Question No. 1 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #01	**1.** Which of the following is/are method(s) of classifying reflexes? (A) Time of development. (B) Number of neurons in reflex loop. (C) CNS location of integration. (D) A & C. (E) All of the above.
Feedback on Each Answer Choice	A. Incorrect! The time of development is a method of classifying reflexes but it is not the only method listed here.
	B. Incorrect! The number of neurons in the reflex loop is a method of classifying reflexes but it is not the only method listed here.
	C. Incorrect! CNS location of integration is a method of classifying reflexes but it is not the only method listed here.
	D. Incorrect! Both the time of development and the CNS location of integration are methods of classifying reflexes but they are not the only methods listed here.
	E. Correct! All of these are methods of classifying reflexes.
Solution	Reflexes are classified based on a number of different things. Firstly it is based on the efferent division of the nervous system. Somatic reflexes are those reflexes that involve motor neuron and skeletal muscles. Visceral reflexes are those that are controlled by autonomic neurons. The next criteria are the location of the integration. Spinal reflexes are integrated in the spinal cord and cranial reflexes are integrated in the brain. Reflexes are classified based on when the reflex is developed. If the reflex is innate then it is a reflex that a person is born with and these are genetically predispositioned. There are other reflexes that are gained through experiences and these are conditioned. The other method of classification is how many neurons are found in the reflex loop. Monosynaptic reflex have only two neurons, an afferent sensory neuron and an efferent motor neuron. Most reflexes are polysynaptic reflexes. These have three or more neurons in the pathway. Divergence allows a single stimulus to affect multiple targets. Convergence allows input from multiple sources. **The correct answer is (E).**

Question No. 2 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #02	**2.** Which of the following is not involved in skeletal muscle contraction? (A) Troponin (B) Caldesmon (C) Tropomyosin (D) A & C (E) All of the above
Feedback on Each Answer Choice	A. Incorrect! Troponin is one of the regulatory proteins involved in skeletal muscle contraction.
	B. Correct! Caldesmon is not involved in skeletal muscle contraction but it is a regulatory protein involved in smooth muscle contraction.
	C. Incorrect! Tropomyosin is one of the regulatory proteins involved in skeletal muscle contraction.
	D. Incorrect! Both troponin and tropomyosin are involved in skeletal muscle contraction.
	E. Incorrect! Not all of these proteins are involved in skeletal muscle contraction.
Solution	Calcium enters the smooth muscle fibers from voltage and chemically gated channels. This causes increased amounts of cytosolic Ca^{2+} from the sarcoplasmic reticulum and from the extracellular fluid. Ca^{2+} binds to calmodulin which is found in the cytosol. Calcium binds to calmodulin and this complex activates an enzyme called myosin light chain kinase (MLCK). MLCK activates the myosin ATPase by phosphorylation. When myosin ATPase activity is high, this causes crossbridge to cycle. In some smooth muscle, a regulatory protein called caldesmon which is bound to actin must be phosphorylated and this allows actin and myosin to interact. **The correct answer is (B).**

Question No. 3 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #03	**3.** Which of the following statements is incorrect about smooth muscle contraction? (A) There is tropomyosin associated with actin. (B) The myosin ATPase activity is slower. (C) Crossbridge cycling is slower. (D) Actin and myosin are arranged in long bundles. (E) There is troponin associated with actin.
Feedback on Each Answer Choice	A. Incorrect! There is tropomyosin associated with actin so this statement is true.
	B. Incorrect! The myosin ATPase activity is slower so this statement is true.
	C. Incorrect! The crossbridge cycling is slower so this statement is true.
	D. Incorrect! The actin and myosin are arranged in long bundles so this statement is true.
	E. Correct! There is no troponin found associated with the actin in smooth muscle. So this statement is false.
Solution	Smooth muscle differs in its contraction process from skeletal muscles in several ways. The actin and myosin are arranged in long bundles. In smooth muscle, the actin filaments are associated with tropomyosin but it lack troponin. In smooth muscle, the crossbridge cycling is slower and contraction phase of twitch is longer. So smooth can sustain contractions longer than skeletal muscle. In smooth muscle there is little sarcoplasmic reticulum that is chemically linked to sarcolemma. Finally the myosin has slower ATPase activity. **The correct answer is (E).**

Question No. 4 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #04	**4.** What is the neuron that innervates contractile fibers? (A) Alpha motor (B) Gamma motor (C) Muscle spindle (D) Golgi tendon organ (E) All of the above
Feedback on Each Answer Choice	A. Correct! The alpha motor neuron is the neuron that innervates contractile fibers.
	B. Incorrect! The gamma motor neurons are small neurons associated with sensory receptors.
	C. Incorrect! The muscle spindles are not neurons. They are stretch receptors that send information to the brain and spinal cord concerning the length of the muscle.
	D. Incorrect! The Golgi tendon organs are receptors responsible for reflex relaxation and are found at the junction of tendons and muscles.
	E. Incorrect! All of these answers are not neurons therefore this cannot be the correct choice.
Solution	There are two motor neurons that carry somatic output information. The first is alpha motor neurons which are efferent neuron that innervate with contractile fibers and they are also known as extrafusal muscle fibers. These fibers cause contraction. The second type is gamma motor neurons and they are smaller neurons associated with muscle fibers that are found associated with sensory neurons. **The correct answer is (A).**

Question No. 5 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #05	**5.** Which of the following statements is true of voluntary movement? (A) Voluntary movement uses an external stimulus. (B) An example of voluntary movement is playing the piano. (C) Voluntary movement is the most complex of the types of movements. (D) Voluntary movement is learned and conditioned. (E) All of the above
Feedback on Each Answer Choice	A. Incorrect! Voluntary uses an external stimulus. It is not the only statement that is true.
	B. Incorrect! An example of voluntary movement is playing the piano. It is not the only statement that is true.
	C. Incorrect! Voluntary movement is the most complex of the types of movements. It is not the only statement that is true.
	D. Incorrect! Voluntary movement is learned and conditioned. It is not the only statement that is true.
	E. Correct! All of the above statements are true concerning voluntary movement.
Solution	There are different types of muscle movement. They can be classified based on the stimulus. Reflex movement has external stimuli that is normally not voluntary, Voluntary movement has external or free will stimuli and rhythmic movement is completely voluntary. The most complex of the movement is voluntary movement. These are things that are learned and need to be conditioned. These will improve with practice. The reflexes are innate and they occur rapidly. The rhythmic movements are learned movements but they become subconscious due to the development of muscle memory. An example of the reflex is the knee jerk. An example of voluntary movement is playing an instrument and an example of rhythmic movement is walking. **The correct answer is (E).**

Question No. 6 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #06	**6.** Which of the following statements is correct? (A) ATP binds to the nucleotide binding site of actin. (B) ATP binds to the nucleotide binding site in step 1 of the sliding filament process. (C) ATP binds to the nucleotide binding site of myosin. (D) ATP binds to troponin and tropomyosin. (E) None of these statements are correct.
Feedback on Each Answer Choice	A. Incorrect! ATP does not bind to the nucleotide binding site of actin. This statement is not correct.
	B. Incorrect! ATP does bind to the nucleotide binding site but it does not bind in step 1 of the process.
	C. Correct! ATP does bind to the nucleotide binding site on the myosin head. This statement is correct.
	D. Incorrect! ATP does not bind to troponin and tropomyosin. So this statement cannot be true.
	E. Incorrect! There is one of these statements that is correct so this cannot be the right answer.
Solution	The following are the steps of the sliding filament mechanism: Step 1- The first step of contraction is the rigor state. During this step, the myosin head is bound to the actin thin filament. Step 2-An ATP molecule binds to the nucleotide binding site on the myosin head releasing it from the actin binding site. Step 3- The ATP is hydrolyze into ADP, inorganic phosphate and energy as it is bound to myosin head. Step 4- The myosin head is now cocked and ready to begin power stroke. Step 5- The inorganic phosphate is released and this begins the power stroke. As the myosin moves, it pushes the actin towards the center. Step 6- The myosin releases the ADP and now the myosin head is tightly bound to the actin again and the cycle is awaiting a new ATP to bind to myosin to start the process again. **The correct answer is (C).**

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #07	**7.** Which of the following statements is incorrect? (A) Troponin binds to calcium. (B) Tropomyosin inhibits tight binding of myosin to actin. (C) Contraction is initiated after calcium binds to tropomyosin. (D) In the "on" position, myosin is tightly bound to actin. (E) All of the above are correct.
Feedback on Each Answer Choice	A. Incorrect! Troponin does bind to calcium. This statement is correct.
	B. Incorrect! Tropomyosin does in inhibit the tight binding of myosin to actin. This statement is correct.
	C. Correct! Contraction is initiated after calcium binds to troponin not tropomyosin and releases the tropomyosin from the actin binding site. This statement is incorrect.
	D. Incorrect! In the "on" position, myosin is tightly bound to actin. This statement is correct.
	E. Incorrect! All of these statements listed here are not all correct. This could not be the right answer. There is one statement that is false.
Solution	Tropomyosin wraps around the actin filament by blocking the actin binding site from the myosin head. When tropomyosin is wrapped around the actin, the myosin head only weakly binds to the actin. This is the "off" position. When calcium is bound to troponin, this pulls tropomyosin towards the groove of the actin filaments. This creates the "on" position and the myosin head can bind to the actin filament. **The correct answer is (C).**

Question No. 8 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #08	**8.** Which of the following statements is incorrect? (A) Calcium binds to calmodulin. (B) Calcium directly activates myosin light chain kinase. (C) MLCK phosphorylates the myosin ATPase. (D) Increased ATPase activity leads to crossbridge cycling. (E) None of the above statements are incorrect.
Feedback on Each Answer Choice	A. Incorrect! Calcium does bind to calmodulin. This statement is correct.
	B. Correct! Calcium does not directly activate the myosin light chain kinase. This statement is false.
	C. Incorrect! MLCK does phosphorylate the myosin ATPase. This statement is correct.
	D. Incorrect! If the ATPase activity is increased, then there will be crossbridge cycling. This statement is correct.
	E. Incorrect! One of the statements listed below is incorrect so this could not be the answer.
Solution	Calcium enters the smooth muscle fibers from voltage and chemically gated channels. This causes increased amounts of cytosolic Ca^{2+} from the sarcoplasmic reticulum and from the extracellular fluid. Ca^{2+} binds to calmodulin which is found in the cytosol. Calcium binds to calmodulin and this complex activates an enzyme called myosin light chain kinase (MLCK). MLCK activates the myosin ATPase by phosphorylation. When myosin ATPase activity is high, this causes crossbridge to cycle. In some smooth muscle, a regulatory protein called caldesmon which is bound to actin must be phosphorylated and this allows actin and myosin to interact. **The correct answer is (B).**

Question No. 9 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #09	**9.** Which of the following statements is correct? (A) Myosin phosphatase dephosphorylates myosin. (B) Calcium enters into the cell leading to smooth muscle relaxation. (C) MLCK is inactivated when calmodulin binds to calcium. (D) The phosphorylation of caldesmon will block myosin binding to actin. (E) All of the above are incorrect.
Feedback on Each Answer Choice	A. Correct! Myosin phosphatase does dephosphorylate myosin. This statement is correct.
	B. Incorrect! Calcium leaves the cell and this triggers smooth muscle relaxation. This statement is incorrect.
	C. Incorrect! MLCK is inactivated when calmodulin releases calcium. This statement is incorrect.
	D. Incorrect! The dephosphorylation will block myosin binding to actin not the phosphorylation. This statement is incorrect.
	E. Incorrect! Of the choices available there is one of them that is actually correct.
Solution	Myosin phosphatase dephosphorylates myosin and this decrease ATPase activity. Ca^{2+} is removed from cytoplasm by the Ca^{2+} Na^{+} antiport and Ca^{2+} ATPase. This causes calmodulin to release Ca^{2+} and then MLCK is inactivated. There is also dephosphorylation of caldesmon and this will allow caldesmon to bind back to actin and block myosin binding. **The correct answer is (A).**

Question No. 10 of 10

Instruction: (1) Read the problem and answer choices carefully (2) Work the problems on paper as needed (3) Pick the answer (4) Go back to review the core concept tutorial as needed.	
Question #10	**10.** Which of the following allows limbs to pull away from painful stimuli? (A) Stretch reflexes (B) Golgi tendon organs (C) Muscle spindles (D) Flexion reflexes (E) None of the above
Feedback on Each Answer Choice	A. Incorrect! Stretch reflexes involve two neurons. There is the sensory neuron from the muscle spindles and the somatic motor neurons to the muscle.
	B. Incorrect! Golgi tendon organs are receptors found at the junction of the tendons and muscle fibers. They are responsible for reflex relaxation.
	C. Incorrect! Muscle spindles act as stretch receptors and they send information to the brain and spinal cord concerning the length of the muscle.
	D. Correct! Flexion reflexes allow the limbs to be pulled away from painful stimuli.
	E. Incorrect! One of these choices, there is a correct answer. So this cannot be the correct choice.
Solution	Stretch reflexes involve two neurons. There is the sensory neuron from the muscle spindles and the somatic motor neurons to the muscle. These reflexes involve using synergistic and antagonistic muscles that act together. The group of neurons will link together in diverging and converging pathways forming a myotatic unit. There is also reciprocal inhibition in which the antagonistic muscle action must occur in order to complete the reflex. Flexion reflexes allow the limbs to be pulled away from painful stimuli. These rely on afferent fibers from pain receptors to activate neurons and this in turn will excite alpha motor neurons to contract the muscle and move the limb. This uses reciprocal inhibition to actually withdraw the limb from the stimulus. **The correct answer is (D).**