeletal muscles, and the Rubrospinal tract – conveys fine motor impulses.

Question No. 5 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #05

The nervous system and the spinal cord develop early during embryological development. Which of the following statements about the development of the spinal cord is correct?

A. By the second week of development, the spinal cord structure is complete.
B. Neural crest cells aggregate to form the autonomic ganglia by the 7th week of development.
C. The tracts, myelination and structure of the spinal cord are complete by the 14th week of development.
D. The endoderm gives rise to the spinal cord.
E. None of the answers are correct.

Feedback

A. Incorrect!
The spinal cord basic structure is complete by the 12th week of development.

B. Correct!
Neural crest cells aggregate to form the autonomic ganglia by the 7th week of development.

C. Incorrect!
The formation and myelination of tracts in the spinal cord continues in the postnatal period.

D. Incorrect!
The ectoderm is the primary germ cell layer that gives rise to the spinal cord.

E. Incorrect!
One of the answers is correct, answer B.

Solution

The nervous system begins to develop in the first 4 weeks of embryonic development. By the end of the second week, the neural groove and folds are in place, as preparation for the closing of the neural tube. This is derived from the primary germ cell layer, known as the ectoderm. By the 7th week of development, neural crest cells aggregate to form the autonomic ganglia. At 12 weeks of development, the basic structure of the spinal cord is in place, and myelination is complete by 20 weeks. The myelination and the formation of tracts within the spinal cord continue in the postnatal period.

Question No. 6 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #06

The nervous system of the human body utilizes neural reflexes to quickly adapt to a changing external environment. Which of the following statements about neural reflex is correct?

A. There are a total of 7 steps in a neural reflex.
B. One of the classifications of a neural reflex is based on the type of response, whether it is somatic or visceral.
C. Reflexes can only involve one synapse.
D. The brain has complete control and is the only portion of the central nervous system responsible for processing the incoming information in a neural reflex.
E. During spinal level processing of a neural reflex, the brain cannot influence the response.

Feedback

A. Incorrect!
There are a total of five steps in a neural reflex: (1) activation of the receptor, (2) relay of information to the central nervous system, (3) processing of the information in the central nervous system, (4) activation of the motor neuron, and (5) peripheral effector action.

B. Correct!
One of the classifications of a neural reflex is based on the type of response, whether it is somatic or visceral.

C. Incorrect!
Reflexes can be polysynaptic, which involve more than one synapse.

D. Incorrect!
The brain can exert its influence on the processing of incoming sensory information during a neural reflex; however, the spinal cord can also process information locally.

E. Incorrect!
The brain can influence spinal level processing, and the result is a combination of the two inputs.

Solution

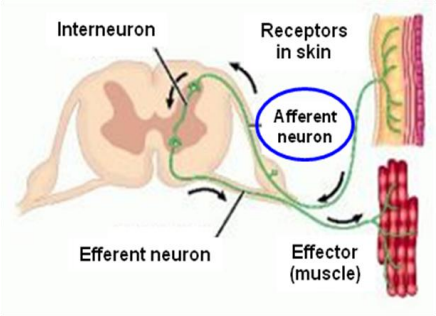
The reflexes of the body can be categorized into different types based on a number of factors. The factors used for classification include: (1) Circuit complexity – monosynaptic (one synapse) or polysynaptic (two or more synapses), (2) Type of response – somatic reflexes that control skeletal muscles or visceral reflexes that control involuntary actions of smooth muscle or cardiac muscle, (3) Processing site – spinal reflexes where the processing is completed in the spinal cord or cranial reflexes, which involve brain processing, and (4) Reflex development – innate reflexes, which are genetically determined, or acquired reflexes that are learned. Testing a patient's reflexes, for example - by the knee-jerk, tests the function of that particular peripheral nerve and the associated spinal cord segments that control it. The reflex occurs in the absence of input from the brain; all the processing of the incoming sensory information and the conversion to a motor output occurs in the spinal cord itself. However, supraspinal input from the brain can influence the spinal reflex action. The spinal reflex can be suppressed by the brain through the action of interneurons. Overall, the spinal reflex response is a combination of local level processing in the spinal cord and the influence of any brain stimulation.

Question No. 7 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #07

Which statement is correct about the component of a neural reflex arc, labeled with the blue circle, in the image below?



A. The afferent neuron transmits motor impulses.
B. The labeled portion of the image represents the first step in a neural reflex.
C. The portion of a neural reflex labeled in the image delivers sensory information into the central nervous system.
D. The labeled portion of the image represents the 4th step in a neural reflex.
E. The distal end of the afferent neuron labeled in the image is involved in a neuromuscular junction with the target muscle.

Feedback

A. Incorrect!
The afferent neuron transmits sensory information to the central nervous system, as part of a neural reflex.

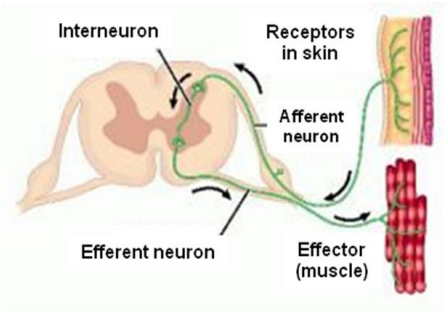
B. Incorrect!
The labeled portion of the image represents the second step of a neural reflex; the activation of sensory receptors is the first step.

C. Correct!
The portion of a neural reflex labeled in the image delivers sensory information into the central nervous system.

D. Incorrect!
The labeled portion of the image represents the second step of a neural reflex; the activation of sensory receptors is the first step.

E. Incorrect!
The distal end of the afferent neuron delivers the signal (through a synapse) to the central nervous system.

Solution



In order to respond to a rapidly changing external environment, the human nervous system uses reflex actions to protect the body and maintain homeostasis. The connections that facilitate a reflex are known as a reflex arc. There are five major steps or components of a reflex arc: (1) activation of the receptor, (2) relay of information to the central nervous system, (3) processing of the information in the central nervous system, (4) activation of the motor neuron, and (5) peripheral effector action.

Question No. 8 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #08

The information processed in the central nervous system is delivered through the spinal nerves, into the peripheral nerves and out to the target. Which of the following statements about the spinal nerves is correct?

A. There are a total of 34 pairs of spinal nerves.
B. There are 5 pairs of coccygeal spinal nerves in the sacral region of the spinal cord.
C. All of the spinal nerves directly travel to and innervate their targets.
D. Spinal nerves are called mixed nerves because they contain both sensory and motor neurons.
E. All spinal nerves enter a nerve plexus and then travel to their target location.

Feedbacks

A. Incorrect!
There are a total of 31 pairs of spinal nerves.

B. Incorrect!
There is one pair of coccygeal nerves, in the sacral region of the spinal cord.

C. Incorrect!
Some of the spinal nerves, such as C_1-C_4, enter a plexus before giving rise to a peripheral nerve.

D. Correct!
Spinal nerves are called mixed nerves because they contain both sensory and motor neurons.

E. Incorrect!
Only some of the spinal nerves enter a nerve plexus, such as C_1-C_4, before giving rise to a peripheral nerve.

Solution

The spinal cord has a total of 31 pairs of spinal nerves. These are divided into the following categories: 8 cervical spinal nerves, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal spinal nerve. Each of the 31 nerves includes the connections to the PNS. Dorsal connections bring information to the CNS; ventral connections send commands to the periphery. Each nerve includes afferent sensory neurons from the periphery and efferent motor neurons to the periphery.

Question No. 9 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #09

The body has a number of nerve plexuses that serve specific regions of the body. Which of the following statements about the cervical plexus is correct?

A. The cervical plexus is made up of the C_1-C_4 spinal nerves.
B. The cervical plexus is made up of all 8 of the cervical spinal nerves.
C. The cervical plexus gives rise to the median nerve.
D. There are three separate trunks in the cervical plexus.
E. The trapezius muscle and the skin of the thigh are innervated through the cervical plexus.

Feedback

A. Correct!
The cervical plexus is made up of the C_1-C_4 spinal nerves.

B. Incorrect!
The cervical plexus is made up of the C_1-C_4 spinal nerves.

C. Incorrect!
The cervical plexus innervates various muscles in the head and neck; the median nerve is supplied through the brachial plexus.

D. Incorrect!
The cervical plexus is not divided into any trunks.

E. Incorrect!
The trapezius muscle is supplied through the cervical plexus, but the skin of the thigh is not. It is supplied through the lumbar plexus.

Solution

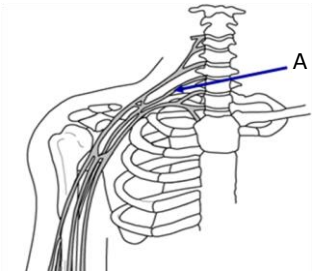
In certain regions of the body, the ventral rami do not proceed directly to their targets they innervate. The innervation of the neck and limbs comes from a blending of the ventral rami and spinal nerves, known as a nerve plexus. These nerve plexuses are formed during early development, when large muscle groups share the same nerve supply. There are four major nerve plexuses in the body: cervical plexus, brachial plexus, lumbar plexus and the sacral plexus. The cervical plexus serves the muscles of the head and neck, through the spinal nerves, C_1-C_4. The muscles innervated by this plexus include: laryngeal muscles, levator scapulae, scalenes, trapezius muscle, and the diaphragm via the phrenic nerve.

Question No. 10 of 10

Instructions: (1) Read the problem statement and answer choices carefully, (2) Work the problems on paper as needed, (3) Pick the answer, and (4) Review the core concept tutorial as needed.

Question #10

Which of the following statements about the nerve plexus in the image below is correct?



A. The image depicts the cervical plexus.
B. The label in the image depicts the middle trunk of the brachial plexus.
C. There are a total of 5 trunks that make up the brachial plexus.
D. The plexus depicted in this image innervates the lower leg and thigh.
E. The plexus depicted in this image gives rise to the sciatic nerve.

Feedback

A. Incorrect!
The image depicts the brachial plexus.

B. Correct!
The label in the image depicts the middle trunk of the three trunks in the brachial plexus.

C. Incorrect!
There are a total of three trunks in the brachial plexus: superior, middle lower trunk.

D. Incorrect!
The plexus depicted in the image supplies the pectoral girdle and the upper limb.

E. Incorrect!
The brachial plexus, depicted in the image, gives rise to the median, radial and ulnar nerves.

Solution

The brachial plexus serves the pectoral girdle and the upper limb. There are three trunks: superior, middle and lower trunks. These trunks then divide into an anterior and posterior division. These eventually give rise to the major nerves of the upper limb: ulnar nerve, median nerve and the radial nerve.