

## Written physio MSK 5

- 1- Compare ( ) red (type 1 or slow oxidative) and white (type 2A or fast glycolytic) ms fiber?
- 2- Def motor unit?
- 3- Enumerate 4 effects of training on sk ms?
- 4- Mention effect of training on neuromuscular control?
- 5- Mention effect of training on ms size?
- 6- Mention effect of training on metabolic adaptation?

## MCQ physio MSK 5

<p><b>1. The motor unit of skeletal muscles is:</b></p> <ul style="list-style-type: none"><li>a) A single skeletal muscle fiber plus multiple nerve fiber.</li><li>b) Multiple skeletal muscle fiber plus multiple nerve fiber.</li><li>c) Multiple skeletal muscle fiber plus single nerve fiber.</li><li>d) Large in muscles that perform fine and delicate movements</li><li>e) Small in muscles that perform coarse movements.</li></ul>	<b>C</b>
<p><b>2. Which of the following correctly describe the term motor unit?</b></p> <ul style="list-style-type: none"><li>a) All motor neurons supplying single skeletal muscle</li><li>b) All muscle fibers of a skeletal muscle and its motor nerve supply</li><li>c) Single muscle fiber and all nerve fibers supplying it</li><li>d) Single nerve fiber and all muscle fibers supplied by it</li><li>e) Single nerve fiber and single muscle fiber</li></ul>	<b>D</b>

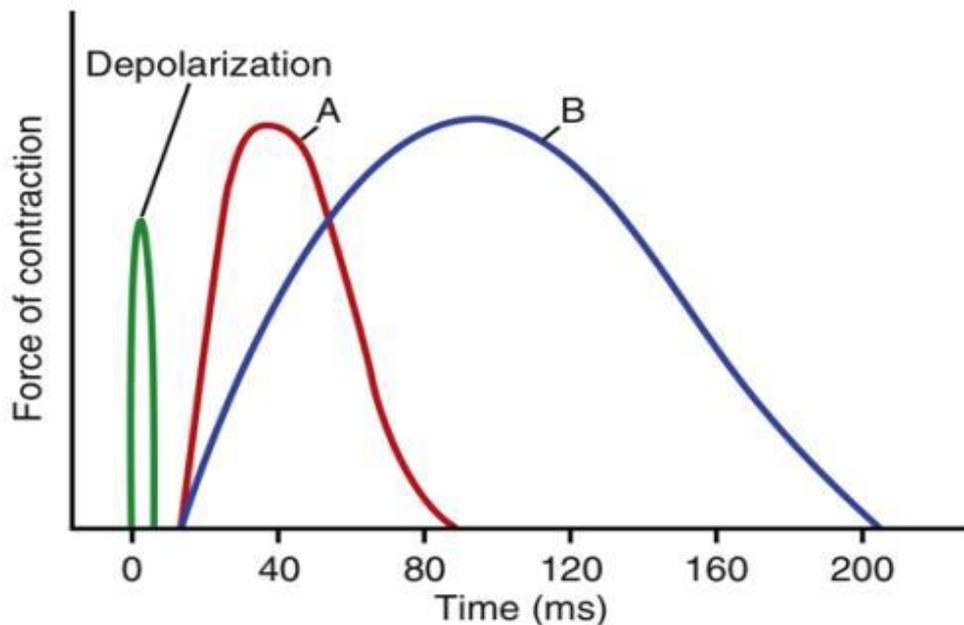
<p><b>3. The fast of muscles is characterized by all the following except :</b></p> <ul style="list-style-type: none"> <li>a) High ATPase activity in the mitochondria.</li> <li>b) Specialization for posture maintenance</li> <li>c) Innervation by large motor neurons (A alpha fibers that conduct at a velocity of 70-120 meters/second).</li> <li>d) Rapid fatigue.</li> <li>e) Absence of myoglobin</li> </ul>	<b>B</b>
<p><b>4. Skeletal, muscles can maintain contraction without fatigue due to the:</b></p> <ul style="list-style-type: none"> <li>a) Treppe phenomenon.</li> <li>b) Summation of contractions.</li> <li>c) Asynchronous firing of motor units.</li> <li>d) Presence of light gap junctions between the muscle fibers.</li> <li>e) Increased consumption of lactic acid</li> </ul>	<b>C</b>
<p><b>5. Weightlifting can result in a dramatic increase in skeletal muscle mass. This increase in muscle mass is primarily attributable to which of the following?</b></p> <ul style="list-style-type: none"> <li>a) Fusion of sarcomeres between adjacent myofibrils</li> <li>b) Hypertrophy of individual muscle fibers</li> <li>c) Increase in skeletal muscle blood supply</li> <li>d) Increase in the number of motor neurons</li> <li>e) Increase in the number of neuromuscular junctions</li> </ul>	<b>B</b>
<p><b>6. Fast-twitch muscle fibers:</b></p> <ul style="list-style-type: none"> <li>A. Are more resistant to fatigue than slow- twitch fibers</li> <li>B. Have a richer blood supply than slow- twitch fibers</li> <li>C. Have a larger amount of stored glycogen than slow twitch fibers</li> <li>D. Have more mitochondria than slow twitch fibers</li> <li>E. Have more myoglobin than slow-twitch fibers</li> </ul>	<b>C</b>

<p><b>7. The slow twitch muscle fiber differs from the fast twitch fiber because the slow twitch fiber:</b></p> <p>A. Has a smaller number of muscle fibers in each motor unit but equally powerful</p> <p>B. Has a higher concentration of myoglobin and mitochondria</p> <p>C. Has a higher ATPase activity</p> <p>D. In a large limb serves as a reserve which can be recruited if there is a forceful contraction</p> <p>E. Is more readily fatigued</p> <p>F. Is part of a motor unit that consists mainly of red fibers</p>	<b>B</b>
<p><b>8. Which of these characteristics is typical of a slow-twitch muscle fiber?</b></p> <p>A. Large number of mitochondria</p> <p>B. Few capillaries</p> <p>C. Low myoglobin content</p> <p>D. Largely anaerobic</p> <p>E. B, C, and D</p>	<b>A</b>
<p><b>9. Which of these conditions would one expect to find within the leg muscle cells of a world-class marathon runner?</b></p> <p>A. Myoglobin-poor</p> <p>B. Contract very quickly</p> <p>C. Primarily anaerobic</p> <p>D. Numerous mitochondria</p> <p>E. Large deposits of glycogen</p>	<b>D</b>
<p><b>10. When compared with oxidative slow muscle fibers, fast glycolytic fibers would have:</b></p> <p>A. Glycogen as their most important energy source</p> <p>B. A higher myoglobin content</p> <p>C. Smaller motor units</p> <p>D. A richer capillary blood supply</p>	<b>C</b>

<p><b>11. An exercise regimen which includes running and swimming long distances will promote an increase in the:</b></p> <p>A. Number of fast glycolytic fibers in skeletal muscle</p> <p>B. Size of existing fast glycolytic fibers in skeletal muscle</p> <p>C. Number of slow oxidative fibers in skeletal muscle</p> <p>D. Mitochondrial content and blood supply of slow oxidative fibers in skeletal muscle</p>	<b>D</b>
<p><b>12. Compared to type II b (fast-glycolytic) muscle fibers, type I (slow oxidative) muscle fibers have:</b></p> <p>a) Less liability to fatigue.</p> <p>b) Fewer capillaries.</p> <p>c) Fewer mitochondria.</p> <p>d) Larger diameter.</p> <p>e) Less amount of myoglobin.</p>	<b>A</b>
<p><b>13. Regular exercise training does not involve increase in:</b></p> <p>a) Contractile proteins</p> <p>b) Glycolytic enzymes</p> <p>c) Muscle fiber number</p> <p>d) Capillaries and mitochondria.</p>	<b>C</b>
<p><b>14. Motor unit:</b></p> <p>a) Involves one motor neuron and muscle fibers innervated by it.</p> <p>b) Is group of neurons that innervate one skeletal muscle.</p> <p>c) Is small size in muscles of thigh.</p> <p>d) Is large size in extra ocular muscle</p>	<b>A</b>
<p><b>15. Pale (fast) fibers are characterized by the following:</b></p> <p>a. Contain much blood capillaries.</p> <p>b. Glycogen stores are low.</p> <p>c. Contain high concentration of myoglobin.</p> <p>d. Depend on anaerobic oxidation.</p>	<b>D</b>

<p><b>16. Fast (pale) muscle fibers are characterized by which of followings:</b></p> <ul style="list-style-type: none"> <li>a) Contain much blood capillaries.</li> <li>b) Glycogen stores are low.</li> <li>c) Contains high concentration of myoglobin.</li> <li>d) Depends on anaerobic oxidation.</li> <li>e) Show delayed onset of fatigue.</li> </ul>	<b>D</b>
<p><b>17. Red muscle differs from pale muscle in what respect?</b></p> <ul style="list-style-type: none"> <li>a. Microvessel density is lower in the red muscle</li> <li>b. Velocity of contraction is faster in red muscle</li> <li>c. Myoglobin levels are higher in red muscles</li> <li>d. Red muscle fatigues more easily than pale muscles</li> </ul>	<b>C</b>
<p><b>18. Which of the following is a character of the skeletal muscle motor units?</b></p> <ul style="list-style-type: none"> <li>a. Slow motor units are composed of glycolytic muscle fibers only.</li> <li>b. Large motor units are found in muscles of the hand.</li> <li>c. Each motor neuron innervates the 2 types of muscle fibers.</li> <li>d. Large motor units have 3-6 fibers per motor unit.</li> <li>e. Small motor units are responsible for precise movements.</li> </ul>	<b>E</b>
<p><b>19. Adaptation of fast glycolytic fibers of skeletal muscle takes place in the form of an increase in:</b></p> <ul style="list-style-type: none"> <li>a. Number of capillaries.</li> <li>b. Myoglobin content.</li> <li>c. Aerobic ATP production.</li> <li>d. Number of mitochondria.</li> <li>e. Number of cross bridges.</li> </ul>	<b>E</b>
<p><b>20. The immediate source of energy in skeletal muscle contraction is from:</b></p> <ul style="list-style-type: none"> <li>a. Glucose</li> <li>b. Glycogen</li> <li>c. Phosphate derivatives</li> <li>d. Free fatty acids</li> </ul>	<b>C</b>

<p><b>21. Short duration, high intensity exercise causes the following change in the muscle fibers:</b></p> <ul style="list-style-type: none"> <li>a. Increase number of mitochondria.</li> <li>b. Increase glycolytic enzymes.</li> <li>c. Increase number of capillaries.</li> <li>d. Increase myoglobin content.</li> <li>e. Increase aerobic ATP production.</li> </ul>	<b>B</b>
<p><b>22. Fast skeletal muscle fibers differ from slow fibers in that fast fibers:</b></p> <ul style="list-style-type: none"> <li>a) are adapted for short rapid muscle contractions.</li> <li>b) have less glycolytic enzymes.</li> <li>c) have more extensive blood supply.</li> <li>d) contain more mitochondria.</li> <li>e) have more myoglobin.</li> </ul>	<b>A</b>
<p><b>23. The fast type of muscle fibers is characterized by all of the following EXCEPT:</b></p> <ul style="list-style-type: none"> <li>a. High ATPase activity in mitochondria</li> <li>b. Specialization for posture maintenance</li> <li>c. Innervation by large motor neuron (A alpha)</li> <li>d. Rapid fatigue</li> <li>e. Absence of myoglobin</li> </ul>	<b>B</b>
<p><b>24. Pale (fast) fiber:</b></p> <ul style="list-style-type: none"> <li>a- contains much blood capillaries.</li> <li>b- doesn't show fatigue.</li> <li>c- contains low concentration of myoglobin.</li> <li>d- depends on aerobic oxidation.</li> </ul>	<b>C</b>



The above figure illustrates the single isometric twitch characteristics of two skeletal muscles, A and B, in response to a depolarizing stimulus. Refer to it when answering Questions 1 and 2.

1) Which of the following best describes muscle B compared with muscle A?

- A) Adapted for rapid contraction
- B) Composed of larger muscle fibers
- C) Fewer mitochondria
- D) has smaller muscles fibers
- E) Less extensive blood supply

D

2) The delay between the termination of the transient de-polarization of the muscle membrane and the onset of muscle contraction observed in both muscles A and B reflects the time necessary for which of the following events to occur?

- A) ADP to be released from the myosin head
- B) ATP to be synthesized
- C)  $Ca^{++}$  to accumulate in the sarcoplasm
- D) G-actin to polymerize into F-actin
- E) Myosin head to complete one cross-bridge cycle

C

<p><b>25. Which of the followings is the correct number of muscle fiber in each motor unit in human leg muscles?</b></p> <p>a) 3-6 skeletal muscle fibers  b) 160 skeletal muscle fibers  c) 260 skeletal muscle fibers  d) 600 skeletal muscle fibers  e) 6000 skeletal muscle fibers</p>	<b>D</b>
<p><b>26. Which type of muscle fiber is more resistant to fatigue?</b></p> <p>a) Slow-twitch (Type I) fibers  b) Fast-twitch oxidative-glycolytic (Type IIA) fibers  c) Fast-twitch glycolytic (Type IIB) fibers  d) All muscle fibers have similar fatigue resistance</p>	<b>A</b>
<p><b>27. Which type of muscle fiber is primarily used for endurance activities such as long-distance running?</b></p> <p>a) Slow-twitch (Type I) fibers  b) Fast-twitch oxidative-glycolytic (Type IIA) fibers  c) Fast-twitch glycolytic (Type IIB) fibers  d) None of the above</p>	<b>A</b>
<p><b>28. Which type of muscle fiber relies more on aerobic metabolism?</b></p> <p>a) Slow-twitch (Type I) fibers  b) Fast-twitch oxidative-glycolytic (Type IIA) fibers  c) Fast-twitch glycolytic (Type IIB) fibers  d) Both (a) and (b)</p>	<b>D</b>
<p><b>29. Which of the following is a physiological effect of resistance training on skeletal muscles?</b></p> <p>a) Increased muscle fiber size  b) Decreased muscle strength  c) Reduced muscle flexibility  d) Decreased muscle endurance</p>	<b>A</b>

<p><b>30. What is the primary mechanism behind muscle hypertrophy in response to resistance training?</b></p> <p>a) Increase in the number of muscle fibers</p> <p>b) Decrease in muscle fiber size</p> <p>c) Increase in muscle fiber length</p> <p>d) Increase in muscle fiber protein synthesis</p>	<b>D</b>
<p><b>31. Which type of muscle fibers are primarily recruited and trained during endurance training?</b></p> <p>a) Slow-twitch (Type I) fibers</p> <p>b) Fast-twitch oxidative-glycolytic (Type IIA) fibers</p> <p>c) Fast-twitch glycolytic (Type IIB) fibers</p> <p>d) All muscle fibers are equally trained</p>	<b>A</b>
<p><b>32. What is the effect of aerobic training on skeletal muscles?</b></p> <p>a) Increased mitochondrial density</p> <p>b) Decreased oxygen utilization</p> <p>c) Reduced capillary network</p> <p>d) Decreased aerobic capacity</p>	<b>A</b>
<p><b>33. Which of the following is a common effect of resistance training on skeletal muscles?</b></p> <p>a) Increased muscle size (hypertrophy)</p> <p>b) Decreased muscle strength</p> <p>c) Reduced muscle flexibility</p> <p>d) Decreased muscle endurance</p>	<b>A</b>
<p><b>34. What is the primary factor responsible for muscle hypertrophy following resistance training?</b></p> <p>a) Increased number of muscle fibers</p> <p>b) Increased muscle fiber length</p> <p>c) Increased muscle fiber diameter</p> <p>d) Decreased muscle fiber density</p>	<b>C</b>

<p><b>35. What happens to the number of muscle fibers with resistance training?</b></p> <p>a) The number of muscle fibers increases  b) The number of muscle fibers decreases  c) The number of muscle fibers remains unchanged  d) None of the above</p>	<b>C</b>
<p><b>36. Which of the following is an effect of endurance training on skeletal muscles?</b></p> <p>a) Increased oxidative capacity of muscle fibers  b) Decreased aerobic endurance  c) Decreased capillary density in muscles  d) None of the above</p>	<b>A</b>
<p><b>37. What is the effect of aerobic training on skeletal muscles?</b></p> <p>a) Increase in muscle size  b) Increase in muscle power  c) Increase in muscle endurance  d) Decrease in muscle flexibility</p>	<b>C</b>
<p><b>38. In sports requiring greatest aerobic and endurance capacity , atheletes have higher percentage of which type of fibers ?</b></p> <p>a) type 1 slow oxidative  b) type 2 A fast oxidative and glycolytic  c) type 2 B fast glycolytic  d) none of the above</p>	<b>A</b>
<p><b>39. In sports requiring greatest anerobic , strength and power and sprinting and weight lifting , atheletes have higher percentage of which type of fibers ?</b></p> <p>a) type 1 slow oxidative  b) type 2 A fast oxidative and glycolytic  c) type 2 B fast glycolytic  d) none of the above</p>	<b>C</b>

<p><b>40. What is the first line of defence against lactic acidosis :</b></p> <ul style="list-style-type: none"> <li>a) Buffer system</li> <li>b) Mitochondrial size and number</li> <li>c) Enzymes of citric cycle</li> <li>d) Number of cross bridges of sarcomere</li> </ul>	<b>A</b>
<p><b>41. One of the following is not one of effects of training :</b></p> <ul style="list-style-type: none"> <li>a) Improved ms coordination is no just about ms but also the nerve</li> <li>b) Sprint training modify the relative sequencing of ms activation and recruitment</li> <li>c) Training enhance aerobic and anerobic energy transfer</li> <li>d) When the prime mover contract, the antagonist ms contract quickly</li> </ul>	<b>D</b>
<p><b>42. Myogenic cell under basement membrane responsible for ms regeneration and transformation:</b></p> <ul style="list-style-type: none"> <li>a) Fibroblast</li> <li>b) Osteoblast</li> <li>c) Sarcomere</li> <li>d) Satellite cell</li> </ul>	<b>D</b>
<p><b>43. Not true about effect of training on sk ms:</b></p> <ul style="list-style-type: none"> <li>a) Aerobic training increase the percentage of type 1 ms fibers</li> <li>b) Athelete with endurance sports require type 1 ms fibers</li> <li>c) Difference in ms fibers distribution among athelete is due to natural selection and training</li> <li>d) Training has a great effect on ms ms transformation</li> </ul>	<b>D</b>

## Written MSK 4

1. Compare () AP of sk ms and thick myelinated nerve fiber ?
2. Mention component of initial heat during sk ms contraction ?
3. Compare () isotonic and isometric contraction ?
4. Def force velocity relationship ?
5. Def long tention relationship ?
6. Give a short note on mechanism of isometric contraction ?

## MCQ MSK 4

<p><b>1. In skeletal muscles, there is an inverse relationship between:</b></p> <ul style="list-style-type: none"><li>a) The muscle length and force of contraction.</li><li>b) The load opposing the contraction and velocity of contraction.</li><li>c) The cross sectional area and strength of the muscle.</li><li>d) All of the above.</li></ul>	<b>B</b>
<p><b>2. In isometric contractions, the initial heat is:</b></p> <ul style="list-style-type: none"><li>a) Too small to measure.</li><li>b) Approximately equal to the activation heat.</li><li>c) Equal to the shortening heat.</li><li>d) More than the relaxation heat.</li></ul>	<b>B</b>
<p><b>3. Maximal tension is developed in skeletal muscles when they are at:</b></p> <ul style="list-style-type: none"><li>a) The equilibrium length,</li><li>b) The resting length.</li><li>c) More than the resting length.</li><li>d) 3 times the equilibrium length.</li></ul>	<b>B</b>
<p><b>4. Concerning isometric and isotonic muscle contractions:</b></p> <ul style="list-style-type: none"><li>a) Isometric contraction does not require sliding of actin filaments.</li><li>b) During isometric contraction a load is moved and work is done.</li></ul>	<b>C</b>

<p>c) During isotonic contraction a greater amount of energy is needed.</p> <p>d) During isotonic contraction the muscle length is not changed.</p> <p>e) in isometric contraction the series and parallel elastic elements are not stretched</p>	
<p><b>5. The contractile response in skeletal muscles:</b></p> <p>a) Starts after the action potential is over.</p> <p>b) Lasts for a similar period as the action potential.</p> <p>c) Produces more tension when the muscle contracts isotonicly.</p> <p>d) Produces more work when the muscle contracts isotonicly</p>	<b>E</b>
<p><b>6. The contractile response in skeletal muscle</b></p> <p>a) starts after the action potential is over.</p> <p>b) does not last as long as the action potential.</p> <p>c) produces more tension when the muscle contracts isometrically than when the muscle contracts isotonicly.</p> <p>d) produces more work when the muscle contracts isometrically than when the muscle contracts isotonicly.</p> <p>e) decreases in magnitude with repeated stimulation.</p>	<b>C</b>
<p><b>7. About activation of skeletal muscles, all the following is true except:</b></p> <p>a) The resting membrane potential is about -90 mV.</p> <p>b) The magnitude of the action potential is more than that in nerves.</p> <p>c) The firing level is reached after about 40 mV of depolarization.</p> <p>d) Shortening occurs simultaneously with the onset of depolarization.</p> <p>e) The spike is propagated along ms surface at a speed of 5 m/second.</p>	<b>D</b>
<p><b>8. About the isotonic muscle contraction:</b></p> <p>a) It does not involve sliding of the actin filaments.</p> <p>b) It requires more energy than the isometric contractions</p> <p>c) It is characterized by rise of the muscle tension.</p> <p>d) During it no work is done.</p> <p>e) It occurs when a load is too heavy to be moved.</p>	<b>B</b>

<p><b>9. In isometric contraction of skeletal muscles:</b></p> <ul style="list-style-type: none"> <li>a. Muscle shortens.</li> <li>b. Work is done.</li> <li>c. Muscle tension is markedly increased.</li> <li>d. Mechanical efficiency is maximum,</li> <li>e. Muscle tension is maintained constant during major part of contraction.</li> </ul>	<b>C</b>
<p><b>10. Skeletal muscle action potential is not characterized by:</b></p> <ul style="list-style-type: none"> <li>a. RMP at -90 mv..</li> <li>b. Magnitude of the spike at 105 mv</li> <li>c. Firing level at -50 mv.</li> <li>d. Velocity of conduction up to 3-5 m/sec.</li> <li>e. Duration of spike 3-5 m sec.</li> </ul>	<b>B</b>
<p><b>11. The duration of action potential of skeletal muscle fiber is:</b></p> <ul style="list-style-type: none"> <li>a. 5 msec.</li> <li>b. 25 msec.</li> <li>c. 200 msec.    d. 250 msec.</li> </ul>	<b>A</b>
<p><b>12. The absolute refractory period:</b></p> <ul style="list-style-type: none"> <li>a) is a period during which excitability is completely lost.</li> <li>b) is a period during which stronger stimulus is needed to excite the muscle fiber.</li> <li>c) is coincided with the descending limb of the spike.</li> <li>d) is a period during which the excitability is less than normal.</li> <li>e) none of the above.</li> </ul>	<b>A</b>
<p><b>13. Relative refractory period:</b></p> <ul style="list-style-type: none"> <li>a) is an increase in excitability.</li> <li>b) is a complete loss of excitability.</li> <li>c) coincides with the second 2/3 of descending limb of spike.</li> <li>d) during it the nerve can't respond to any stimulus whatever its strength.</li> <li>e) coincides with after hyperpolarization.</li> </ul>	<b>C</b>

<p><b>14. The absolute refractory period in the skeletal muscle:</b></p> <ul style="list-style-type: none"> <li>a) coincides with the descending limb of the spike.</li> <li>b) coincides with after depolarization.</li> <li>c) is short and ends before start of contraction.</li> <li>d) is accompanied only with decreased excitability.</li> <li>e) is long and occupies the duration of contraction.</li> </ul>	<b>C</b>
<p><b>15. The excitability of the Ms is zero during:</b></p> <ul style="list-style-type: none"> <li>a) super normal phase of excitability.</li> <li>b) relative refractory period.</li> <li>c) sub normal phase of excitability.</li> <li>d) local response. E) absolute refractory period.</li> </ul>	<b>E</b>
<p><b>16. Strength of contraction of skeletal muscle is high when it is stimulated at:</b></p> <ul style="list-style-type: none"> <li>a) resting length.</li> <li>b) equilibrium length.</li> <li>c) lower temperature.</li> <li>d) a length more than the resting length.</li> <li>e) a length less than the resting length.</li> </ul>	<b>A</b>
<p><b>17. Isometric contraction is characterized by:</b></p> <ul style="list-style-type: none"> <li>a) constant tension.</li> <li>b) constant length.</li> <li>c) decrease in length.</li> <li>d) high mechanical efficiency.</li> <li>e) low tension in the muscle.</li> </ul>	<b>B</b>
<p><b>18. Isotonic contraction differs than isometric contraction in that it:</b></p> <ul style="list-style-type: none"> <li>a) shows constant length.</li> <li>b) shows increased tension.</li> <li>c) performs no work.</li> <li>d) has zero mechanical deficiency.</li> <li>e) needs more energy.</li> </ul>	<b>E</b>

<p><b>19. When shortening of the contractile element of the skeletal muscle fiber is compensated by equal lengthening of series elastic element, accompanied by increase in muscle tension, this is considered:</b></p> <ul style="list-style-type: none"> <li>a. Isotonic contraction.</li> <li>b. Isometric contraction.</li> <li>c. Preloading.</li> <li>d. All or none law.</li> <li>e. Afterloading.</li> </ul>	<b>B</b>
<p><b>20. Force of skeletal muscle contraction:</b></p> <ul style="list-style-type: none"> <li>a. Is independent on number of motor units.</li> <li>b. Increases with increasing the load facing the muscle.</li> <li>c. Is directly proportional to the number of <math>Ca^{++}</math> ions in the muscle.</li> <li>d. Is independent on summation.</li> <li>e. Is inversely proportional to the initial length of the muscle.</li> </ul>	<b>C</b>
<p><b>21. Which of the following describes the Force-Velocity Relationship:</b></p> <ul style="list-style-type: none"> <li>a. It is applied during the isometric contraction.</li> <li>b. Velocity of shortening depends on the initial length of the muscle fiber.</li> <li>c. Velocity of shortening is minimal at zero load.</li> <li>d. Velocity of shortening is directly proportional to the load.</li> <li>e. Shortening velocity is determined by the rate at which cross bridges undergo their cycle activity.</li> </ul>	<b>E</b>
<p><b>22. During isotonic contraction:</b></p> <ul style="list-style-type: none"> <li>a. The mechanical efficiency is zero.</li> <li>b. The muscle length is unchanged.</li> <li>c. The external work done by the muscle is zero.</li> <li>d. The energy required is high.</li> <li>e. The heat production is maximal.</li> </ul>	<b>D</b>

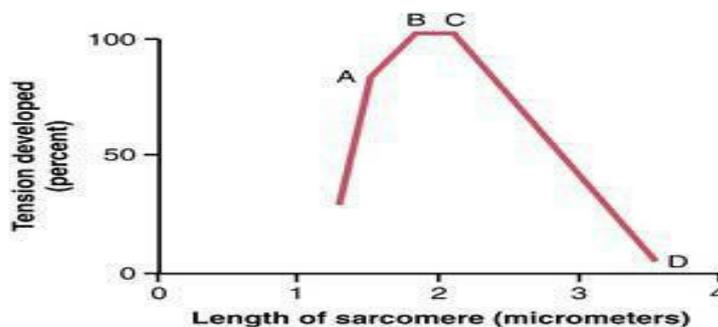
<p><b>23. On plotting the electrical and mechanical events of the skeletal muscle simultaneously, the absolute refractory period in the action potential corresponds to which of the following phase in the simple muscle twitch?</b></p> <p>a. The latent period.  b. The contraction phase.  c. The relaxation phase.  d. The peak of the twitch.  e. The entire twitch.</p>	<b>A</b>
<p><b>24. During isometric contraction:</b></p> <p>a. The duration of contraction is long.  b. The muscle tension is constant.  c. The external work done by the muscle is zero.  d. The heat production is minimal.  e. The energy required is high.</p>	<b>C</b>
<p><b>25. Absolute Refractory Period electrically occupies:</b></p> <p>a. Ascending limb of depolarization only.  b. Ascending limb of depolarization + upper 1/3 of repolarization.  c. Lower 2/3 of repolarization only.  d. Ascending limb of depolarization + upper 2/3 of repolarization.  e. Descending limb of repolarization only.</p>	<b>B</b>
<p><b>26. Relative Refractory Period electrically occupies:</b></p> <p>a. Ascending limb of depolarization only.  b. Ascending limb of depolarization + upper 1/3 of repolarization.  c. Lower 2/3 of repolarization only.  d. Ascending limb of depolarization + upper 2/3 of repolarization.  e. Descending limb of repolarization only.</p>	<b>C</b>

<p><b>27. A skeletal muscle contracting isometrically generates the greatest tension at its normal resting length because at that length:</b></p> <p>A. The cellular concentration of ATP is highest</p> <p>B. Sarcoplasmic reticulum is most precisely aligned with the thick filaments</p> <p>C. The rate of conduction of the action potential across the cell membrane is most rapid</p> <p>D. The greatest number of cross bridges is aligned with actin binding sites</p>	<b>D</b>
<p><b>28. When contracting isometrically, a skeletal muscle will develop its greatest tension:</b></p> <p>A. At its normal resting length</p> <p>B. At 60% of its normal resting length</p> <p>C. At 150% of its normal resting length</p> <p>D. The tension developed is constant, irrespective of its length</p>	<b>A</b>
<p><b>29. The force of contraction of a skeletal muscle depends on all of the following factors EXCEPT:</b></p> <p>A. Its initial length</p> <p>B. The number of motor units activated</p> <p>C. The type of muscle fiber it contains</p> <p>D. The extracellular <math>Ca^{++}</math> concentration</p>	<b>D</b>
<p><b>30. The contractile response of the skeletal muscle:</b></p> <p>a. Starts after the AP is over</p> <p>b. Lasts for a similar period as AP</p> <p>c. Produces more tension when the muscle contracts isotonicly</p> <p>d. Produces more work when he muscle contracts isometrically</p> <p>e. Can increase with repeated stimuli</p>	<b>E</b>



**35. The diagram shows the length–tension relationship for a single sarcomere.**

**Why is the tension development maximal between points B and C?**



- A) Actin filaments are overlapping each other
- B) Myosin filaments are overlapping each other
- C) The myosin filament is at its minimal length
- D) The Z discs of the sarcomere abut the ends of the myosin filament
- E) There is optimal overlap between the actin and myosin filaments
- F) There is minimal overlap between the actin and myosin filaments

**E**

**36. As regard thermal changes during sk ms contraction , which is true :**

- a) heat production during isotonic contraction is greater than during isometric contraction
- b) delayed heat is 30 times greater than intial heat
- c) most of energy consumed during contraction is converted into work
- d) shortening heat caused by release of Ca from SR

**A**

**37. Which of the following best describes the contractile response of skeletal muscle?**

- A. It starts after the action potential
- B. It does not last as long as the action potential
- C. It produces more tension when the muscle contract isometrically than isotonicly
- D. It produces more tension when the muscle contract isotonicly than isometricly
- E. It decreases in magnitude with repeated stimulation

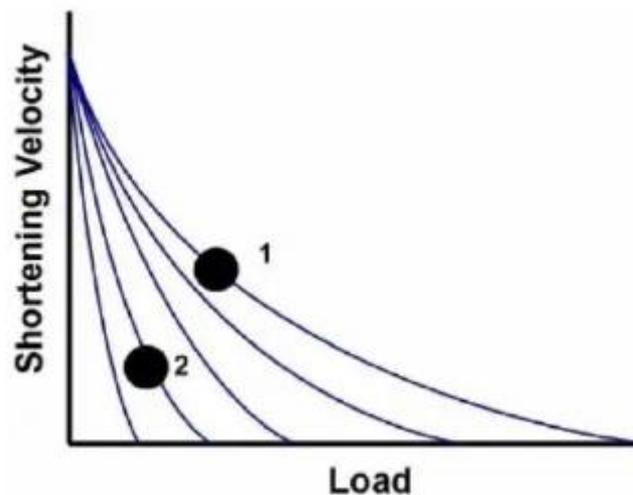
**C**

**38. Which of the following best describes the reason why you can tetanize skeletal muscle but not cardiac muscle?**

- A. The myosin ATPase activity is greater in skeletal muscle when compared to cardiac muscle
- B.  $\text{Ca}^{2+}$ -induced  $\text{Ca}^{2+}$ -release does not allow for tetanization to take place in cardiac muscle
- C. The length tension relationship for cardiac muscle is shorter than that of skeletal muscle
- D. The duration of muscle contraction is longer in skeletal muscle
- E. The ratio of action potential duration to twitch duration is much less in skeletal muscle

**E**

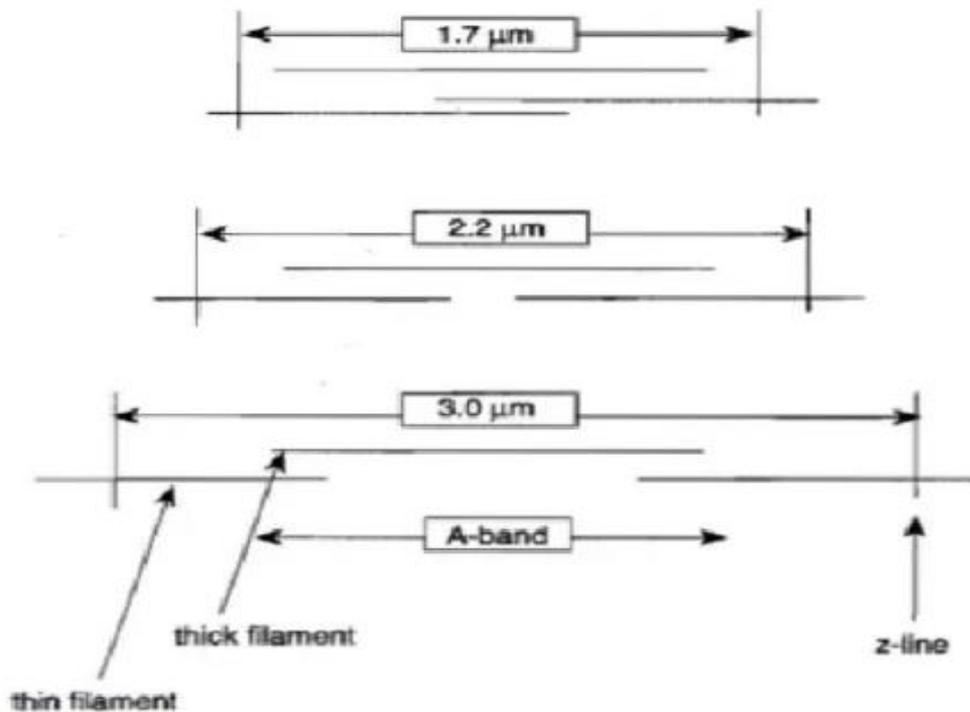
**39. Use the force-velocity diagrams, from the same muscle, below to answer the following question. Which one of the following statements must be true when comparing Point 1 to Point 2?**



- (A) Point 1 is at a shorter resting muscle length
- (B) Point 1 is on a curve that has a greater maximum velocity of shortening
- (C) Point 1 is lifting a greater load
- (D) Point 1 utilizes less energy
- (E) At Point 1 no shortening occurs

**C**

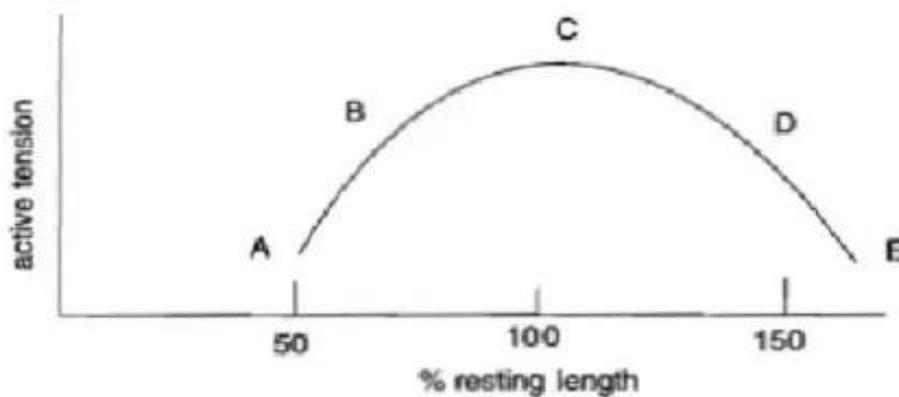
40. During the resting state, a single skeletal muscle sarcomere can exist at a number of lengths. During an isometric contraction, the length at which it can exert its maximum force in response to stimulation is:



B

- (A) 1.7 μm
- (B) 2.2 μm
- (C) 3.0 μm
- (D) All of the them
- (E) Both B and C

41. The figure below depicts the isometric length-tension relationship of skeletal muscle. Identify the region where actin and myosin overlap is the least.



E

<p><b>42. In an isometric contraction of a skeletal muscle, force of contraction cannot be altered by:</b></p> <p>(A) Changing the resting length of the muscle</p> <p>(B) Increasing stimulation frequency</p> <p>(C) Increasing the number of sarcomeres in parallel in the muscle</p> <p>(D) Increasing the number of sarcomeres in series in the muscle</p>	<b>D</b>
<p><b>43. The force produced by a single skeletal muscle fiber can be increased by which of the following?</b></p> <p>A. Decreasing extracellular <math>K^+</math> concentration</p> <p>B. Increasing the amplitude of the depolarizing stimulus</p> <p>C. Increasing the frequency of stimulation of the fiber</p> <p>D. Increasing the number of voltage-gated <math>Na^+</math> channels in the sarcolemma</p> <p>E. Increasing the permeability of the sarcolemma to <math>K^+</math></p>	<b>C</b>
<p><b>44. Repetitive stimulation of a skeletal muscle fiber will cause an increase in contractile strength due to an increase in which of the following?</b></p> <p>(A) The duration of cross-bridge cycling</p> <p>(B) The concentration of <math>Ca^{2+}</math> in the myoplasm during contraction</p> <p>(C) The magnitude of the end-plate potential</p> <p>(D) The number of muscle myofibrils generating tension</p> <p>(E) The velocity of muscle contraction</p>	<b>A</b>
<p><b>45. The sk ms :</b></p> <p>(A) contain pacemaker cell</p> <p>(B) contract when Ca taken up by sarcotubular system</p> <p>(C) Contraction strength related to initial length</p> <p>(D) contraction occur when actine and myosin shorten</p>	<b>C</b>
<p><b>46. Percentage of energy converted into work during ms contraction :</b></p> <p>(A) 60-70%</p> <p>(B) 10-20%</p> <p>(C) 40-50%      (D) 80-90%</p>	<b>C</b>

**MCQ**

<p>1. Which type of skeletal muscle fibers has a high oxidative capacity and is rich in myoglobin and blood capillaries?</p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>A</p>
<p>2. Which type of skeletal muscle fibers are adapted for rapid fine movements and have a rapid contraction phase?</p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>C</p>
<p>3. Which type of muscle fibers are resistant to fatigue due to their slow contraction rate and rich blood supply?</p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>A</p>
<p>4. Which type of muscle fibers have a higher number of mitochondria, myoglobin, and blood capillaries, providing more energy through aerobic oxidation?</p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>A</p>

<p><b>5. Which type of muscle fibers are more predominant in athletes involved in sports requiring aerobic and endurance capacities?</b></p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>A</p>
<p><b>6. The primary stimulus for muscle hypertrophy in response to training?</b></p> <p>a) Increased actin and myosin concentration                  b) Increased number and size of myofibrils                  c) Increased muscle tension                  d) decreased muscle work</p>	<p>C</p>
<p><b>7. What are the metabolic adaptations that occur with training in skeletal muscle fibers?</b></p> <p>a) Increase in mitochondrial size and number                  b) Increase in enzymes of citric acid cycle and electron transport                  c) Increase in muscle buffer capacity                  d) All of the above</p>	<p>D</p>
<p><b>8. Which type of skeletal muscle fibers has a high glycolytic capacity and is adapted for rapid fine movements?</b></p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>C</p>
<p><b>9. Which muscle fiber type is associated with a rapid SMT?</b></p> <p>a) Type I (Slow oxidative)                  b) Type IIA (Fast oxidative)                  c) Type IIB (Fast glycolytic)                  d) All of the above</p>	<p>C</p>

<p><b>10. Which type of muscle fibers have a higher ATPase activity?</b></p> <ul style="list-style-type: none"> <li>a) Type I (Slow oxidative)</li> <li>b) Type IIA (Fast oxidative)</li> <li>c) Type IIB (Fast glycolytic)</li> <li>d) All of the above</li> </ul>	<p><b>C</b></p>
<p><b>11. Which type of muscle fibers are adapted for anaerobic oxidation and have fewer mitochondria and blood capillaries?</b></p> <ul style="list-style-type: none"> <li>a) Type I (Slow oxidative)</li> <li>b) Type IIA (Fast oxidative)</li> <li>c) Type IIB (Fast glycolytic)</li> <li>d) All of the above</li> </ul>	<p><b>C</b></p>
<p><b>12. Primary adaptation that leads to increased muscle size with training?</b></p> <ul style="list-style-type: none"> <li>a) Hyperplasia</li> <li>b) Hypertrophy</li> <li>c) Increased connective tissue</li> <li>d) Increased elastic tissue</li> </ul>	<p><b>B</b></p>
<p><b>13. What are the metabolic adaptations that occur with aerobic training in muscle fibers?</b></p> <ul style="list-style-type: none"> <li>a) Increase in mitochondrial size and number</li> <li>b) Increase in enzymes of citric acid cycle and electron transport</li> <li>c) Increase in muscle buffer capacity</li> <li>d) All of the above</li> </ul>	<p><b>D</b></p>
<p><b>14. Which type of muscle fibers are more resistant to fatigue due to their high oxidative capacity?</b></p> <ul style="list-style-type: none"> <li>a) Type I (Slow oxidative)</li> <li>b) Type IIA (Fast oxidative)</li> <li>c) Type IIB (Fast glycolytic)</li> <li>d) All of the above</li> </ul>	<p><b>A</b></p>

<p><b>15. Which type of muscle fibers have a higher density of blood capillaries?</b></p> <ul style="list-style-type: none"> <li>a) Type I (Slow oxidative)</li> <li>b) Type IIA (Fast oxidative)</li> <li>c) Type IIB (Fast glycolytic)</li> <li>d) All of the above</li> </ul>	<p><b>A</b></p>
<p><b>16. Which type of muscle fibers have a smaller diameter?</b></p> <ul style="list-style-type: none"> <li>a) Type I (Slow oxidative)</li> <li>b) Type IIA (Fast oxidative)</li> <li>c) Type IIB (Fast glycolytic)</li> <li>d) All of the above</li> </ul>	<p><b>A</b></p>
<p><b>17. What is the effect of training on muscle fibers' oxidative capacity?</b></p> <ul style="list-style-type: none"> <li>a) Decreased oxidative capacity</li> <li>b) Unchanged oxidative capacity</li> <li>c) Increased oxidative capacity</li> <li>d) Neglect oxidation &amp; depend only on glycolysis</li> </ul>	<p><b>C</b></p>
<p><b>18. Which type of muscle fibers have the highest concentration of myoglobin?</b></p> <ul style="list-style-type: none"> <li>a) Type I (Slow oxidative)</li> <li>b) Type IIA (Fast oxidative)</li> <li>c) Type IIB (Fast glycolytic)</li> <li>d) All of the above</li> </ul>	<p><b>A</b></p>
<p><b>19. Red (slow) fibers are characterized by the following except</b></p> <ul style="list-style-type: none"> <li>a- Contains much blood capillaries</li> <li>b- Called type I fibers</li> <li>c- Contains high concentration of myoglobin</li> <li>d- Depends on anaerobic oxidation</li> </ul>	<p><b>D</b></p>



<p><b>20. The fast of muscles is characterized by all the following except :</b></p> <ul style="list-style-type: none"><li>a. High ATPase activity in the mitochondria.</li><li>b. Specialization for posture maintenance.</li><li>c. Rapid fatigue.</li><li>d. Absence of myoglobin.</li></ul>	<b>B</b>
<p><b>21. Hypertrophy in skeletal muscle fibers primarily occurs due to:</b></p> <ul style="list-style-type: none"><li>a) Increased number of muscle cells</li><li>b) Increased size of muscle cells</li><li>c) Increased tendinous and ligamentous tissues</li><li>d) Increased quantity of enzymes and stored nutrients</li></ul>	<b>B</b>
<p><b>22. Which type of muscle fibers are typically increased with anaerobic training?</b></p> <ul style="list-style-type: none"><li>a) Type I fibers</li><li>b) Type II fibers</li><li>c) Both type I and type II fibers</li><li>d) There is no change in fiber type distribution with anaerobic training</li></ul>	<b>B</b>
<p><b>23. Improved muscle coordination with training is attributed to:</b></p> <ul style="list-style-type: none"><li>a) Muscle fiber hypertrophy</li><li>b) Increased mitochondrial size and number</li><li>c) Enhanced neuromuscular control</li><li>d) Increased muscle buffer capacity</li></ul>	<b>C</b>
<p><b>24. Athletes in sports requiring the greatest aerobic and endurance capacities typically have a high percentage of:</b></p> <ul style="list-style-type: none"><li>a) Type I fibers</li><li>b) Type II fibers</li><li>c) Both type I and type II fibers</li><li>d) No specific fiber type preference</li></ul>	<b>A</b>

<p><b>25. Athletes involved in sports requiring greater anaerobic capacities and power typically have a higher percentage of:</b></p> <ul style="list-style-type: none"><li>a) Type I fibers</li><li>b) Type II fibers</li><li>c) Both type I and type II fibers in equal proportion</li><li>d) No specific fiber type preference</li></ul>	<b>B</b>
<p><b>26. Sprint training may alter neuromuscular control by:</b></p> <ul style="list-style-type: none"><li>a) Decreasing the recruitment of fast-twitch motor units</li><li>b) Decreasing the firing frequency of fast-twitch motor units</li><li>c) Increasing the recruitment or firing frequency of fast-twitch motor units</li><li>d) Decreasing coordination of antagonistic muscle pairs</li></ul>	<b>C</b>
<p><b>27. What is the primary role of muscle buffer capacity?</b></p> <ul style="list-style-type: none"><li>a) Enhancing muscle coordination</li><li>b) Preventing lactic acidosis</li><li>c) Increasing muscle strength</li><li>d) Promoting muscle hypertrophy</li></ul>	<b>B</b>
<p><b>28. The distribution of muscle fiber types in athletes is influenced by:</b></p> <ul style="list-style-type: none"><li>a) Natural selection only</li><li>b) Training-induced fiber-type transformation and gender</li><li>c) Training-induced fiber-type transformation and natural selection</li><li>d) Age and gender</li></ul>	<b>C</b>
<p><b>29. What is the role of satellite cells in muscle fiber regeneration?</b></p> <ul style="list-style-type: none"><li>a) Differentiation and proliferation to form new muscle fibers</li><li>b) Synthesis of contractile proteins in muscle fibers</li><li>c) Enhancement of muscle coordination</li><li>d) Stimulation of mitochondrial growth in muscle fibers</li></ul>	<b>A</b>



**1. The skeletal muscle fibers are innervated by.....:**

- A. Type A alpha nerve fibers
- B. Type A beta nerve fibers
- C. Type B nerve fibers
- D. Type C nerve fibers

**2. The skeletal muscle fibers are innervated by.....**

- A. Thick non-myelinated nerve fibers
- B. Thick myelinated nerve fibers
- C. Thin myelinated nerve fibers
- D. Thin non-myelinated nerve fibers

**3. .....is a motor neuron and the muscle fibers supplied by it**

- A. Motor end plate
- B. Neuromuscular transmission
- C. Motor unit
- D. None of the above

**4. In muscles perform fine and delicate movements, number of muscle fibers innervated by the same motor neuron is.....**

- A. Less than 10
- B. 100
- C. 1000
- D. 2000

**5. In muscles perform coarse movements, number of muscle fibers innervated by the same motor neuron is.....**

- A. Less than 10
- B. 100
- C. 500
- D. 1000

1. A	2. B	3. C	4. A	5. D
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**6. Which of the following muscles perform fine and delicate movements.....:**

- A. Back muscles
- B. Eye muscles
- C. Thigh muscles
- D. Gastrocnemius muscle

**7. Regarding gastrocnemius muscle which of the following is correct**

- A. It perform coarse movements
- B. Number of its muscle fibers innervated by the same motor neuron is less than 10
- C. It perform fine and delicate movements
- D. Number of its muscle fibers innervated by the same motor neuron is 100

**8. Vesicles at the presynaptic part of NMJ contain .....**

- A. Adrenaline
- B. Noradrenaline
- C. Acetylcholine
- D. Dopamine

**9. Width of synaptic cleft of NMJ is .....**

- A. 5-10 nm
- B. 10-20 nm
- C. 20-30 nm
- D. 10-30 nm

**10. Receptors present at motor end plate are .....**

- A. Muscarinic
- B. Nicotinic (Nm)
- C. Nicotinic (Nn)
- D. Alpha adrenergic

6. B	7. A	8. C	9. D	10. B
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**11. Nicotinic receptors at the motor end plate are.....:**

- A. G protein coupled receptors
- B. Ligand-gated ion channels
- C. Voltage-gated ion channels
- D. None of the above

**12. .....enzyme hydrolyzes Ach to choline and acetic acid**

- A. Cholinesterase
- B. MAO
- C. COMT
- D. Choline acetyltransferase

**13. Acetylcholine synthesis is mediated by.....enzyme**

- A. Cholinesterase
- B. MAO
- C. COMT
- D. Choline acetyltransferase

**14. Miniature end plate potential**

- A. Is a weak repolarization of the MEP.
- B. Is caused by spontaneous rupture of few vesicles at rest
- C. Persist for a long time
- D. Is diffuse at the MEP

**15. Regarding neuromuscular transmission which of the following is correct.....**

- A. It is bi-directional
- B. It doesn't show fatigue
- C. There is a synaptic delay
- D. All of the above

11.B	12.A	13.D	14.B	15.C
------	------	------	------	------



**16. Synaptic delay of neuromuscular transmission is about.....:**

- A. 0.5 m.sec
- B. 1 m.sec
- C. 1.5 m.sec
- D. 2 m.sec

**17. Fatigue of neuromuscular transmission is due to.....**

- A. Presence of Ach only in terminal parts of the nerve fiber
- B. Depletion of the Ach vesicles
- C. Spontaneous rupture of few vesicles at rest
- D. All of the above

**18. Synaptic transmission at the NMJ is.....?**

- A. Enhanced by high levels of cholinesterase
- B. Caused by influx of potassium ions through the muscle membrane
- C. Stimulated by magnesium ions
- D. Produced by the release of Ach from alpha motor neurons in skeletal muscles

**19. Neuromuscular transmission is blocked by.....?**

- A. Neostigmine
- B. Methacholine
- C. Succinylcholine
- D. Potassium ions

**20. Which of the following competes with Ach at the nicotinic receptors .....**

- A. Curare
- B. Hemicholinium
- C. Botulinum toxin
- D. Methacholine

16.A	17.B	18.D	19.C	20.A
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**21. Which of the following causes postsynaptic block at the NMJ.....:**

- A. Succinylcholine
- B. Hemicholinium
- C. Botulinum toxin
- D. Methacholine

**22. Which of the following causes presynaptic block at the NMJ .....?**

- A. Succinylcholine
- B. Hemicholinium
- C. Curare
- D. Methacholine

**23. Which of the following prevent synthesis and release of Ach .....?**

- A. Succinylcholine
- B. Neostigmine
- C. Botulinum toxin
- D. Methacholine

**24. Which of the following stimulates NMT?**

- A. Succinylcholine
- B. Curare
- C. Hemicholinium
- D. Methacholine

**25. Which of the following increases NMT?**

- A. Hypercalcemia
- B. Magnesium ions
- C. Potassium ions
- D. All of the above

21.A

22.B

23.C

24.D

25.C



**26. Which of the following has anti-curare action on the motor end plate .....**

- A. Magnesium ions
- B. Potassium ions
- C. Hemicholinium
- D. Succinylcholine

**27. Which of the following Stabilize the Ach vesicles and prevent release of Ach?**

- A. Magnesium ions
- B. Potassium ions
- C. Curare
- D. Succinylcholine

**28. Which of the following inhibit cholinesterase enzyme.....?**

- A. Succinylcholine
- B. Botulinum toxin
- C. Neostigmine
- D. Methacholine

**29. Hemicholinium action on the NMJ is.....?**

- A. Stimulate Nm receptors directly
- B. Inhibit cholinesterase enzyme
- C. Prevent synthesis and release of Ach
- D. Interfere with choline uptake

**30. Myasthenia gravis is characterized by.....**

- A. It is an autoimmune disease where muscle contraction is aggravated
- B. Antibodies against muscarinic receptors at the MEP
- C. Muscle weakness that can be treated by anti-cholinesterase
- D. None of the above

26. B	27. A	28. C	29. D	30. C
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**31. The first muscles to be affected in myasthenia gravis are.....:**

- A. Lower limb muscles
- B. Muscles supplied by cranial nerves
- C. Back muscles
- D. Arm muscles

**32. NMJ in myasthenia gravis is characterized by.....?**

- A. Decreased number of junctional folds
- B. Decreased number of Ach receptors on MEP
- C. Widening of synaptic cleft
- D. All of the above

**33. Myasthenia gravis .....**

- A. is an autoimmune disease that affects neuro-muscular junction
- B. Characterized by marked muscle weakness and rapid onset of fatigue
- C. is common in young females
- D. All of the above

**34. Cause of death in patients with myasthenia gravis is.....?**

- A. Renal failure
- B. Cerebral hemorrhage
- C. Paralysis of respiratory muscles
- D. Myocardial infarction

**35. Myasthenia gravis can be treated with.....**

- A. Prostigmine
- B. Succinylcholine
- C. Curare
- D. Benzodiazepines

31. B	32. D	33. D	34. C	35. A
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**1. Muscles constitute .....of the body weight?**

- A. 10 %
- B. 20 %
- C. 40 %
- D. 50 %

**2. Skeletal muscles constitute .....of the body weight?**

- A. 10 %
- B. 20 %
- C. 40 %
- D. 50 %

**3. During rest, .....of heat production in body is due to muscle tone**

- A. 30 %
- B. 50 %
- C. 70 %
- D. 90 %

**4. Structural unit of skeletal muscles is.....**

- A. Muscle fiber
- B. Myofibril
- C. Sarcomere
- D. Fasciculus

**5. Functional unit of skeletal muscles is .....**

- A. Muscle fiber
- B. Myofibril
- C. Sarcomere
- D. Fasciculus

1. D

2. C

3. B

4. A

5. C



6. .....are tubular extensions extend from sarcolemma deep into the muscle fiber at the junction of A bands & I bands?
- A. Terminal cisternae
  - B. Longitudinal tubules
  - C. Transverse tubules
  - D. Sarcomere
7. Which of the following help longitudinal distribution of ions and substances within the sarcoplasm?
- A. Terminal cisternae
  - B. Sarcoplasmic reticulum
  - C. Transverse tubules
  - D. Sarcomere
8. Triad of tubular system in skeletal muscles is formed of.....
- A. One T tubule and two terminal cisternae
  - B. Two T tubules and one terminal cisternae
  - C. Three T tubules
  - D. Three terminal cisternae
9. Which of the following is responsible for calcium release and storage during muscle contraction and relaxation respectively.....
- A. Sarcolemma
  - B. T tubules
  - C. Sarcomere
  - D. Terminal cisternae
10. Which of the following help the spread of depolarization wave to inside the interior of muscle fiber?
- A. Terminal cisternae
  - B. Sarcoplasmic reticulum
  - C. Transverse tubules
  - D. Sarcomere

6. C

7. B

8. A

9. D

10. C



**11. Part of the myofibril present between the 2 Z lines is.....:**

- A. Terminal cisternae
- B. Sarcoplasmic reticulum
- C. Transverse tubules
- D. Sarcomere

**12. Which of the following is a relaxing protein that covers the binding sites of myosin on actin?**

- A. Tropomyosin
- B. Troponin C
- C. Troponin T
- D. Troponin I

**13. Troponin I binds to.....**

- A. Tropomyosin
- B. Actin
- C. Ca ions
- D. Myosin

**14. Which of the following are thick filaments?**

- A. Actin
- B. Tropomyosin
- C. Myosin
- D. Troponin

**15. Troponin C binds to .....**

- A. Tropomyosin
- B. Actin
- C. Myosin
- D. Ca ions

11.D	12.A	13.B	14.C	15.D
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**16. Regarding myosin filaments which of the following is correct .....:**

- A. Head of cross-bridges act as ATPase
- B. The tail contains binding sites for actin and ATP
- C. They binds to troponin T
- D. All of the above

**17. Transverse striations of skeletal muscle fibers are made by.....**

- A. Thick and thin filaments
- B. Light and dark bands
- C. T tubules
- D. None of the above

**18. Regarding cross-bridge cycling which of the following is correct.....?**

- A. Cross-bridge binds to troponin.
- B. ATP binds to the actin binding site.
- C. Detachment of the cross-bridges from the thin filaments doesn't require ATP
- D. Cross-bridge cycling occurs so long as  $\text{Ca}^{++}$  ions combine with troponin.

**19. All of the following occur as a result of cross-bridge cycling except.....?**

- A. The Z lines are approximated from each other.
- B. The sarcomeres become shorter
- C. The width of the A band decrease
- D. H zones become narrower

**20. In excitation-contraction coupling .....**

- A. The muscle action potential propagates along the sarcolemma and down the transverse tubules.
- B.  $\text{Ca}^{2+}$  released from the sarcoplasmic reticulum binds to tropomyosin.
- C. Troponin blocks binding of myosin heads to actin filaments.
- D. Relaxation occurs when  $\text{Ca}^{2+}$  is excreted from the muscle fibre

16.A

17.B

18.D

19.C

20.A

**21. Excitation-contraction coupling in skeletal muscles involves.....:**

- A. Binding of Ca ions to tropomyosin
- B. Binding of Ca ions to myosin head
- C. Attachment of myosin head to the active site of actin
- D. Release of Ca ions from T-tubules

**22. Relaxation of skeletal muscles .....?**

- A. Can occur in the absence of ATP
- B. Is completely passive process
- C. Results from simple diffusion of Ca to extracellular fluid
- D. None of the above

**23. Excitation contraction coupling involves all the following except .....?**

- A. Release of Ca<sup>++</sup> from troponin.
- B. Formation of cross bridges between actin and myosin.
- C. Spread of depolarization along the transverse tubules.
- D. Bending of the cross-bridges and sliding of the thin filaments across the thick filaments.

**24. Inability of the cross bridges to detach from actin due to lack of ATP after death****leads to.....?**

- A. Algor mortis
- B. Rigor mortis
- C. Livor mortis
- D. None of the above

21.C

22.D

23.A

24.B



**2** Changes occurring as a result of muscle contraction

**1. Resting membrane potential of skeletal muscle fibers is.....?**

- A. - 90 mv
- B. - 70 mv
- C. - 60 mv
- D. - 50 mv

**2. Firing level of action potential in skeletal muscle fibers is..... ?**

- A. - 60 mv
- B. - 55 mv
- C. - 50 mv
- D. - 40 mv

**3. Magnitude of the spike potential in skeletal muscle fibers is.....**

- A. 90 mv
- B. 105 mv
- C. 120 mv
- D. 130 mv

**4. Which of the following is correct regarding action potential in skeletal muscle fibers.....**

- A. Duration of the spike potential is 0.5 - 1 m.sec
- B. Velocity of conduction is 3-5 meters/sec
- C. Duration of the after potentials is relatively shorter than thick myelinated nerve fibers
- D. All of the above

**5. Concerning isometric and isotonic contraction .....**

- A. Isometric contraction occurs when muscle contract against light or moderate load
- B. During isometric contraction a load is moved and work is done
- C. Oxygen and nutrient requirements are greater during isotonic contraction than isometric contraction
- D. During isotonic contraction the muscle length is not changed

1. A	2. C	3. D	4. B	5. C
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**6. Regarding isometric contraction which of the following is correct?**

- A. Energy is converted into heat only
- B. Muscle tension is markedly increased
- C. It occurs when muscle contract against heavy load
- D. All of the above

**7. Regarding isotonic contraction all of the following is correct except.....?**

- A. The muscle shortens
- B. The load is not moved and no work is done
- C. Mechanical efficiency is maximum
- D. Muscle tension Increase at first then maintained constant during major part of contraction

**8. During muscle contraction .....**

- A. Heat production is markedly increased compared with the heat production during rest
- B. 50-60% of the energy liberated as a result of hydrolysis of ATP is converted into work.
- C. 40-50% of the energy is liberated as heat at the onset of and during muscle contraction
- D. All of the above

**9. Regarding anerobic oxidation of glucose in the muscles which of the following is correct.....**

- A. It occurs during low or moderate activity
- B. Great amount of ATP is produced
- C. It is rapid but not economic
- D. It supplies ATP at a slow rate within a long time

**10. In exhausted muscles mechanism for the supply of ATP is.....?**

- A. Anerobic oxidation of glucose
- B. Combining two ADP molecules to reform one ATP molecule and one AMP molecule
- C. Aerobic oxidation of glucose
- D. None of the above

6. D	7. B	8. A	9. C	10. B
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**11. Regarding aerobic oxidation of glucose in the muscles which of the following is correct .....**

- A. It occurs when the muscle is doing work at a faster rate than the blood can supply O<sub>2</sub> and nutrients
- B. It supplies ATP at a high rate and within short time
- C. Great amount of ATP is produced
- D. It is slow and not economic

**12. The high energy phosphate storage in the muscle is sufficient to allow the muscle to contract only .....times?**

- A. 5-10
- B. 10-20
- C. 30-60
- D. 50-100

**13. Skeletal muscle contraction of the .....**

- A. Isometric type is characterized by increased tension
- B. Isotonic type is characterized by decreased length
- C. Isotonic type is characterized by more energy consumption
- D. All of the above

**14. During isometric contraction?**

- A. Tension is constant
- B. Tension is increased
- C. Tension is decreased
- D. Muscle length decreases

**15. Isotonic contraction is characterized by .....**

- A. Decrease in muscle length
- B. Decreased tension
- C. Very low mechanical efficiency
- D. Constant length

11.C	12.D	13.D	14.B	15.A
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**16. The energy of muscle contraction is derived from all of the following except .....**

- A. ATP
- B. Muscle glycogen
- C. Lactic acid
- D. Creatine phosphate

**17. Recovery of muscles occurs by .....**

- A. Binding of the cross bridges with actin filaments
- B. Removal of the lactic acid and regeneration of the energy stores
- C. Release of  $\text{Ca}^{2+}$  ions from the terminal cisternae of the sarcoplasmic reticulum.
- D. None of the above

**18. Which of the following statements is correct.....?**

- A. In aerobic oxidation of glucose 2 ATP is produced from 1 glucose molecule
- B. The major part of lactic acid produced in muscles is converted into fatty acids in the liver
- C. Energy produced from lactic acid oxidation is used for reformation of ATP
- D. At the end of muscle recovery, energy stores are depleted and lactic acid accumulates

**19. At first during contraction, the pH changes towards .....**

- A. The acidic side due to the release of phosphoric acid.
- B. The alkaline side due to the release of creatine from the Cr-P.
- C. The acidic side due to the release of lactic acid from the anaerobic oxidation of glucose.
- D. None of the above

16.C	17.B	18.C	19.A
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**1. Regarding isometric contraction which of the following is correct?**

- A. The series and parallel elastic elements are not stretched
- B. The length of the muscle remains constant
- C. Tension is markedly decreased
- D. All of the above

**2. Which of the following statements is correct?**

- A. The tension that develops during isometric contraction depend on the size of the muscle
- B. The tension decreases when the muscle length is at the optimal length
- C. At optimal length maximum number of cross bridges connects thin & thick filaments.
- D. A maximum tension is obtained when length of muscle is longer than the optimal length

**3. At optimal length, the sarcomere length is.....**

- A. 1  $\mu\text{m}$
- B. 2  $\mu\text{m}$
- C. 3  $\mu\text{m}$
- D. 4  $\mu\text{m}$

**4. At lengths longer or shorter than optimal length .....**

- A. Degree of overlap between thin and thick filaments decreases
- B. Number of cross bridges between thin and thick filaments decrease
- C. Tension decreases
- D. All of the above

**5. Regarding pacemaker cells which of the following is correct .....**

- A. Nerve terminals are often restricted to pacemaker cells.
- B. They are present in all types of muscles
- C. They receive only sympathetic nerve supply
- D. They initiate the action potential in the muscle

1. B	2. C	3. B	4. D	5. A
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**6. Skeletal muscle action is regulated by.....?**

- A. Nervous control
- B. Hormonal control
- C. Pacemaker cells
- D. None of the above

**7. Plateau is present in the action potential of.... ?**

- A. Skeletal muscles
- B. Cardiac muscles
- C. Smooth muscles
- D. All of the above

**8. The plateau in the action potential of cardiac muscles occurs due to.....**

- A. Inward Na current
- B. Inward K current
- C. Outward Na current
- D. Inward Ca current

**9. The upstroke in the action potential of skeletal muscles occurs due to.....**

- A. Inward Na current
- B. Inward K current
- C. Outward Na current
- D. Inward Ca current

**10. The upstroke in the action potential of smooth muscles occurs due to.....?**

- A. Inward Na current
- B. Outward Na current
- C. Inward Ca current
- D. Outward Ca current

6. A

7. B

8. D

9. A

10. C



**11. Release of calcium ions from sarcoplasmic reticulum in smooth muscles occurs though.....:**

- A. Action potential on T tubules
- B. Calcium ions
- C. Inositol triphosphate
- D. All of the above

**12. Source of calcium ions in skeletal muscles is.....?**

- A. Sarcoplasmic reticulum
- B. ECF
- C. Sarcoplasmic reticulum and ECF
- D. Sarcolemma

**13. Calcium ions enter cardiac muscle fibers from ECF through.....**

- A. Voltage gated  $Ca^{+2}$  channels
- B. DHP  $Ca^{+2}$  channels
- C. Leak  $Ca^{+2}$  channels
- D. None of the above

**14. The regulatory protein in smooth muscles is.....?**

- A. Actin
- B. Tropomyosin
- C. Troponin
- D. Calmodulin

**15. Speed of contraction is very slow in.....**

- A. Skeletal muscles
- B. Cardiac muscles
- C. Smooth muscles
- D. All of the above

11.C

12.A

13.B

14.D

15.C

**16. In smooth muscles calcium ions bind with .....:**

- A. Troponin C
- B. Troponin I
- C. Calmodulin
- D. Troponin T

**17. Smooth muscles needs.....**

- A. Calmodulin for contraction
- B. Nitric oxide for contraction
- C. K<sup>+</sup> for contraction
- D. Monoamine oxidase for contraction

**18. In contraction of gastrointestinal smooth muscle, which of the following events occurs after binding of Ca<sup>2+</sup> to calmodulin .....?**

- A. Depolarization of the sarcolemma membrane
- B. Ca<sup>2+</sup> induced Ca release
- C. Activation of myosin light chain kinase
- D. Opening of ligand-gated Ca<sup>2+</sup> channels

**19. Concerning smooth muscle fibers .....?**

- A. Action potential occurs due to Na influx after opening of voltage gated Na channels
- B. Relaxation occurs when myosin light chain kinase becomes inactive
- C. Ca<sup>2+</sup> /troponin complex activates myosin light chain kinase
- D. Source of calcium ions is only from SR

**20. During contraction of smooth muscles .....**

- A. Ca<sup>2+</sup> binds to calmodulin
- B. Myosin light chain is phosphorylated
- C. The dense bodies come closer to each other
- D. All of the above

**21. During relaxation of smooth muscles .....**

- A. Intracellular Ca<sup>2+</sup> concentration increases
- B. Myosin phosphatase enzyme becomes active.
- C. Myosin light chain kinase enzyme becomes active
- D. All of the above

16.C

17.A

18.C

19.B

20.D

21.B

1.	<p><b>In skeletal muscle, which of the following events occurs before depolarization of the T tubules in the mechanism of excitation-contraction coupling?</b></p> <ul style="list-style-type: none"> <li>a) Depolarization of the sarcolemmal membrane.</li> <li>b) Opening of <math>\text{Ca}^{++}</math> release channels on the sarcoplasmic reticulum (SR).</li> <li>c) Uptake of <math>\text{Ca}^{++}</math> into the SR by <math>\text{Ca}^{++}</math>adenosine triphosphatase (ATPase).</li> <li>d) Binding of <math>\text{Ca}^{++}</math> to troponin C (e) Binding of actin and myosin. Cross bridging of actin over myosin.</li> </ul>	A
2.	<p><b>Among the steps of skeletal muscle relaxation:</b></p> <ul style="list-style-type: none"> <li>a) inward spread of the depolarization wave along the transverse tubules.</li> <li>b) Pumping of <math>\text{Ca}^{++}</math> back into the sarcoplasmic reticulum.</li> <li>c) Release of <math>\text{Ca}^{++}</math> from the sarcoplasmic reticulum.</li> <li>d) Binding of <math>\text{Ca}^{++}</math> to troponin C.</li> <li>e) Binding of cross bridges to actin.</li> </ul>	B
3.	<p><b>Which of the following temporal sequences is correct for excitation-contraction coupling in skeletal muscle?</b></p> <ul style="list-style-type: none"> <li>a) Increased intracellular <math>[\text{Ca}^{++}]</math>; action potential in the muscle membrane; cross-bridge formation.</li> <li>b) Action potential in the muscle membrane; depolarization of the T tubules; release of <math>\text{Ca}^{++}</math> from the sarcoplasmic reticulum (SR).</li> <li>c) Action potential in the muscle membrane; splitting of adenosine triphosphate (ATP); binding of <math>\text{Ca}^{++}</math> to troponin C.</li> <li>d) Release of <math>\text{Ca}^{++}</math> from the SR; depolarization of the T tubules; binding of <math>\text{Ca}^{++}</math> to troponin C.</li> </ul>	B
4.	<p><b>During muscle contraction, which of the following statement is false:</b></p> <ul style="list-style-type: none"> <li>a) The binding sites at the actin filaments are activated by <math>\text{Ca}^{++}</math>.</li> <li>b) The sliding of actin continues as long as <math>\text{Ca}^{++}</math> is attached to troponin C.</li> <li>c) The detachment of myosin heads from actin needs binding of an ATP molecule.</li> <li>d) The transverse tubules become filled with intracellular fluid.</li> <li>e) The sarcomeres become shortened.</li> </ul>	D
5.	<p><b>During muscles contraction:</b></p> <ul style="list-style-type: none"> <li>a) The A bands remain constant.</li> <li>b) The I bands are elongated.</li> <li>c) The Z lines move further apart.</li> <li>d) The H zones become wider.</li> <li>e) The tropomyosin molecules remain in place.</li> </ul>	A

6.	<p><b>In skeletal muscles, the transverse tubules and adjacent cisterns constitute:</b></p> <ul style="list-style-type: none"> <li>a) A triad.</li> <li>b) The sarcolemma.</li> <li>c) A myofibril.</li> <li>d) A muscle fiber.</li> <li>e) The sarcomere.</li> </ul>	A
7.	<p><b>The following characteristics are present in both skeletal and smooth muscles:</b></p> <ul style="list-style-type: none"> <li>a) The myofibrils in both have Z membranes.</li> <li>b) Both initiate spontaneous rhythmic contractions.</li> <li>c) Both contain actin &amp; myosin &amp; show tonic (partial) contraction at rest.</li> <li>d) Both can be affected by hormones and chemicals equally.</li> <li>e) Both have T tubules.</li> </ul>	C
8.	<p><b>In skeletal muscles, one of the following is incorrect:</b></p> <ul style="list-style-type: none"> <li>a) Tropomyosin is found in the thin filaments.</li> <li>b) Myosin is found in the thick filaments.</li> <li>c) The lateral sacs of sarcoplasmic reticulum are rich in <math>Ca^{++}</math></li> <li>d) Troponin C molecules bind <math>Ca^{++}</math>.</li> <li>e) Energy from ATP is not required for muscle relaxation.</li> </ul>	E
9.	<p><b>In skeletal muscles, the:</b></p> <ul style="list-style-type: none"> <li>a) A bands are broader than the I bands and contain both actin and myosin.</li> <li>b) H zones contain only actin and increase in width during contraction.</li> <li>c) Z membranes are present in the middle of the H zones.</li> <li>d) I bands contain myosin only.</li> <li>e) Sole feet at the motor end plate are myelinated branches of the nerve.</li> </ul>	A
10.	<p><b>The functions of tropomyosin in skeletal muscles include:</b></p> <ul style="list-style-type: none"> <li>a) Sliding on actin to produce shortening.</li> <li>b) Releasing <math>Ca^{++}</math> from the sarcoplasmic reticulum.</li> <li>c) Binding to myosin during contraction.</li> <li>d) Acting as a relaxing protein at rest.</li> <li>e) Generating ATP and providing it to the contractile proteins.</li> </ul>	D
11.	<p><b>The cross bridges in skeletal muscles are components of:</b></p> <ul style="list-style-type: none"> <li>a) Myosin</li> <li>b) Troponin</li> <li>c) Actin</li> <li>d) Myelin.</li> <li>e) Tropomyosin</li> </ul>	A

12.	<p><b>One of the following is wrong:</b></p> <ul style="list-style-type: none"> <li>a) Tight gap junctions are absent in skeletal muscles and present in smooth muscles.</li> <li>b) Skeletal muscles don't obey the all or none law while visceral smooth muscles do.</li> <li>c) A motor unit is a single motor neuron and all muscle fibers innervated by it.</li> <li>d) The smooth muscle contracts when stretched in absence of extrinsic nerves.</li> <li>e) All types of muscle contract when <math>\text{Ca}^{++}</math> is taken up by the sarcoplasmic reticulum</li> </ul>	E
13.	<p><b>The action potential of skeletal muscles:</b></p> <ul style="list-style-type: none"> <li>a) Has a prolonged plateau phase.</li> <li>b) Has a smaller magnitude than that of smooth muscles.</li> <li>c) Spreads inwards to all parts of the muscle fiber via the T-tubules.</li> <li>d) Causes uptake of <math>\text{Ca}^{++}</math> into the lateral sacs of the sarcoplasmic reticulum.</li> <li>e) Is not essential for contraction.</li> </ul>	C
14.	<p><b>Among the Steps of muscles contraction one of the following is wrong</b></p> <ul style="list-style-type: none"> <li>a) Generation of an action potential.</li> <li>b) Spread of depolarization into the muscle fibers via the T system.</li> <li>c) Release of <math>\text{Ca}^{++}</math> from the sarcoplasmic reticulum.</li> <li>d) Release of <math>\text{K}^+</math> from troponin T.</li> <li>e) Formation of cross linkages between actin and myosin.</li> </ul>	D
15.	<p><b>Which of the following causes rigor in skeletal muscle?</b></p> <ul style="list-style-type: none"> <li>a) Lack of action potentials in motoneurons.</li> <li>b) An increase in intracellular <math>\text{Ca}^{++}</math> level.</li> <li>c) A decrease in intracellular <math>\text{Ca}^{++}</math> level</li> <li>d) An increase in adenosine triphosphate (ATP) level.</li> <li>e) A decrease in ATP level.</li> </ul>	E
16.	<p><b>About excitation contraction coupling of skeletal muscle which of the following is false:</b></p> <ul style="list-style-type: none"> <li>a) ATP hydrolysis.</li> <li>b) Binding of Ca to calmodulin.</li> <li>c) Stimulation of DHP R.</li> <li>d) T tubule depolarization.</li> <li>e) Increase Na permeability of sarcolemma.</li> </ul>	B

17.	<p><b>Single contraction of skeletal muscle is mostly terminated by:</b></p> <ul style="list-style-type: none"> <li>a) Closure of postsynaptic nicotinic A.choline R.</li> <li>b) Removal of A choline from NMJ.</li> <li>c) Removal of Ca from terminal of motor neuron.</li> <li>d) Removal of sarcoplasmic Ca.</li> <li>e) Return of DHP to resting state.</li> </ul>	D
18.	<p><b>Which of the following decrease in length during contraction:</b></p> <ul style="list-style-type: none"> <li>a) A band of sarcomere.</li> <li>b) I band of sarcomere.</li> <li>c) Z disc of sarcomere.</li> <li>d) Thick filament.</li> <li>e) Thin filament</li> </ul>	B
19.	<p><b>H zone contain the following proteins:</b></p> <ul style="list-style-type: none"> <li>a) Actin.</li> <li>b) Actin and myosin.</li> <li>c) Myosin but not actin.</li> <li>d) Titin protein</li> <li>e) Tropomyosin</li> </ul>	C
20.	<p><b>One of the following is not a character of sarcomere:</b></p> <ul style="list-style-type: none"> <li>a) It is the distance between 2 Z membranes.</li> <li>b) It is shortened during contraction.</li> <li>c) The width of the I band does not change during contraction.</li> <li>d) The width of the A band does not change during contraction.</li> <li>e) H-zone becomes narrower during contraction.</li> </ul>	C
21.	<p><b>One of the following is not a character of transverse tubules:</b></p> <ul style="list-style-type: none"> <li>a) It increases the surface area of the cell membrane.</li> <li>b) It transmits action potential to inside the fiber.</li> <li>c) It acts as a Ca<sup>++</sup> stores.</li> <li>d) It is absent in smooth muscle fibers.</li> <li>e) There are 2 in each sarcomere in skeletal muscle</li> </ul>	C
22.	<p><b>Repeated stimulation of a skeletal muscle fiber causes a sustained contraction (tetanus). Accumulation of which solute in intracellular fluid is responsible for the tetanus (continuous contraction)?</b></p> <ul style="list-style-type: none"> <li>a) Na<sup>+</sup></li> <li>b) K<sup>+</sup></li> <li>c) Cl<sup>-</sup></li> <li>d) Mg<sup>++</sup></li> <li>e) Ca<sup>++</sup></li> </ul>	E

23.	<p><b>Excitation contraction coupling involves all the following except:</b></p> <ul style="list-style-type: none"> <li>a- Release of <math>\text{Ca}^{++}</math> from troponin.</li> <li>b- Formation of cross bridges between actin and myosin.</li> <li>c- Spread of depolarization along the transverse tubules.</li> <li>d- Hydrolysis of ATP to ADP.</li> </ul>	A
24.	<p><b>Muscle fatigue is due to:</b></p> <ul style="list-style-type: none"> <li>a- Inability of the action potential to spread over the muscle.</li> <li>b- Failure of transmission in the motor nerve.</li> <li>c- Failure of neuro-muscular transmission.</li> <li>d- Depletion of energy stores.</li> </ul>	D
25.	<p><b>The action potential of skeletal muscle:</b></p> <ul style="list-style-type: none"> <li>a- has a prolonged plateau phase.</li> <li>b- spread inward to all parts of the muscle via T tubules.</li> <li>c- is longer than the action potential in the cardiac muscle.</li> <li>d- cause re-uptake of <math>\text{Ca}^{++}</math> into the terminal cisternae.</li> </ul>	B
26.	<p><b>As regard transverse tubules all are true except:</b></p> <ul style="list-style-type: none"> <li>a- it increases the surface area of the cell membrane.</li> <li>b- it transmits action potential to inside the fiber.</li> <li>c- it acts as a <math>\text{Ca}^{++}</math> stores.</li> <li>d- it is absent in smooth muscle fibers.</li> </ul>	C

## Written Q Physio MSK 3

1. Enumerate functions of T-tubule ?
2. Enumerate function of sarcoplasmic reticulum ?
3. Enumerate steps of cross bridge cycle ?
4. Def rigor mortis ?
5. Compare () sk , smooth , cardiac ms ?
6. Enumerate functions of sk ms ?

## Written Q Physio MSK 3

<p><b>1. About Sarcomere, which of the following statements is correct?</b></p> <p>A. Consisted of one transverse tubule and 2 terminal cisterne</p> <p>B. Contains thick myofilaments only</p> <p>C. includes a whole I band and two hales of A band on each side.</p> <p>D. is the area that has between two A band.</p> <p>E. Represent the functional contracile unit of skeletal myofibrils</p>	<b>E</b>
<p><b>2. Which of the following is a character of Malignant Hyperthermia?</b></p> <p>A. Excessive sweating</p> <p>B. Vasodilation</p> <p>C. Production of Cytokines</p> <p>D. Massive increase in metabolic rate</p> <p>E. Brown fat thermogenesis</p>	<b>D</b>
<p><b>3. Excitation contraction coupling involves all the following except</b></p> <p>a. release of <math>Ca^{+2}</math> from troponin.</p> <p>b. formation of cross bridges between actin and myosin.</p> <p>c. spread of depolarization along the transverse tubules.</p> <p>d. hydrolysis of ATP to ADP.</p>	<b>A</b>

<p><b>4. In skeletal muscle, which of the Following events occurs before depolarization of the T tubules in the mechanism of excitation-contraction coupling?</b></p> <p>a) Depolarization of the sarcolemmal membrane.</p> <p>b) Opening of <math>Ca^{++}</math> release channels on the sarcoplasmic reticulum (SR).</p> <p>c) Uptake of <math>Ca^{++}</math> into the SR by <math>Ca^{++}</math> adenosine triphosphatase (ATPase).</p> <p>d) Binding of <math>Ca^{++}</math> to troponin C (e) Binding of actin and myosin.</p> <p>e) Cross bridging of actin over myosin.</p>	<b>A</b>
<p><b>5. The function of Tropomyosin in skeletal muscle include:</b></p> <p>a. Binding to myosin during contraction</p> <p>b. Acting as a relaxing protein at rest by covering binding sites on actin.</p> <p>c. Sliding on actin shortening to produce</p> <p>d. Releasing <math>Ca^{++}</math> after propagation of action potential</p> <p>e. Reuptake of <math>Ca^{++}</math> during muscle relaxation</p>	<b>B</b>
<p><b>6. Among the steps of skeletal muscle relaxation:</b></p> <p>a. Binding of cross bridges to actin</p> <p>b. Pumping of <math>Ca^{++}</math> back into the sarcoplasmic reticulum.</p> <p>c. Binding of <math>Ca^{++}</math> to troponin C.</p> <p>d. inward spread of the depolarization waves along the transverse tubules.</p> <p>e. Binding of <math>Ca^{++}</math> to troponin C.</p>	<b>B</b>
<p><b>7. Functions of skeletal muscles include:</b></p> <p>a. Regulation of food intake</p> <p>b. Regulation of arterial blood pressure</p> <p>c. Regulation of body temperature</p> <p>d. Regulation of urine formation</p> <p>e. Regulation of blood glucose level</p>	<b>C</b>

<p><b>8. The myosin head contain:</b></p> <ul style="list-style-type: none"> <li>a. AMP binding sites</li> <li>b. ATP binding sites</li> <li>c. ADP binding sites</li> <li>d. GTP binding sites</li> </ul>	<b>B</b>
<p><b>9. The main protein that form the thick muscle protein is:</b></p> <ul style="list-style-type: none"> <li>a. troponin</li> <li>b. tropomyosin</li> <li>c. actin</li> <li>d. myosin</li> </ul>	<b>D</b>
<p><b>10. One of the following is NOT a protein that forms the thin muscle protein is :</b></p> <ul style="list-style-type: none"> <li>a. troponin C</li> <li>b. tropomyosin</li> <li>c. actin</li> <li>d. myosin</li> <li>e. troponin T</li> </ul>	<b>D</b>
<p><b>11. The T tubule:</b></p> <ul style="list-style-type: none"> <li>a) helps in longitudinal distribution of fluids, ions and substances synthesized within the sarcoplasm or mitochondria.</li> <li>b) releases Ca ions during muscle contraction and store it during ms relaxation.</li> <li>c) runs parallel to the myofibrils.</li> <li>d) transmits chemical substances from the nerve to the muscle.</li> <li>e) allows the depolarization wave to pass rapidly inside the muscle fiber to activate deep myofibrils.</li> </ul>	<b>E</b>
<p><b>12. The Sarcomere:</b></p> <ul style="list-style-type: none"> <li>a. is the distance between myosin and actin.</li> <li>b. is the distance between two H zones.</li> <li>c. is the cause of the cross striation of the skeletal muscle.</li> </ul>	<b>E</b>

<p>d. does not shorten when the muscle contracts.</p> <p>e. is the part of the myofibril present between the 2 Z discs.</p>	
<p><b>13. The myofibrils:</b></p> <p>a) are about 10 um in diameter</p> <p>b) extend from one end of the muscle fiber to the other giving the muscle fiber its longitudinal striation.</p> <p>c) the thick filaments contain the contractile protein actin, troponin and tropomyosin.</p> <p>d) the thin filaments contain the contractile protein myosin.</p> <p>e) each sarcomere contains two sets of thick filaments, one at each end.</p>	<b>B</b>
<p><b>14. Relaxing protein is:</b></p> <p>a. Myosin</p> <p>b. Actin</p> <p>c. Hzone</p> <p>d. Tropomyosin</p> <p>e. T. tubule.</p>	<b>D</b>
<p><b>15. Cross bridges of sarcomere in skeletal muscles are made up of:</b></p> <p>a. actin.</p> <p>b. troponin.</p> <p>c. tropomyosin.</p> <p>d. myosin.</p>	<b>D</b>
<p><b>16. As regard transverse tubules, all are true except:</b></p> <p>a. it increases the surface area of the cell membrane.</p> <p>b. it transmits action potential to inside the fiber.</p> <p>c. it acts as Ca<sup>2+</sup> stores.</p> <p>d. it's absent in smooth muscle fibers.</p>	<b>C</b>

<p><b>17. The action potential of skeletal muscles:</b></p> <ul style="list-style-type: none"> <li>a. has a prolonged plateau phase.</li> <li>b. spreads inwards to all parts of the muscle via T tubules.</li> <li>c. is longer than the action potential in the cardiac muscle.</li> <li>d. causes reuptake of <math>Ca^{+2}</math> into terminal cisternae.</li> </ul>	<b>B</b>
<p><b>18. During muscle contraction, all the following is true except:</b></p> <ul style="list-style-type: none"> <li>a) the binding sites at the actin filament are activated by <math>Ca^{+2}</math>.</li> <li>b) the walk along theory of contraction assumes that sliding of actin continues as long as <math>Ca^{+2}</math> is attached to troponin C.</li> <li>c) detachment of myosin heads from actin needs binding of ATP molecule</li> <li>d) the transverse tubules (T.T) become filled with intracellular fluid.</li> </ul>	<b>D</b>
<p><b>19. In skeletal muscles, all the following is true except:</b></p> <ul style="list-style-type: none"> <li>a. tropomyosin is found in the thin filaments.</li> <li>b. myosin is found in the thick filaments.</li> <li>c. the lateral sacs of sarcoplasmic reticulum are rich in <math>Ca^{+2}</math>.</li> <li>d. troponin C molecules bind <math>Ca^{+2}</math>.</li> <li>e. energy from ATP is not required for muscle relaxation.</li> </ul>	<b>E</b>
<p><b>20. Excitation-contraction coupling in skeletal muscles involves all the following events except one. Which one is this exception?</b></p> <ul style="list-style-type: none"> <li>a. ATP hydrolysis.</li> <li>b. binding of <math>Ca^{+2}</math> to calmodulin.</li> <li>c. conformational change in dihydropyridine receptor.</li> <li>d. depolarization of the transverse tubule (T-tubule) membrane,</li> <li>e. increased <math>Na^{+}</math> conductance of sarcolemma.</li> </ul>	<b>B</b>

<p><b>21. A single contraction of skeletal muscle is most likely to be terminated by which of the following actions?</b></p> <p>a. closure of post-synaptic nicotinic acetylcholine receptors.</p> <p>b. removal of acetylcholine from the neuro-muscular junction.</p> <p>c. removal of <math>Ca^{2+}</math> from the terminal of the motor neuron.</p> <p>d. removal of sarcoplasmic <math>Ca^{2+}</math>.</p> <p>e. return of the dihydropyridine receptor to its resting conformation.</p>	<b>D</b>
<p><b>22. In skeletal muscles, the transverse tubules and adjacent cisterns consulate?</b></p> <p>a) A triad.</p> <p>b) The sarcolemma.</p> <p>c) A myofibril</p> <p>d) A muscle fiber. E) The sarcomere.</p>	<b>A</b>
<p><b>23. Among the Steps of muscles contraction one of the following is wrong</b></p> <p>a) Generation of an action potential.</p> <p>b) Spread of depolarization into the muscle fibers via the T system.</p> <p>c) Release of <math>Ca^{++}</math> from the sarcoplasmic reticulum.</p> <p>d) Release of K from troponin T.</p> <p>e) formation of cross linkages between actin and myosin.</p>	<b>D</b>
<p><b>24. Which of the following temporal sequences is correct for excitation-contraction coupling in skeletal muscle?</b></p> <p>a) Increased intracellular <math>[Ca^{++}]</math>: action potential in the muscle membrane; cross-bridge formation.</p> <p>b) Action potential in the muscle membrane, depolarization of the T tubules; release of <math>Ca^{++}</math> from the sarcoplasmic reticulum (SR).</p> <p>c) Action potential in the muscle membrane; splitting of adenosine triphosphate (ATP); binding of <math>Ca^{++}</math> to troponin C.</p> <p>d) Release of <math>Ca^{++}</math> from the SR, depolarization of the T tubules; binding of <math>Ca^{++}</math> to troponin C</p>	<b>B</b>

<p><b>25. One of the following is wrong:</b></p> <ul style="list-style-type: none"> <li>a) <i>Tight gap junctions are absent in skeletal muscles and present in smooth muscles.</i></li> <li>b) <i>Skeletal muscles don't obey the all or none law while visceral smooth muscles do.</i></li> <li>c) <i>A motor unit is a single motor neuron and all muscle fibers innervated by it.</i></li> <li>d) <i>The smooth muscle contracts when stretched in absence of extrinsic nerves.</i></li> <li>e) <i>All types of muscle contract when <math>Ca^{++}</math> is taken up by sarcoplasmic reticul.</i></li> </ul>	<b>E</b>
<p><b>26. The functions of tropomyosin in skeletal muscles include:</b></p> <ul style="list-style-type: none"> <li>a) <i>Sliding on actin to produce shortening.</i></li> <li>b) <i>Releasing <math>Ca^{++}</math> from the sarcoplasmic reticulum.</i></li> <li>c) <i>Binding to myosin during contraction.</i></li> <li>d) <i>Acting as a relaxing protein at rest.</i></li> <li>e) <i>Operating ATP and providing it to the contractile proteins.</i></li> </ul>	<b>D</b>
<p><b>27. The following characteristics are present in both skeletal &amp; smooth muscles:</b></p> <ul style="list-style-type: none"> <li>a) <i>The myofibrils in both have Z membranes.</i></li> <li>b) <i>Both initiate spontaneous rhythmic contractions.</i></li> <li>c) <i>Both contain actin and myosin and show tonic (partial) contraction at rest.</i></li> <li>d) <i>Both can be affected by hormones and chemicals equally.</i></li> <li>e) <i>Both have T tubules.</i></li> </ul>	<b>C</b>
<p><b>28. Single contraction of skeletal muscle is mostly terminated by:</b></p> <ul style="list-style-type: none"> <li>a) <i>Closure of postsynaptic nicotinic A.choline R.</i></li> <li>b) <i>Removal of A choline from nmJ.</i></li> <li>c) <i>Removal of Ca from terminal of motor neuron.</i></li> <li>d) <i>Removal of sarcoplasmic Ca.</i></li> <li>e) <i>Return of DHP to resting state.</i></li> </ul>	<b>D</b>

<p><b>29. The action potential of skeletal muscle:</b></p> <ul style="list-style-type: none"> <li>a- has a prolonged plateau phase</li> <li>b- spread inward to all parts of the muscle via T tubules.</li> <li>c- is longer than the action potential in the cardiac muscle.</li> <li>d- cause re-uptake of <math>Ca^{++}</math> into the terminal cisternae.</li> </ul>	<b>B</b>
<p><b>30. The function of troponin C is:</b></p> <ul style="list-style-type: none"> <li>a) binding with <math>Ca^{++}</math>.</li> <li>b) binding with the tropomyosin.</li> <li>c) binding with actin.</li> <li>d) covering active sites of actin.</li> <li>e) binding with the myosin head.</li> </ul>	<b>A</b>
<p><b>31. Which of the following is correct:</b></p> <ul style="list-style-type: none"> <li>a) RMP is the signal used by the CNS.</li> <li>b) the RMP of a neuron is 70 volts.</li> <li>c) depolarization phase of AP is due to <math>Na^{+}</math> efflux.</li> <li>d) neuromuscular transmission is stimulated by curare.</li> <li>e) during depolarization phase of an AP , permeability to <math>Na^{+}</math> increases.</li> </ul>	<b>E</b>
<p><b>32. The T-tubules of the skeletal muscles:</b></p> <ul style="list-style-type: none"> <li>a) is part of the longitudinal tubular system.</li> <li>c) is present also in smooth muscle.</li> <li>b) contains intracellular fluid (ICF).</li> <li>d) contain very high concentration of <math>Ca^{++}</math>.</li> <li>e) transmit action potential to the interior of the muscle fiber.</li> </ul>	<b>E</b>

<p><b>33. T-tubules:</b></p> <ul style="list-style-type: none"> <li>a) are part of sarcoplasmic reticulum.</li> <li>c) are present in smooth muscles.</li> <li>b) contain ICF.</li> <li>d) are stores of calcium.</li> <li>e) help rapid propagation of AP to inside the skeletal muscle fibers.</li> </ul>	<b>E</b>
<p><b>34. During skeletal muscle contraction:</b></p> <ul style="list-style-type: none"> <li>a) ATP ase activity of myosin head is inhibited.</li> <li>b) tropomyosin covers the active site of actin.</li> <li>c) attachment, tilting, and detachment cycling occurs between myosin head and actin.</li> <li>d) <math>Ca^{++}</math> needed to start contraction comes from T-tubules.</li> <li>e) <math>Ca^{++}</math> needed to start contraction comes from ECF.</li> </ul>	<b>C</b>
<p><b>35. The propagation of AP along the membrane of the T-tubules causes:</b></p> <ul style="list-style-type: none"> <li>a) the release of NE from the terminal cisternae.</li> <li>b) contraction of the T- tubules.</li> <li>c) the release of Ach from the terminal cisternae.</li> <li>d) the pumping of <math>ca^{++}</math> back into the sarcoplasmic reticulum.</li> <li>e) the release of <math>ca^{++}</math> from the terminal cisternae.</li> </ul>	<b>E</b>
<p><b>36. Excitation-contraction coupling in the skeletal muscles involves:</b></p> <ul style="list-style-type: none"> <li>a) binding of <math>Ca^{++}</math> to tropomyosin.</li> <li>b) binding of <math>Ca^{+}</math> to myosin head.</li> <li>c) release of <math>Ca^{++}</math> from T-tubules.</li> <li>d) attachment of myosin head to the active site of actin.</li> <li>e) cleavage of ATP by G-protein.</li> </ul>	<b>D</b>

<p><b>37. Depolarization in smooth muscles is mainly due to:</b></p> <ul style="list-style-type: none"> <li>a) <math>\text{Na}^+</math> inflow.</li> <li>b) <math>\text{K}^+</math> outflow.</li> <li>c) <math>\text{Ca}^{++}</math> inflow.</li> <li>d) <math>\text{Ca}^{++}</math> outflow.</li> <li>e) <math>\text{Na}^+</math> outflow.</li> </ul>	<p><b>C</b></p>
<p><b>38. Smooth muscle does not contain:</b></p> <ul style="list-style-type: none"> <li>a) troponin.</li> <li>b) myosin.</li> <li>c) tropomyosin.</li> <li>d) calmodulin.</li> <li>e) actin.</li> </ul>	<p><b>A</b></p>
<p><b>39. Depolarization in smooth muscle:</b></p> <ul style="list-style-type: none"> <li>a) is caused by <math>\text{Na}^+</math> entry.</li> <li>b) requires calmodulin.</li> <li>c) is caused by <math>\text{Ca}^{++}</math> entry.</li> <li>d) is faster than that in skeletal muscle.</li> <li>e) is due to <math>\text{Ca}^+</math> outflow.</li> </ul>	<p><b>C</b></p>
<p><b>40. Which of the following is correct:</b></p> <ul style="list-style-type: none"> <li>a) all smooth muscles have a stable RMP.</li> <li>b) myasthenia gravis is due to loss of ATP.</li> <li>c) troponin I is attached to actin.</li> <li>d) troponin C is attached to tropomyosin.</li> <li>e) troponin I is attached to tropomyosin.</li> </ul>	<p><b>C</b></p>

**41. Which of the following is correct:**

- a) rigor mortis results from excessive (too much) ATP.
- b) muscle relaxation generates force.
- c) cholinesterase inhibitors bind to and degrade acetylcholine.
- d) before binding to actin the myosin head binds to and hydrolyzes an ATP molecule.
- e) myasthenia gravis is caused by depletion of Ach in the synaptic knobs.

**D**

<p><b>42. As regard sarcomere all are true:</b></p> <ul style="list-style-type: none"> <li>a. It is the distance between 2 Z membranes.</li> <li>b. It is prolonged during contraction.</li> <li>c. The width of the I band does not change during contraction.</li> <li>d. The width of the A band shortens change during contraction</li> <li>e. Is the structural unit of the skeletal muscle</li> </ul>	<p><b>A</b></p>
<p><b>43. Rigors mortis is due to:</b></p> <ul style="list-style-type: none"> <li>a. Failure of detachment between actin and myosin</li> <li>b. Excessive release of <math>Ca^{++}</math> from SR</li> <li>c. Damage of troponin protein molecules.</li> <li>d. Lack of binding sites of myosin on actin</li> <li>e. Failure of propagation of action potential along muscle fibres</li> </ul>	<p><b>A</b></p>
<p><b>44. During muscle contraction:</b></p> <ul style="list-style-type: none"> <li>a) the A bands remain constant.</li> <li>b) the Z lines move further apart.</li> <li>c) the tropomyosin molecules remain in place.</li> <li>d) the bands are elongated.</li> <li>e) the H zones become wider.</li> </ul>	<p><b>A</b></p>
<p><b>45. A cross sectional view of a skeletal muscle fiber through the H zone would reveal the presence of what?</b></p> <ul style="list-style-type: none"> <li>a. actin and fitin.</li> <li>b. actin but no myasin.</li> <li>c. actin, myosin and fitin,</li> <li>d. myosin and actin.</li> <li>E. myosin but no actin.</li> </ul>	<p><b>E</b></p>

<p><b>46. During muscles contraction:</b></p> <ul style="list-style-type: none"> <li>a) The A bands remain constant.</li> <li>b) The I bands are elongated.</li> <li>c) The Z lines move further apart.</li> <li>d) The H zones become wider.</li> <li>e) The tropomyosin molecules remain in place.</li> </ul>	<b>A</b>
<p><b>47. Which of the following causes rigor in skeletal muscle?</b></p> <ul style="list-style-type: none"> <li>a) Lack of action potentials in motoneurons.</li> <li>b) An increase in intracellular <math>Ca^{++}</math> level.</li> <li>c) A decrease in intracellular <math>Ca^{++}</math> level</li> <li>d) An Increase in adenosine triphosphate (ATP) level.</li> <li>e) A decrease in ATP level.</li> </ul>	<b>E</b>
<p><b>48. In skeletal muscle, the:</b></p> <ul style="list-style-type: none"> <li>a) A bands are broader than the I bands and contain both actin and myosin.</li> <li>b) H zones contain only actin and increase in width during contraction.</li> <li>c) Z membranes are phase in the middle of the H zones.</li> <li>d) I bands contain myosin only.</li> <li>e) Sole feet at the motor end plate are myelinated branches of the nerve.</li> </ul>	<b>A</b>
<p><b>49. One of the following is not a character of sarcomere:</b></p> <ul style="list-style-type: none"> <li>a) It is the distance between 2Z membranes.</li> <li>b) It is shortened during contraction.</li> <li>c) The width of I band does not change during contraction.</li> <li>d) The width of the A band does not change during contraction.</li> <li>e) H-zone becomes narrower during contraction.</li> </ul>	<b>C</b>

<p><b>50. Which of the following decrease in length during contraction:</b></p> <ul style="list-style-type: none"> <li>a) A band of sarcomere.</li> <li>b) I band of sarcomere.</li> <li>c) Z disc of sarcomere.</li> <li>d) Thick filament.</li> <li>e) Thin Filament.</li> </ul>	<b>B</b>
<p><b>51. In skeletal muscle, the:</b></p> <ul style="list-style-type: none"> <li>a) A bands are broader than the I bands and contain both actin and myosin.</li> <li>b) H zones contain only actin and increase in width during contraction.</li> <li>c) Z membranes are phase in the middle of the H zones.</li> <li>d) I bands contain myosin only.</li> <li>e) Sole feet at the motor end plate are myelinated branches of the nerve.</li> </ul>	<b>A</b>
<p><b>52. Rigor mortis:</b></p> <ul style="list-style-type: none"> <li>a) is due to failure of neuromuscular transmission.</li> <li>b) is due to loss of ATP.</li> <li>c) means muscle stiffness after fatigue.</li> <li>d) is an autoimmune disease.</li> <li>e) is due to of loss of <math>Ca^{++}</math>.</li> </ul>	<b>B</b>
<p><b>53. Rigor mortis:</b></p> <ul style="list-style-type: none"> <li>a) is flaccidity occurring after death.</li> <li>b) is due to ATP depletion</li> <li>c) starts 24 hours after death.</li> <li>d) disappears after 2 hours.</li> <li>e) is due to separation of actin and myosin.</li> </ul>	<b>B</b>



<p>1) <b><u>During intense, short-duration exercise (e.g., 100m sprint), which energy system is primarily utilized?</u></b></p> <p>A) Aerobic system          B) Glycogen-lactic acid system          C) Phosphagen system          D) Fatty acid oxidation          E) Cori cycle</p>	C
<p>2) <b><u>What is the maximum duration for which the phosphagen system can supply energy during exercise?</u></b></p> <p>A) 1–2 minutes          B) 8–10 seconds          C) 3 seconds          D) 30–60 minutes          E) 5–7 hours</p>	B
<p>3) <b><u>Which system produces the highest number of ATP molecules per glucose molecule?</u></b></p> <p>A) Phosphagen system          B) Anaerobic glycolysis          C) Aerobic oxidation          D) Creatine phosphate system          E) Fatty acid metabolism</p>	C
<p>4) <b><u>During prolonged mild to moderate exercise, the primary source of energy is:</u></b></p> <p>A) ATP stored in muscles          B) Anaerobic glycolysis          C) Aerobic metabolism of glucose          D) Breakdown of creatine phosphate          E) Conversion of lactic acid to glucose</p>	C
<p>5) <b><u>Which of the following is a function of lactic acid?</u></b></p> <p>A) Directly enters the Krebs' cycle          B) Increases hemoglobin's affinity for oxygen          C) Converted back to glucose via the Cori cycle          D) Provides energy for 8–10 seconds of activity          E) Primary fuel for resting muscles</p>	C



<p>6) <b><u>What is the primary fuel source for resting muscles?</u></b></p> <p>A) Glucose          B) Lactic acid          C) Fatty acids          D) Creatine phosphate          E) Pyruvic acid</p>	C
<p>7) <b><u>How many ATP molecules are generated per glucose molecule in anaerobic glycolysis?</u></b></p> <p>A) 38          B) 2          C) 15          D) 10          E) 0</p>	B
<p>8) <b><u>Which system acts as an "ATP buffer" by maintaining cellular ATP levels during short bursts of activity?</u></b></p> <p>A) Aerobic system          B) ATP-CP system          C) Glycogen-lactic acid system          D) Fatty acid oxidation          E) Cori cycle</p>	B
<p>9) <b><u>The shift of the oxygen dissociation curve to the right during exercise is primarily caused by:</u></b></p> <p>A) Decreased lactic acid levels          B) Increased hemoglobin affinity for oxygen          C) Lactic acid reducing hemoglobin's oxygen affinity          D) Aerobic metabolism of fatty acids          E) Breakdown of creatine phosphate</p>	C
<p>10) <b><u>Which energy system is described as "slow and economic," suitable for prolonged mild to moderate exercise?</u></b></p> <p>A) Phosphagen system          B) Glycogen-lactic acid system          C) Aerobic system          D) ATP-CP buffer system          E) Fatty acid oxidation</p>	C



<p><b>11) <u>Creatine phosphate is approximately how many times more abundant than ATP in muscle cells?</u></b></p> <p>A) 1–2 times          B) 3–8 times          C) 10–12 times          D) 15–20 times          E) Equal to ATP</p>	<b>B</b>
<p><b>12) <u>During the recovery period after exercise, lactic acid is primarily oxidized to:</u></b></p> <p>A) Pyruvic acid          B) Glucose          C) Fatty acids          D) Replenish ATP and energy stores          E) Creatine phosphate</p>	<b>D</b>
<p><b>13) <u>Which organ preferentially uses lactic acid as a fuel source?</u></b></p> <p>A) Liver          B) Brain          C) Heart          D) Kidneys          E) Skeletal muscles</p>	<b>C</b>
<p><b>14) <u>The ATP-CP system is termed a "buffer" because it:</u></b></p> <p>A) Neutralizes lactic acid          B) Maintains constant ATP levels during short bursts of activity          C) Converts glucose to glycogen          D) Requires oxygen for ATP production          E) Stores energy as fatty acids</p>	<b>B</b>
<p><b>15) <u>Which process reforms ATP by combining ADP with creatine phosphate?</u></b></p> <p>A) Anaerobic glycolysis          B) Aerobic oxidation          C) Cori cycle          D) Phosphagen system          E) Beta-oxidation</p>	<b>D</b>



<p><b>16) <u>During the first few seconds of intense exercise, energy is primarily derived from:</u></b></p> <p>A) Aerobic metabolism          B) Breakdown of fatty acids          C) ATP and creatine phosphate stores          D) Glycogen-lactic acid system          E) Protein catabolism</p>	C
<p><b>17) <u>Which system is entirely dependent on oxygen availability?</u></b></p> <p>A) Phosphagen system          B) Anaerobic glycolysis          C) Aerobic oxidation          D) ATP-CP system          E) Cori cycle</p>	C
<p><b>18) <u>The Cori cycle primarily occurs between which two tissues?</u></b></p> <p>A) Muscles and liver          B) Heart and lungs          C) Kidneys and brain          D) Liver and adipose tissue          E) Skeletal muscles and heart</p>	A
<p><b>19) <u>Which biochemical reaction directly recharges ATP using creatine phosphate during the phosphagen system?</u></b></p> <p>A) <math>ADP + AMP \rightarrow ATP</math>          B) <math>ADP + CP \rightarrow ATP + Creatine</math>          C) <math>Glucose \rightarrow 2 Pyruvate + 2 ATP</math>          D) <math>Lactic\ acid \rightarrow Glucose</math> (Cori cycle)          E) <math>Fatty\ acids \rightarrow Acetyl-CoA</math></p>	B



<p><b>1) <u>About Sarcomere, which of the following statements is correct?</u></b></p> <p>A. Consisted of one transverse tubule and 2 terminal cisterne</p> <p>B. Contains thick myofilaments only</p> <p>C. includes a whole I band and two halves of A band on each side.</p> <p>D. is the area that has between two A band.</p> <p>E. Represent the functional contracile unit of skeletal myofibrils</p>	E
<p><b>2) <u>The main protein that form the thick muscle protein is:</u></b></p> <p>a. troponin</p> <p>b. tropomyosin</p> <p>c. actin</p> <p>d. myosin</p>	D
<p><b>3) <u>Cross bridges of sarcomere in skeletal muscles are made up of:</u></b></p> <p>a. actin.</p> <p>b. troponin.</p> <p>c. tropomyosin.</p> <p>d. myosin.</p>	D
<p><b>4) <u>The Sarcomere:</u></b></p> <p>a. is the distance between myasin and actin.</p> <p>b. is the distance between two 2 H zones.</p> <p>c. is the cause of the cross striation of the skeletal muscle.</p> <p>d. does not shorten when the muscle contracts.</p> <p>e. is the part of the myofibril present between the 2 Z discs.</p>	E
<p><b>5) <u>The myofibrils:</u></b></p> <p>a) are about 10 um in diameter</p> <p>b) extend from one end of the muscle fiber to the other giving the muscle fiber its longitudinal striation.</p> <p>c) the thick filaments contain the contractile protein actin, troponin and tropomyosin.</p> <p>d) the thin filaments contain the contractile protein myosin.</p> <p>e) each sarcomere contains two sets of thick filaments, one at each end.</p>	B



<p><b>6) <u>Cholinesterase enzyme is an important molecule in the neuromuscular junction because it:</u></b></p> <p>a) Stimulates receptors on the presynaptic terminal.  b) Synthesizes acetylcholine from acetic acid and choline.  c) Stimulates receptors within the postsynaptic membrane.  d) Breaks down acetylcholine.  e) Causes the release of Ca ++ from the sarcoplasmic reticulum.</p>	D
<p><b>7) <u>In skeletal muscle, the:</u></b></p> <p>a) A bands are broader than the I bands and contain both actin and myosin.  b) H zones contain only actin and increase in width during contraction.  c) Z membranes are phase in the middle of the H zones.  d) I bands contain myosin only.  e) Sole feet at the motor end plate are myelinated branches of the nerve.</p>	A
<p><b>8) <u>In skeletal muscles, the transverse tubules and adjacent cisterns constitute:</u></b></p> <p>a) A triad.  b) The sarcolemma.  c) A myofibril.  d) A muscle fiber.  e) The sarcomere.</p>	A
<p><b>9) <u>During muscle contraction:</u></b></p> <p>a) the A bands remain constant.  b) the Z lines move further apart.  c) the tropomyosin molecules remain in place.  d) the bands are elongated.  e) the H zones become wider</p>	A
<p><b>10) <u>A cross sectional view of a skeletal muscle fiber through the H zone would reveal the presence of what?</u></b></p> <p>a. actin and fitin.  b. actin but no myasin.  c. actin, myosin and fitin,  d. myosin and actin.  E. myosin but no actin.</p>	E



<p><b>11) <u>Which of the following is mentioned as a functional unit of skeletal ms ?</u></b></p> <p>A) Sarcomeres B) Mitochondria C) Nuclei D) Ribosomes E) Golgi apparatus</p>	<b>A</b>
<p><b>12) <u>Which of the following is mentioned as a structural unit of skeletal ms ?</u></b></p> <p>A) Sarcomeres B) Mitochondria C) myofiber D) sarcolemma E) Golgi apparatus</p>	<b>C</b>



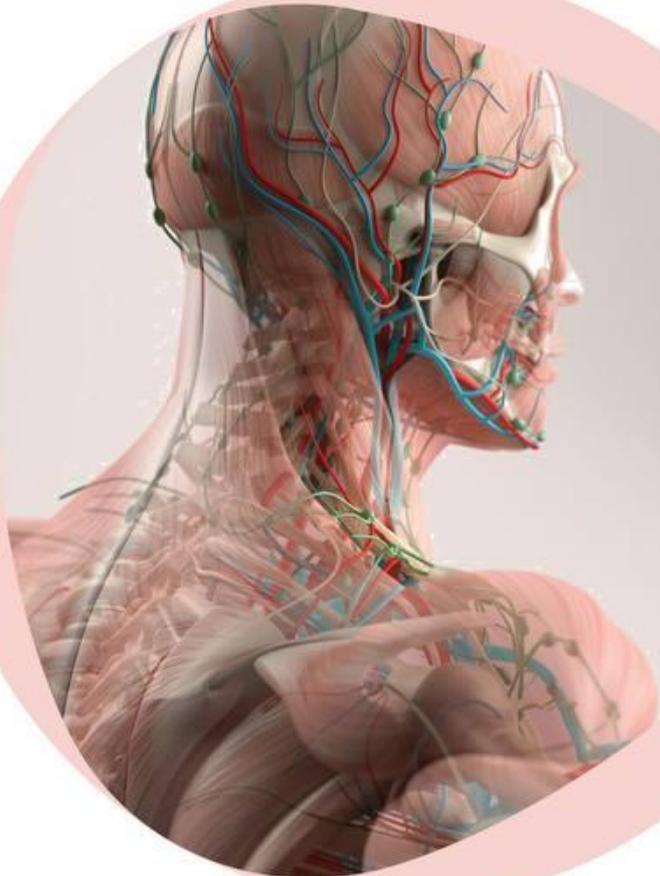
SCAN ME

2024

Level 1 Semester 2

MSS module

# PHYSIOLOGY



**MCQ L3**

**DR. ELSAWY**



## MCQ

<p><b>1. What is the structural unit of skeletal muscle?</b></p> <p>a) Fasciculus b) Myofibril c) Sarcomere d) Myofiber</p>	<b>D</b>
<p><b>2. What is the function of T tubules in skeletal muscle fibers?</b></p> <p>a) Increase the surface area of the sarcolemma b) Help movement of ions and other substances into and out of the cell c) Help the spread of depolarization wave to the interior of muscle fibers d) All of the above</p>	<b>D</b>
<p><b>3. Z lines (discs) divide the myofibril into smaller units called:</b></p> <p>a) Fasciculi b) Myofibers c) Sarcomeres d) Myofibrils</p>	<b>C</b>
<p><b>4. Which protein is responsible for covering the binding sites on actin?</b></p> <p>a) Troponin b) Tropomyosin c) Myosin d) Troponin C</p>	<b>B</b>
<p><b>5. Lack of ATP leads to failure of detachment between actin and myosin, resulting in:</b></p> <p>a) Rigor mortis b) Continuous muscle contraction c) Muscle spasms d) Elevated body temperature</p>	<b>A</b>



<p><b>6. Which organelle is responsible for storing and releasing calcium ions in muscle fibers?</b></p> <ul style="list-style-type: none"><li>a) Golgi apparatus</li><li>b) Sarcoplasmic reticulum</li><li>c) Mitochondria</li><li>d) Ribosomes</li></ul>	<p><b>B</b></p>
<p><b>7. What is the diameter of a myofibril?</b></p> <ul style="list-style-type: none"><li>a) 1 nm</li><li>b) 1 <math>\mu</math>m</li><li>c) 1 mm</li><li>d) 1 cm</li></ul>	<p><b>B</b></p>
<p><b>8. What happens during the relaxation of muscle fibers?</b></p> <ul style="list-style-type: none"><li>a) Calcium ions are transported into the sarcoplasmic reticulum</li><li>b) Troponin returns to its original state, covering the binding sites on actin</li><li>c) Actin filaments slide back to their original position</li><li>d) All of the above</li></ul>	<p><b>D</b></p>
<p><b>9. Malignant hyperthermia is a medical problem commonly seen during:</b></p> <ul style="list-style-type: none"><li>a) Exercise</li><li>b) Sleep</li><li>c) Anesthesia</li><li>d) Fasting</li></ul>	<p><b>C</b></p>
<p><b>10. What is the primary cause of elevated body temperature in malignant hyperthermia?</b></p> <ul style="list-style-type: none"><li>a) Increased heat production from muscle spasms</li><li>b) Impaired sweating</li><li>c) Inefficient heat regulating center</li><li>d) Overactivation of heat-generating proteins in hypothalamus</li></ul>	<p><b>A</b></p>



<p><b>11. Which decrease in length during contraction?</b></p> <ul style="list-style-type: none"><li>a) A band of sarcomere.</li><li>b) I band of sarcomere.</li><li>c) Z disc of sarcomere.</li><li>d) thick filament.</li></ul>	<b>B</b>
<p><b>12. The action potential of skeletal muscles:</b></p> <ul style="list-style-type: none"><li>a. Has a prolonged plateau phase.</li><li>b. Longer than the action potential in the cardiac muscle.</li><li>c. Spreads inwards to all parts of the muscle via t tubules.</li><li>d. Causes reuptake of <math>Ca^{+2}</math> into terminal cisternae.</li></ul>	<b>C</b>
<p><b>13. Excitation contraction coupling involves all the following except:</b></p> <ul style="list-style-type: none"><li>a. Formation of cross bridges between actin &amp; myosin.</li><li>b. Spread of depolarization along the transverse tubules.</li><li>c. Release of <math>Ca^{+2}</math> from troponin.</li><li>d. Hydrolysis of ATP to ADP.</li></ul>	<b>C</b>
<p><b>14. Function of Tropomyosin in skeletal muscle include:</b></p> <ul style="list-style-type: none"><li>a. Releasing <math>Ca^{++}</math> after propagation of action potential</li><li>b. Sliding on actin shortening to produce</li><li>c. Binding to myosin during contraction</li><li>d. Acting as a relaxing protein at rest by covering binding sites on actin.</li></ul>	<b>D</b>
<p><b>15. Cross bridges of sarcomere in skeletal muscles are made up of:</b></p> <ul style="list-style-type: none"><li>a. Actin.</li><li>b. Troponin.</li><li>c. Tropomyosin.</li><li>d. Myosin.</li></ul>	<b>D</b>



<p><b>16. In skeletal muscles, one of the following is incorrect:</b></p> <ul style="list-style-type: none"><li>a) Tropomyosin is found in thin filament</li><li>b) Myosin is found in thick filament</li><li>c) sarcoplasmic reticulum are rich in Ca</li><li>d) Energy from ATP is not required for muscle relaxation.</li></ul>	<b>D</b>
<p><b>17. The cross bridges in skeletal muscles are components of:</b></p> <ul style="list-style-type: none"><li>a) Myosin</li><li>b) Troponin</li><li>c) Actin</li><li>d) Myelin.</li></ul>	<b>A</b>
<p><b>18. Rigors mortis is due to:</b></p> <ul style="list-style-type: none"><li>a. Excessive release of <math>Ca^{++}</math> from SR</li><li>b. Damage of troponin .</li><li>c. Failure of detachment between actin and myosin</li><li>d. Lack of binding sites of myosin on actin</li></ul>	<b>C</b>
<p><b>19. Main protein that forms thick muscle protein is:</b></p> <ul style="list-style-type: none"><li>a. Troponin</li><li>b. Tropomyosin</li><li>c. Actin</li><li>d. Myosin</li></ul>	<b>D</b>
<p><b>20. Myosin head contain:</b></p> <ul style="list-style-type: none"><li>a. ATP binding sites</li><li>b. AMP binding sites</li><li>c. ADP binding sites</li><li>d. GTP binding sites</li></ul>	<b>A</b>



<p><b>21. As regard transverse tubules all are true except:</b></p> <ul style="list-style-type: none"><li>a- it increases the surface area of the cell membrane.</li><li>b- it transmits action potential to inside the fiber.</li><li>c- it acts as a Ca<sup>++</sup> stores.</li><li>d- it is absent in smooth muscle fibers.</li></ul>	<p><b>C</b></p>
<p><b>22. Which is NOT a protein that forms the thin muscle protein is :</b></p> <ul style="list-style-type: none"><li>a. Troponin C</li><li>b. Tropomyosin</li><li>c. Myosin</li><li>d. Actin</li></ul>	<p><b>C</b></p>
<p><b>23. The action potential of skeletal muscles:</b></p> <ul style="list-style-type: none"><li>a) Spreads inwards to all parts of the muscle fiber via the T-tubules.</li><li>b) Has a prolonged plateau phase.</li><li>c) Has a smaller magnitude than that of smooth muscles.</li><li>d) Is not essential for contraction.</li></ul>	<p><b>A</b></p>
<p><b>24. T tubule:</b></p> <ul style="list-style-type: none"><li>a. Is not important for skeletal muscle</li><li>b. Allows the depolarization wave to pass rapidly inside the muscle fiber</li><li>c. Runs parallel to the myofibrils.</li><li>d. Transmits chemical substances from the nerve to the muscle.</li></ul>	<p><b>B</b></p>
<p><b>25. Function of tropomyosin in skeletal muscle:</b></p> <ul style="list-style-type: none"><li>a. Binding to myosin during contraction.</li><li>b. Sliding on actin shortening.</li><li>c. Releasing ca after propagation of action potential.</li><li>d. Acting as a relaxing protein at rest by covering the binding sites on actin</li></ul>	<p><b>D</b></p>



<p><b>26. The Sarcomere:</b></p> <ul style="list-style-type: none"><li>a. The distance between myosin and actin.</li><li>b. The distance between two 2 H zones.</li><li>c. The cause of the longitudinal striations of the skeletal muscle.</li><li>d. The part of the myofibril presents between the 2 z discs.</li></ul>	<b>D</b>
<p><b>27. The myofibrils:</b></p> <ul style="list-style-type: none"><li>a. Extend from one end of the muscle fiber to the other giving the muscle fiber its longitudinal striation.</li><li>b. About 1000 um in diameter</li><li>c. Thick filaments contain actin, troponin and tropomyosin.</li><li>d. Thin filaments contain myosin.</li></ul>	<b>A</b>
<p><b>28. During muscle contraction:</b></p> <ul style="list-style-type: none"><li>a) A bands remain constant.</li><li>b) Tropomyosin molecules remain in place.</li><li>c) Z lines move further apart.</li><li>d) H zones become wider.</li></ul>	<b>A</b>
<p><b>29. Relaxing protein is:</b></p> <ul style="list-style-type: none"><li>a. Myosin</li><li>b. Actin</li><li>c. Hzone</li><li>d. Tropomyosin</li></ul>	<b>D</b>
<p><b>30. About excitation contraction coupling of skeletal muscle which of the following is False:</b></p> <ul style="list-style-type: none"><li>a) ATP hydrolysis.</li><li>b) Binding of Ca to calmodulin.</li><li>d) T tubule depolarization.</li><li>e) Increase Na permeability of sarcolemma.</li></ul>	<b>B</b>



<p><b>31. Excitation-contraction coupling in skeletal muscles involves all the following events except ?</b></p> <ul style="list-style-type: none"><li>a. ATP hydrolysis.</li><li>b. Binding of <math>\text{Ca}^{+2}</math> to calmodulin.</li><li>c. Conformational change in dihydropyridine receptor.</li><li>d. Depolarization of the transverse tubule (T-tubule) membrane</li></ul>	<b>B</b>
<p><b>32. One of the following is not a character of sarcomere:</b></p> <ul style="list-style-type: none"><li>a) the distance between 2 Z membranes.</li><li>b) shortened during contraction.</li><li>c) The width of all bands does not change during contraction.</li><li>d) The width of the A band does not change during contraction.</li></ul>	<b>C</b>
<p><b>33. In skeletal muscles, the transverse tubules and adjacent cisterns consulate?</b></p> <ul style="list-style-type: none"><li>a) Triad.</li><li>b) The sarcolemma.</li><li>c) A myofibril</li><li>d) A muscle fiber.</li></ul>	<b>A</b>
<p><b>34. Which causes rigor in skeletal muscle?</b></p> <ul style="list-style-type: none"><li>a) Lack of action potentials</li><li>b) An increase in intracellular <math>\text{Na}^{+}</math> level.</li><li>c) A decrease in intracellular <math>\text{Ca}^{++}</math> level</li><li>d) A decrease in ATP level.</li></ul>	<b>D</b>
<p><b>35. Excitation contraction coupling involves all the following except:</b></p> <ul style="list-style-type: none"><li>a- Release of <math>\text{Ca}^{++}</math> from troponin.</li><li>b- Formation of cross bridges between actin and myosin.</li><li>c- Spread of depolarization along the transverse tubules.</li><li>d- Hydrolysis of ATP to ADP.</li></ul>	<b>A</b>



<p><b>36. In skeletal muscle Which is correct:</b></p> <ul style="list-style-type: none"><li>a) I bands contain myosin only.</li><li>b) Z membranes are present in the middle of the H zones.</li><li>c) H zones contain only actin and increase in width during contraction.</li><li>d) A Bands are broader than I bands and contain both actin and myosin.</li></ul>	<p><b>D</b></p>
<p><b>37. Which are present in both skeletal &amp; smooth muscles:</b></p> <ul style="list-style-type: none"><li>a) Both have Z membranes.</li><li>b) Both initiate spontaneous rhythmic contractions.</li><li>c) Both contain actin - myosin</li><li>d) Both have T tubules.</li></ul>	<p><b>C</b></p>
<p><b>38. Which of the Following events occurs before depolarization of T tubules ?</b></p> <ul style="list-style-type: none"><li>a) Depolarization of sarcolemmal membrane.</li><li>b) Opening of Ca<sup>++</sup> release channels</li><li>c) Binding of Ca<sup>++</sup> to troponin C</li><li>d) Binding of actin and myosin.</li></ul>	<p><b>A</b></p>



<p><b>1) <u>The motor unit consists of:</u></b></p> <ul style="list-style-type: none"> <li>a. Single muscle fibers</li> <li>b. Single nerve fiber and ms fibers supplied by it</li> <li>c. All motor nerve fibers supplying a skeletal muscle</li> <li>d. All skeletal ms fibers</li> <li>e. All motor neurons arising from AHCS supplying several muscles</li> </ul>	B
<p><b>2) <u>The space between the axon terminal &amp; the muscle cell membrane is?</u></b></p> <ul style="list-style-type: none"> <li>a. Motor end-plate.</li> <li>b. Myelin sheath.</li> <li>c. Synaptic cleft.</li> <li>d. Motor neuron.</li> <li>e. Terminal knob.</li> </ul>	C
<p><b>3) <u>Junctional folds of NMJ:</u></b></p> <ul style="list-style-type: none"> <li>a. Are present at motor end plate</li> <li>b. At present at axonal terminal</li> <li>c. Contains vesicles of acetylcholine</li> <li>d. Contain catechol-orthomethyl transferase (CAT) enzyme</li> <li>e. Decrease the surface area of postsynaptic membrane</li> </ul>	A
<p><b>4) <u>Which step of neuromuscular transmission appear after Na permeability increase :</u></b></p> <ul style="list-style-type: none"> <li>a. Action potential spread on the membrane.</li> <li>b. End plate potential develop.</li> <li>c. Release of acetylcholine.</li> <li>d. Muscle contraction.</li> <li>e. Muscle relaxation.</li> </ul>	B
<p><b>5) <u>Synaptic vesicles which help neuromuscular transmission have?</u></b></p> <ul style="list-style-type: none"> <li>a- Noradrenaline.</li> <li>b- Dopamine.</li> <li>c-Acetylcholine.</li> <li>d. Adrenaline.</li> <li>e. Muscarine.</li> </ul>	C



<p><b>6) <u>An action potential arriving at the presynaptic terminal causes:</u></b></p> <p>A) Sodium ions to diffuse into the cell.          B) Sodium ions to diffuse out of the cell.          C) Calcium ions to diffuse into the cell.          D) Acetylcholine to diffuse into the cell.          E) Ligand-gated sodium channels to open.</p>	C
<p><b>7) <u>Arrange the following in the proper order in which they occur at the pre-synaptic side of a neuromuscular junction.</u></b></p> <p>1) Calcium ions are released          2) Action potential arrives at the presynaptic terminal          3) Neurotransmitter is released</p> <p>a. 3,2,1          b. 3.1.2          c. 1.3.2          d. 1.2.3          e. 2.1.3</p>	E
<p><b>8) <u>In the neuromuscular junction, acetylcholine:</u></b></p> <p>A. Binds to acetylcholine receptors on the postsynaptic muscle fiber.          B. Is actively transported across the synaptic cleft and binds to voltage gated acetylcholine receptors on the postsynaptic muscle fiber.          C. Diffuses across the synaptic cleft and causes calcium ions to diffuse into the postsynaptic muscle fiber.          D. Diffuses across the synaptic cleft and causes sodium ions to diffuse out of the postsynaptic muscle fiber.          E. Is actively transported across the synaptic cleft and causes chloride ions to diffuse into the postsynaptic muscle fiber.</p>	A
<p><b>9) <u>During neuromuscular transmission, the arrival of nerve action potential at the synaptic knob leads to which of the following?</u></b></p> <p>A-Opening of Na channels.          B- Opening of voltage gated Ca channels.          C-Opening of ligand gate Ca<sup>++</sup> channels          D-Opening of Cl<sup>-</sup> channels.          E-Closure of all channels.</p>	B



<p><b>10) Neuromuscular transmission is characterized by:</b></p> <ul style="list-style-type: none"> <li>a) uni-directional.</li> <li>b) stimulated by succinyl choline.</li> <li>c) inhibited by increased <math>Ca^{++}</math>.</li> <li>d) the chemical transmitter is noradrenaline.</li> <li>E. stimulated by curare.</li> </ul>	<b>A</b>
<p><b>11) At the muscle end plate, acetylcholine (ACh) causes the opening of:</b></p> <ul style="list-style-type: none"> <li>a. <math>Na^+</math> channels only.</li> <li>b. Ca channels only.</li> <li>c. <math>Na^+</math> and <math>K^+</math> channels and depolarization to a value halfway between <math>Na^+</math> and <math>K^+</math> equilibrium potentials.</li> <li>d. <math>Na^+</math> and <math>K^+</math> channels and hyperpolarization to a value halfway between <math>Na^+</math> and <math>K^+</math> equilibrium p</li> </ul>	<b>C</b>
<p><b>12) Myasthenia gravis:</b></p> <ul style="list-style-type: none"> <li>a) means muscle stiffness.</li> <li>b) is a disease of the nerve.</li> <li>c) is a disease of the muscle.</li> <li>d) is a disease of the neuromuscular junction.</li> <li>e) is due to loss of ATP.</li> </ul>	<b>D</b>
<p><b>13) Neuromuscular transmission is inhibited by:</b></p> <ul style="list-style-type: none"> <li>a) acetylcholine.</li> <li>b) curare.</li> <li>c) noradrenaline.</li> <li>d) methacholine ions.</li> <li>e) calcium ions.</li> </ul>	<b>B</b>
<p><b>14) During neuromuscular transmission:</b></p> <ul style="list-style-type: none"> <li>a) Ach release can be inhibited by excess <math>Mg^{++}</math>.</li> <li>b) Ach release can be inhibited by hypercalcemia.</li> <li>c) Ach acts on voltage gated <math>Na^+</math> channels in the synaptic gutter.</li> <li>d) Ach is released by simple diffusion.</li> <li>e) acetyl choline esterase enzyme blocks Ach gated ion channels.</li> </ul>	<b>A</b>



<p><b>15) <u>Myasthenia gravis is due to:</u></b></p> <p>a) loss of ATP.  b) decrease of acetylcholine in synaptic knobs.  c) hyperpolarization of sarcolemma.  d) destruction of myosin heads.  e) destruction of acetylcholine-gated ion channels on synaptic gutter (destruction of Ach receptors).</p>	E
<p><b>16) <u>Synaptic delay is caused by:</u></b></p> <p>a. Formation of Ach  b. Packing of Ach into vesicles.  c. Breakdown of Ach  d. Ach diffusion across the synaptic cleft.  e. Reuptake of choli</p>	D
<p><b>17) <u>During neuromuscular transmission:</u></b></p> <p>a) Ca<sup>++</sup> enters through synaptic gutter.  b) Ach is released from synaptic gutter.  c) the impulse is transmitted in one direction.  d) motor endplate potential occurs in synaptic knobs.  e) there is a delay of about 5 milliseconds.</p>	C
<p><b>18) <u>Which of the following statement is true for impulse transmission at the neuromuscular junction:</u></b></p> <p>a) it is stimulated by high level of choline esterase.  b) it is associated with influx of potassium ions through the muscle membrane.  c) it is depressed by a low level of magnesium.  d) it is dependent on the amount of acetyl choline released at the end plate.  e) none of the above is correct.</p>	D
<p><b>19) <u>Which of the following is thought to be an autoimmune disease of acetylcholine receptors?</u></b></p> <p>a. Myasthenia gravis.  b. Myotonic dystrophy.  c. Multiple sclerosis.  d. Muscular dystrophy.  e. Fibromyalgia.</p>	A

45.	<p><b>In skeletal muscle, which of the following events occurs before depolarization of the T tubules in the mechanism of excitation-contraction coupling?</b></p> <p>a) Depolarization of the sarcolemmal membrane.  b) Opening of <math>Ca^{++}</math> release channels on the sarcoplasmic reticulum (SR).  c) Uptake of <math>Ca^{++}</math> into the SR by <math>Ca^{++}</math>adenosine triphosphatase (ATPase).  d) Binding of <math>Ca^{++}</math> to troponin C (e) Binding of actin and myosin.  Cross bridging of actin over myosin.</p>	A
46.	<p><b>Among the steps of skeletal muscle relaxation:</b></p> <p>a) inward spread of the depolarization wave along the transverse tubules.  b) Pumping of <math>Ca^{++}</math> back into the sarcoplasmic reticulum.  c) Release of <math>Ca^{++}</math> from the sarcoplasmic reticulum.  d) Binding of <math>Ca^{++}</math> to troponin C.  e) Binding of cross bridges to actin.</p>	B
47.	<p><b>Which of the following temporal sequences is correct for excitation-contraction coupling in skeletal muscle?</b></p> <p>a) Increased intracellular <math>[Ca^{++}]</math>; action potential in the muscle membrane; cross-bridge formation.  b) Action potential in the muscle membrane; depolarization of the T tubules; release of <math>Ca^{++}</math> from the sarcoplasmic reticulum (SR).  c) Action potential in the muscle membrane; splitting of adenosine triphosphate (ATP); binding of <math>Ca^{++}</math> to troponin C.  d) Release of <math>Ca^{++}</math> from the SR; depolarization of the T tubules; binding of <math>Ca^{++}</math> to troponin C.</p>	B
48.	<p><b>During muscle contraction, which of the following statement is false:</b></p> <p>a) The binding sites at the actin filaments are activated by <math>Ca^{++}</math>.  b) The sliding of actin continues as long as <math>Ca^{++}</math> is attached to troponin C.  c) The detachment of myosin heads from actin needs binding of an ATP molecule.  d) The transverse tubules become filled with intracellular fluid.  e) The sarcomeres become shortened.</p>	D
49.	<p><b>About the activity of skeletal muscles, one of the following is incorrect:</b></p> <p>a) Hypertrophy develops as a result of forced repeated contractions.  b) The function of the T system is the rapid transmission of the action potential from the cell membrane to inside the muscle fiber.  c) During the spike potential, the muscle excitability is normal.  d) Acetylcholine released at the M.E.P. is rapidly hydrolyzed by cholinesterase.  e) Pale muscle fibers show rapid fatigue.</p>	C

50.	<p><b>During muscles contraction:</b></p> <ul style="list-style-type: none"> <li>a) The A bands remain constant.</li> <li>b) The I bands are elongated.</li> <li>c) The Z lines move further apart.</li> <li>d) The H zones become wider.</li> <li>e) The tropomyosin molecules remain in place.</li> </ul>	A
51.	<p><b>In skeletal muscles, the transverse tubules and adjacent cisterns constitute:</b></p> <ul style="list-style-type: none"> <li>a) A triad.</li> <li>b) The sarcolemma.</li> <li>c) A myofibril.</li> <li>d) A muscle fiber.</li> <li>e) The sarcomere.</li> </ul>	A
52.	<p><b>The following characteristics are present in both skeletal and smooth muscles:</b></p> <ul style="list-style-type: none"> <li>a) The myofibrils in both have Z membranes.</li> <li>b) Both initiate spontaneous rhythmic contractions.</li> <li>c) Both contain actin &amp; myosin &amp; show tonic (partial) contraction at rest.</li> <li>d) Both can be affected by hormones and chemicals equally.</li> <li>e) Both have T tubules.</li> </ul>	C
53.	<p><b>In skeletal muscles, one of the following is incorrect:</b></p> <ul style="list-style-type: none"> <li>a) Tropomyosin is found in the thin filaments.</li> <li>b) Myosin is found in the thick filaments.</li> <li>c) The lateral sacs of sarcoplasmic reticulum are rich in <math>Ca^{++}</math></li> <li>d) Troponin C molecules bind <math>Ca^{++}</math>.</li> <li>e) Energy from ATP is not required for muscle relaxation.</li> </ul>	E
54.	<p><b>In skeletal muscles, the:</b></p> <ul style="list-style-type: none"> <li>a) A bands are broader than the I bands and contain both actin and myosin.</li> <li>b) H zones contain only actin and increase in width during contraction.</li> <li>c) Z membranes are present in the middle of the H zones.</li> <li>d) I bands contain myosin only.</li> <li>e) Sole feet at the motor end plate are myelinated branches of the nerve.</li> </ul>	A
55.	<p><b>The functions of tropomyosin in skeletal muscles include:</b></p> <ul style="list-style-type: none"> <li>a) Sliding on actin to produce shortening.</li> <li>b) Releasing <math>Ca^{++}</math> from the sarcoplasmic reticulum.</li> <li>c) Binding to myosin during contraction.</li> <li>d) Acting as a relaxing protein at rest.</li> <li>e) Generating ATP and providing it to the contractile proteins.</li> </ul>	D

56.	<p><b>The cross bridges in skeletal muscles are components of:</b></p> <ul style="list-style-type: none"> <li>a) Myosin</li> <li>b) Troponin</li> <li>c) Actin</li> <li>d) Myelin.</li> <li>e) Tropomyosin</li> </ul>	A
57.	<p><b>Skeletal muscles can maintain contraction without fatigue due to the:</b></p> <ul style="list-style-type: none"> <li>a) Treppe phenomenon.</li> <li>b) Summation of contractions.</li> <li>c) Alternation of the muscle fiber contraction.</li> <li>d) Presence of tight gap junctions between the muscle fibers.</li> <li>e) Increased consumption of lactic acid</li> </ul>	C
58.	<p><b>One of the following is wrong:</b></p> <ul style="list-style-type: none"> <li>a) Tight gap junctions are absent in skeletal muscles and present in smooth muscles.</li> <li>b) Skeletal muscles don't obey the all or none law while visceral smooth muscles do.</li> <li>c) A motor unit is a single motor neuron and all muscle fibers innervated by it.</li> <li>d) The smooth muscle contracts when stretched in absence of extrinsic nerves.</li> <li>e) All types of muscle contract when <math>Ca^{++}</math> is taken up by the sarcoplasmic reticulum</li> </ul>	E
59.	<p><b>The action potential of skeletal muscles:</b></p> <ul style="list-style-type: none"> <li>a) Has a prolonged plateau phase.</li> <li>b) Has a smaller magnitude than that of smooth muscles.</li> <li>c) Spreads inwards to all parts of the muscle fiber via the T-tubules.</li> <li>d) Causes uptake of <math>Ca^{++}</math> into the lateral sacs of the sarcoplasmic reticulum.</li> <li>e) Is not essential for contraction.</li> </ul>	C
60.	<p><b>Among the Steps of muscles contraction one of the following is wrong</b></p> <ul style="list-style-type: none"> <li>a) Generation of an action potential</li> <li>b) Spread of depolarization into the muscle fibers via the T system.</li> <li>c) Release of <math>Ca^{++}</math> from the sarcoplasmic reticulum.</li> <li>d) Release of <math>K^{+}</math> from troponin T.</li> <li>e) Formation of cross linkages between actin and myosin.</li> </ul>	D
61.	<p><b>Which of the following causes rigor in skeletal muscle?</b></p> <ul style="list-style-type: none"> <li>a) Lack of action potentials in motoneurons.</li> <li>b) An increase in intracellular <math>Ca^{++}</math> level.</li> <li>c) A decrease in intracellular <math>Ca^{++}</math> level</li> <li>d) An increase in adenosine triphosphate (ATP) level.</li> <li>e) A decrease in ATP level.</li> </ul>	E

62.	<p><b>About excitation contraction coupling of skeletal muscle which of the following is false:</b></p> <ul style="list-style-type: none"> <li>a) ATP hydrolysis.</li> <li>b) Binding of Ca to calmodulin.</li> <li>c) Stimulation of DHP R.</li> <li>d) T tubule depolarization.</li> <li>e) Increase Na permeability of sarcolemma.</li> </ul>	B
63.	<p><b>Single contraction of skeletal muscle is mostly terminated by:</b></p> <ul style="list-style-type: none"> <li>a) Closure of postsynaptic nicotinic A.choline R.</li> <li>b) Removal of A choline from NMJ.</li> <li>c) Removal of Ca from terminal of motor neuron.</li> <li>d) Removal of sarcoplasmic Ca.</li> <li>e) Return of DHP to resting state.</li> </ul>	D
64.	<p><b>Which of the following decrease in length during contraction:</b></p> <ul style="list-style-type: none"> <li>a) A band of sarcomere.</li> <li>b) I band of sarcomere.</li> <li>c) Z disc of sarcomere.</li> <li>d) Thick filament.</li> <li>e) Thin filament</li> </ul>	B
65.	<p><b>H zone contain the following proteins:</b></p> <ul style="list-style-type: none"> <li>a) Actin.</li> <li>b) Actin and myosin.</li> <li>c) Myosin but not actin.</li> <li>d) Titin protein</li> <li>e) Tropomyosin</li> </ul>	C
66.	<p><b>One of the following is not a character of sarcomere:</b></p> <ul style="list-style-type: none"> <li>a) It is the distance between 2 Z membranes.</li> <li>b) It is shortened during contraction.</li> <li>c) The width of the I band does not change during contraction.</li> <li>d) The width of the A band does not change during contraction.</li> <li>e) H-zone becomes narrower during contraction.</li> </ul>	C
67.	<p><b>One of the following is not a character of transverse tubules:</b></p> <ul style="list-style-type: none"> <li>a) It increases the surface area of the cell membrane.</li> <li>b) It transmits action potential to inside the fiber.</li> <li>c) It acts as a Ca<sup>++</sup> stores</li> <li>d) It is absent in smooth muscle fibers.</li> <li>e) There are 2 in each sarcomere in skeletal muscle</li> </ul>	C

(3)

68.	<p>Repeated stimulation of a skeletal muscle fiber causes a sustained contraction (tetanus). Accumulation of which solute in intracellular fluid is responsible for the tetanus (continuous contraction)?</p> <p>a) <math>\text{Na}^+</math>  b) <math>\text{K}^+</math>  c) <math>\text{Cl}^-</math>  d) <math>\text{Mg}^{++}</math>  e) <math>\text{Ca}^{++}</math></p>	E
69.	<p>Excitation contraction coupling involves all the following except:</p> <p>a- Release of <math>\text{Ca}^{++}</math> from troponin.  b- Formation of cross bridges between actin and myosin.  c- Spread of depolarization along the transverse tubules.  d- Hydrolysis of ATP to ADP.</p>	A
70.	<p>Muscle fatigue is due to:</p> <p>a- Inability of the action potential to spread over the muscle.  b- Failure of transmission in the motor nerve.  c- Failure of neuro-muscular transmission  d- Depletion of energy stores.</p>	D
71.	<p>The action potential of skeletal muscle:</p> <p>a- has a prolonged plateau phase.  b- spread inward to all parts of the muscle via T tubules.  c- is longer than the action potential in the cardiac muscle.  d- cause re-uptake of <math>\text{Ca}^{++}</math> into the terminal cisternae.</p>	B
72.	<p>As regard transverse tubules all are true except:</p> <p>a- it increases the surface area of the cell membrane.  b- it transmits action potential to inside the fiber.  c- it acts as a <math>\text{Ca}^{++}</math> stores.  d- it is absent in smooth muscle fibers.</p>	C



<p><b>1) <u>The function of Tropomyosin in skeletal muscle include:</u></b></p> <ul style="list-style-type: none"> <li>a. Binding to myosin during contraction</li> <li>b. Acting as a relaxing protein at rest by covering binding sites on actin.</li> <li>c. Sliding on actin shortening to produce</li> <li>d. Releasing Ca<sup>++</sup> after propagation of action potential</li> <li>e. Reuptake of Ca<sup>++</sup> during muscle relaxation</li> </ul>	<b>B</b>
<p><b>2) <u>Among the steps of skeletal muscle relaxation:</u></b></p> <ul style="list-style-type: none"> <li>a. Binding of cross bridges to actin</li> <li>b. Pumping of Ca<sup>++</sup> back into the sarcoplasmic reticulum.</li> <li>c. Binding of Ca<sup>++</sup> to troponin C.</li> <li>d. inward spread of the depolarization waves along the transverse tubules.</li> <li>e. Binding of Ca<sup>++</sup> to troponin C.</li> </ul>	<b>B</b>
<p><b>3) <u>The myosin head contain:</u></b></p> <ul style="list-style-type: none"> <li>a. AMP binding sites</li> <li>b. ATP binding sites</li> <li>c. ADP binding sites</li> <li>d. GTP binding sites</li> </ul>	<b>B</b>
<p><b>4) <u>The main protein that form the thick muscle protein is:</u></b></p> <ul style="list-style-type: none"> <li>a. troponin</li> <li>b. tropomyosin</li> <li>c. actin</li> <li>d. myosin</li> </ul>	<b>D</b>
<p><b>5) <u>Relaxing protein is:</u></b></p> <ul style="list-style-type: none"> <li>a. Myosin</li> <li>b. Actin</li> <li>c. Hzone</li> <li>d. Tropomyosin</li> <li>e. T. tubule.</li> </ul>	<b>D</b>



<p><b>6) <u>Cross bridges of sarcomere in skeletal muscles are made up of:</u></b></p> <ul style="list-style-type: none"> <li>a. actin.</li> <li>b. troponin.</li> <li>c. tropomyosin.</li> <li>d. myosin.</li> </ul>	D
<p><b>7) <u>During muscle contraction, all the following is true except:</u></b></p> <ul style="list-style-type: none"> <li>a) the binding sites at the actin filament are activated by <math>Ca^{+2}</math>.</li> <li>b) the walk along theory of contraction assumes that sliding of actin continues as long as <math>Ca^{+2}</math> is attached to troponin C.</li> <li>c) detachment of myosin heads from actin needs binding of ATP molecule</li> <li>d) the transverse tubules (T.T) become filled with intracellular fluid</li> </ul>	D
<p><b>8) <u>In skeletal muscles, all the following is true except:</u></b></p> <ul style="list-style-type: none"> <li>a. tropomyosin is found in the thin filaments.</li> <li>b. myosin is found in the thick filaments.</li> <li>c. the lateral sacs of sarcoplasmic reticulum are rich in <math>Ca^{+2}</math>.</li> <li>d. troponin C molecules bind <math>Ca^{+2}</math>.</li> <li>e. energy from ATP is not required for muscle relaxation.</li> </ul>	E
<p><b>9) <u>A single contraction of skeletal muscle is most likely to be terminated by which of the following actions?</u></b></p> <ul style="list-style-type: none"> <li>a. closure of post-synaptic nicotinic acetylcholine receptors.</li> <li>b. removal of acetylcholine from the neuro-muscular junction.</li> <li>c. removal of <math>Ca^{+2}</math> from the terminal of the motor neuron.</li> <li>d. removal of sarcoplasmic <math>Ca^{+2}</math>.</li> <li>e. return of the dihydropyridine receptor to its resting conformation.</li> </ul>	D
<p><b>10) <u>Rigors mortis is due to:</u></b></p> <ul style="list-style-type: none"> <li>a. Failure of detachment between actin and myosin</li> <li>b. Excessive release of <math>Ca^{++}</math> from SR</li> <li>c. Damage of troponin protein molecules.</li> <li>d. Lack of binding sites of myosin on actin</li> <li>e. Failure of propagation of action potential along muscle fibres</li> </ul>	A



<p><b>11) <u>During muscle contraction:</u></b></p> <ul style="list-style-type: none"> <li>a) the A bands remain constant.</li> <li>b) the Z lines move further apart.</li> <li>c) the tropomyosin molecules remain in place.</li> <li>d) the bands are elongated.</li> <li>e) the H zones become wider.</li> </ul>	<b>A</b>
<p><b>12) <u>Which of the following causes rigor in skeletal muscle?</u></b></p> <ul style="list-style-type: none"> <li>a) Lack of action potentials in motoneurons.</li> <li>b) An increase in intracellular <math>Ca^{++}</math> level.</li> <li>c) A decrease in intracellular <math>Ca^{++}</math> level</li> <li>d) An Increase in adenosine triphosphate (ATP) level.</li> <li>e) A decrease in ATP level.</li> </ul>	<b>E</b>
<p><b>13) <u>One of the following is not a character of sarcomere:</u></b></p> <ul style="list-style-type: none"> <li>a) It is the distance between 2Z membranes.</li> <li>b) It is shortened during contraction.</li> <li>c) The width of I band does not change during contraction.</li> <li>d) The width of the A band does not change during contraction.</li> <li>e) H-zone becomes narrower during contraction.</li> </ul>	<b>C</b>
<p><b>14) <u>In skeletal muscle, the:</u></b></p> <ul style="list-style-type: none"> <li>a) A bands are broader than the I bands and contain both actin and myosin.</li> <li>b) H zones contain only actin and increase in width during contraction.</li> <li>c) Z membranes are phase in the middle of the H zones.</li> <li>d) I bands contain myosin only.</li> <li>e) Sole feet at the motor end plate are myelinated branches of the nerve.</li> </ul>	<b>A</b>



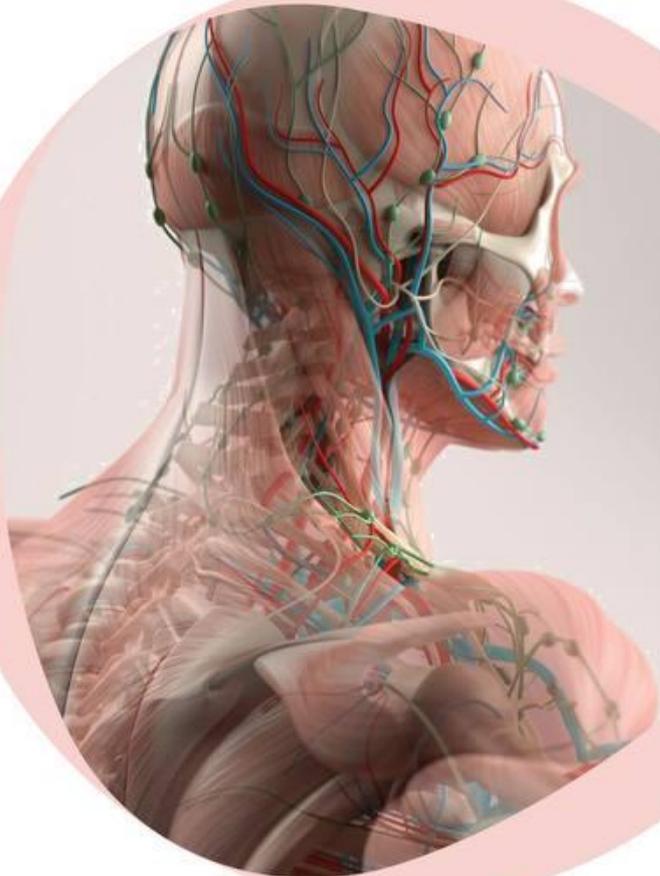
SCAN ME

2024

Level 1 Semester 2

MSS module

# PHYSIOLOGY



**MCQ L4**

**DR. ELSAWY**



## MCQ

<p><b>1) The resting heat production in skeletal muscles :</b></p> <ul style="list-style-type: none"><li>a. Occurs during contraction.</li><li>b. Occurs during recovery following exercise.</li><li>c. Is called the initial heat.</li><li>d. Is external manifestation of basal metabolic processes.</li></ul>	<b>D</b>
<p><b>2) Concerning isometric and isotonic muscle contractions:</b></p> <ul style="list-style-type: none"><li>a. Isometric contraction does not require sliding of actin filaments.</li><li>b. During isometric contraction a load is moved and work is done.</li><li>c. During isotonic contraction a greater amount of energy is needed.</li><li>d. During isotonic contraction the muscle length is not changed.</li></ul>	<b>C</b>
<p><b>3) About the properties of various types of muscles:-</b></p> <ul style="list-style-type: none"><li>a. Excitation-contraction coupling is more rapid in smooth ms than skeletal ms.</li><li>b. An isometric contraction means a contraction with out shortening.</li><li>c. Acetylcholine is not released at the M.E.P.</li><li>d. Curare blocks NM transmission by preventing release of A.Ch</li></ul>	<b>B</b>
<p><b>4) In skeletal muscles, there is an inverse relationship between :</b></p> <ul style="list-style-type: none"><li>a. The muscle length and force of contraction.</li><li>b. The load opposing the contraction and velocity of contraction.</li><li>c. The cross sectional area and strength of the muscle.</li><li>d. All of the above.</li></ul>	<b>B</b>
<p><b>5) The skeletal muscles:</b></p> <ul style="list-style-type: none"><li>a. Contain pacemaker cells.</li><li>b. Contract when Ca is taken up by the sarco-tubular system.</li><li>c. Contraction strength is related to the initial length.</li><li>d. Contract when the actin and myosin filaments shorten.</li></ul>	<b>C</b>



<p><b>6) Maximal tension is developed in skeletal muscles when they are at :</b></p> <ul style="list-style-type: none"><li>a. The equilibrium length.</li><li>b. The resting length.</li><li>c. More than the resting length.</li><li>d. 3 times the equilibrium length.</li></ul>	<p><b>B</b></p>
<p><b>7) In isometric contractions, the initial heat is :</b></p> <ul style="list-style-type: none"><li>a. Too small to measure.</li><li>b. Approximately equal to the activation heat.</li><li>c. Equal to the shortening heat.</li><li>d. More than the relaxation heat.</li></ul>	<p><b>B</b></p>
<p><b>8) Electrical changes during muscle contraction are similar to those produced in nerve fibers, except for which of following differences?</b></p> <ul style="list-style-type: none"><li>a) Resting membrane potential</li><li>b) Firing level (Threshold)</li><li>c) Magnitude of the spike potential</li><li>d) Duration of the negative and positive afterpotentials</li><li>e) All of the above</li></ul>	<p><b>E</b></p>
<p><b>9) Which of the following is heat production included in initial heat ?</b></p> <ul style="list-style-type: none"><li>a) Activation heat</li><li>b) Shortening heat</li><li>c) Work heat</li><li>d) All of the above</li></ul>	<p><b>D</b></p>
<p><b>10) Isometric contraction occurs when the muscle contracts against:</b></p> <ul style="list-style-type: none"><li>a) Light load</li><li>b) Moderate load</li><li>c) Heavy load</li><li>d) No load</li></ul>	<p><b>C</b></p>



<p><b>11) Mechanical efficiency of muscle contraction is defined as ratio of:</b></p> <ul style="list-style-type: none"><li>a) Work to total energy expenditure</li><li>b) Heat to total energy expenditure</li><li>c) Load to distance of movement</li><li>d) Tension to velocity of shortening</li></ul>	<p><b>A</b></p>
<p><b>12) The force-velocity relationship during muscle contraction states that the velocity of shortening is inversely proportional to:</b></p> <ul style="list-style-type: none"><li>a) Muscle tension</li><li>b) Length-tension relationship</li><li>c) Weight of the load</li><li>d) Optimal muscle length</li></ul>	<p><b>C</b></p>
<p><b>13) Muscle contraction results in changes in which of the following aspects?</b></p> <ul style="list-style-type: none"><li>a) Electrical changes</li><li>b) Excitability changes</li><li>c) Thermal changes</li><li>d) Mechanical changes</li><li>e) All of the above</li></ul>	<p><b>E</b></p>
<p><b>14) Resting membrane potential of skeletal ms fibers is approximately:</b></p> <ul style="list-style-type: none"><li>a) -70 mV</li><li>b) -90 mV</li><li>c) -50 mV</li><li>d) +40 mV</li></ul>	<p><b>B</b></p>
<p><b>15) Which phase of heat production during muscle contraction occurs before any shortening has occurred?</b></p> <ul style="list-style-type: none"><li>a) Activation heat</li><li>b) Shortening heat</li><li>c) Work heat</li><li>d) Delayed heat</li></ul>	<p><b>A</b></p>



<p><b>16) Isotonic contraction occurs when the muscle:</b></p> <ul style="list-style-type: none"><li>a) Contracts against heavy load</li><li>b) Contracts against light or moderate load</li><li>c) Shortens without moving</li><li>d) Does not perform any work</li></ul>	<p><b>B</b></p>
<p><b>17) The force-velocity relationship in muscle contraction states that:</b></p> <ul style="list-style-type: none"><li>a) Velocity of shortening is inversely proportional to weight of load</li><li>b) Velocity of shortening is directly proportional to weight of load</li><li>c) Maximum tension is obtained when the muscle length is longer than optimal length</li><li>d) Tension decreases when the muscle length is equal to resting length</li></ul>	<p><b>A</b></p>
<p><b>18) During muscle contraction, approximately what percentage of the energy liberated as a result of ATP hydrolysis is converted into work?</b></p> <ul style="list-style-type: none"><li>a) 10-20%</li><li>b) 30-40%</li><li>c) 40-50%</li><li>d) 70-80%</li></ul>	<p><b>C</b></p>
<p><b>19) What is the duration of the negative and positive afterpotentials in skeletal muscle fibers?</b></p> <ul style="list-style-type: none"><li>a) 0.5-1 m.sec</li><li>b) 3-5 m.sec</li><li>c) 10-15 m.sec</li><li>d) 20-25 m.sec</li></ul>	<p><b>B</b></p>



<p><b>20) Which phase of heat production during muscle contraction occurs after the muscle has relaxed?</b></p> <ul style="list-style-type: none"><li>a) Activation heat</li><li>b) Shortening heat</li><li>c) Work heat</li><li>d) Delayed heat</li></ul>	<p><b>D</b></p>
<p><b>21) What is the magnitude of the spike potential in skeletal muscle fibers?</b></p> <ul style="list-style-type: none"><li>a) 90 mV</li><li>b) 70 mV</li><li>c) 130 mV</li><li>d) 105 mV</li></ul>	<p><b>C</b></p>
<p><b>22) Which phase of heat production during muscle contraction is proportional to the degree of shortening?</b></p> <ul style="list-style-type: none"><li>a) Activation heat</li><li>b) Shortening heat</li><li>c) Work heat</li><li>d) Delayed heat</li></ul>	<p><b>B</b></p>
<p><b>23) What is the velocity of conduction in thick myelinated nerve fibers?</b></p> <ul style="list-style-type: none"><li>a) 3-5 meters/sec</li><li>b) 10-15 meters/sec</li><li>c) 40-50 meters/sec</li><li>d) Up to 120 meters/sec</li></ul>	<p><b>D</b></p>



<p><b>24) Which phase of excitability changes occurs after the absolute refractory period?</b></p> <ul style="list-style-type: none"><li>a) Relative refractory period</li><li>b) Supernormal phase of excitability</li><li>c) Subnormal phase of excitability</li><li>d) Absolute refractory period</li></ul>	<p><b>A</b></p>
<p><b>25) In an isotonic contraction, what happens to the muscle length?</b></p> <ul style="list-style-type: none"><li>a) It shortens</li><li>b) It remains constant</li><li>c) It lengthens</li><li>d) It varies depending on the load</li></ul>	<p><b>A</b></p>
<p><b>26) What is the duration of the spike potential in skeletal muscle fibers?</b></p> <ul style="list-style-type: none"><li>a) 0.5-1 m.sec</li><li>b) 3-5 m.sec</li><li>c) 10-15 m.sec</li><li>d) 20-25 m.sec</li></ul>	<p><b>B</b></p>
<p><b>27) Which phase of heat production during muscle contraction occurs due to the metabolic reactions needed to reform energy stores in the muscle?</b></p> <ul style="list-style-type: none"><li>a) Activation heat</li><li>b) Shortening heat</li><li>c) Work heat</li><li>d) Delayed heat</li></ul>	<p><b>D</b></p>



<p><b>28) What is the primary source of energy for muscle contraction?</b></p> <ul style="list-style-type: none"><li>a) Glucose</li><li>b) Lactic acid</li><li>c) ATP</li><li>d) Calcium ions</li></ul>	<p><b>C</b></p>
<p><b>29) In an isometric contraction, muscle tension:</b></p> <ul style="list-style-type: none"><li>a) Increases at first and then is maintained constant</li><li>b) Markedly increases</li><li>c) Decreases as the muscle lengthens</li><li>d) Varies depending on the load</li></ul>	<p><b>B</b></p>
<p><b>30) The velocity of shortening during isotonic contraction is inversely proportional to:</b></p> <ul style="list-style-type: none"><li>a) The weight of the load</li><li>b) The duration of the contraction</li><li>c) The resting length of the muscle</li><li>d) The degree of shortening</li></ul>	<p><b>A</b></p>

Harvard

Important & Formative  
MCQ  
MSK Physiology

فَلَسْ طِينِ

**MCQ notes L1**

- 1) Surface area of skin is **1.2-2.2 m<sup>2</sup>**
- 2) Skin account for **7%** of body weight , weigh **5 kg**
- 3) **Epidermis** is the outer most layer of skin
- 4) **Dermis** contain connective tissue , blood vessel , piloerector ms , nerve fibers
- 5) **Hypodermis** is layer of fat , act as heat insulator
- 6) **Skin has** protective function by low PH , bacteriocidal agant , defensin , cathelicidin (prevent infection by group A streptococci) , melanin (protect against UV rays)
- 7) **Some substances can penetrate skin** in limited amount as lipid soluble substance as O<sub>2</sub>,CO<sub>2</sub> , organic solvent , heavy metals and penetration enhancer
- 8) **Skin is rich in** sensory receptors as Meissner , merkels
- 9) **Metabolic function of skin :**
  - Synthesis of vit D<sub>3</sub> from 7 dehydrocholesterol
  - Detoxify cancer producing chemicals
  - Activate steroids
- 10) **Vascular network** in dermis contain 5% of body blood volume , constrict in hemorrhage and exercise
- 11) Normal body temperature is **36.6-37.2**
- 12) Skin is **major effector organ** beside sk ms involved in regulation of body temperature
- 13) **Insulating property** of normal male body equal  $\frac{3}{4}$  of usual suit of clothes

## MCQ L1

<p>1. Which of the following is NOT a function of the skin?</p> <p>A) Temperature regulation.  B) Vitamin D synthesis.  C) Protection from bacterial infection.  D) Blood cell production.</p>	D
<p>2. Which of the following is NOT a protective function of the skin?</p> <p>A) covering to keep pathogens out  B) sweating to reduce temperature  C) melanin to protect from UV radiation.  D) sebum to retard bacterial growth</p>	B
<p>3. Which of the following does NOT occur in cool temperatures?</p> <p>A) blood vessels dilate  B) shivering  C) sweat glands become inactive  D) arrector pili muscles contract</p>	A
<p>4. Place the layers of the skin and the hypodermis in order of most superficial to deepest.</p> <p>A) dermis, epidermis and hypodermis  B) epidermis, dermis and hypodermis  C) epidermis; hypodermis and dermis  D) hypodermis, dermis and epidermis</p>	B
<p>5. The hypodermis is also known as the:</p> <p>A) cutaneous membrane.  B) integument.  C) mucous membrane  D) subcutaneous tissue</p>	D
<p>6. The primary cell of the epidermis is the:</p> <p>A) keratinocyte  B) Langerhans cell  C) melanocytes  D) Merkel cells</p>	A

<p>7. The cell of the epidermis that detects tactile sensations is the:</p> <p>A) keratinocyte                  B) Langerhans cell                  C) melanocytes                  D) Merkel cells</p>	<p>D</p>
<p>8. The cell of the epidermis that produces the pigment primarily responsible for skin color is the:</p> <p>A) keratinocyte                  B) Langerhans cell                  C) melanocytes                  D) Merkel cells</p>	<p>C</p>
<p>9. The epidermis is made of:</p> <p>A) simple squamous epithelium.                  B) stratified squamous epithelium                  C) simple cuboidal epithelium                  D) loose connective tissue</p>	<p>B</p>
<p>10. Vitamin D is created from ..... by skin cells.</p> <p>A. Dehydrocholesterol                  B. Cholesterol                  C. Hydrocholesterol                  D. Hydrodermis</p>	<p>A</p>
<p>11. The innermost layer of the skin is the:</p> <p>A. hypodermis                  B. epidermis                  C. stratum lucidum                  D. dermis</p>	<p>A</p>
<p>12. which of the following is not a skin derivative :</p> <p>a. sweat gland                  b. sebaceous gland                  c. hair                  d. muscle</p>	<p>D</p>
<p>13. AVERAGE surface area of skin is .... m<sup>2</sup></p> <p>a) 1.2-2.2                  b) 3.5-5                  c) 8-10                  d) 15-20</p>	<p>A</p>

<p>14. which layer of skin store fat and act as heat insulator :</p> <p>a) epidermis b) dermis c) hypodermis d) muscle</p>	<p>C</p>
<p>15. Which of the following is not function of skin:</p> <p>a) Protection against internal pathogen b) Regulation of body temperature c) Synthesis of vit C d) Sensation of touch and pressure</p>	<p>C</p>
<p>16. What area of the skin structure is responsible for "goose bump" formation of the skin?</p> <p>a) Arrector Pili Muscle b) Meissner's Corpuscle c) Sensory Nerve Fiber d) Pacinian corpuscle</p>	<p>A</p>
<p>17. Which of the following does NOT describe the dermis?</p> <p>A) Has dermal papillae. B) Contains hair follicles. c) Formed from epithelium. D) Contains blood vessels.</p>	<p>C</p>
<p>18. Consider the dermis. Which of the following is FALSE?</p> <p>A. composed of both loose and dense connective tissue B. collagen fibers predominate and they are mostly type I C. it is poorly innervated D. it has a rich superficial vascular bed E. provides nourishment for the epidermis.</p>	<p>C</p>
<p>19. Hair, nails and glands originate from ..... tissue.</p> <p>A) dermal B) epidermal c) hypodermal</p>	<p>A</p>
<p>20. Which of the following substances do not penetrate the skin easily:</p> <p>a) O<sub>2</sub>, CO<sub>2</sub> b) Vitamin D c) Vitamin C d) Steroids e) Mercury.</p>	<p>C</p>

<p>21. weight of in adult man is normally :</p> <ul style="list-style-type: none"><li>a) 1-3 kg</li><li>b) 4-5 kg</li><li>c) 8-10 kg</li><li>d) 15-20 kg</li></ul>	B
<p>22. which protect the skin against invasion of group A streptococci :</p> <ul style="list-style-type: none"><li>a) Low pH of the skin.</li><li>b) Cathelicidins.</li><li>c) Bactericidal in sebum.</li><li>d) Defensin</li><li>e) Thick epidermis.</li></ul>	B

## MCQ Notes L2

- 1) **Motor unit** is single motor nerve + ms fibers supplied by it
- 2) Fine movement as hand and eye : **small motor unit (<10)**
- 3) Coarse movement (gastrocnemius) : **large motor unit (1000-2000)**
- 4) Chemical transmitter of NMJ is **acetylcholine**
- 5) Junctional folds are present on **MEP**
- 6) **Synaptic cleft** present ( ) nerve terminal and ms , diameter 10-30 nm
- 7) Each vesicle contains **5000-10000 molecules** of acetylcholine
- 8) Release of ach from nerve terminal is **dependent on Ca influx** by voltage-gated channels
- 9) Binding of acetylcholine on nicotinic receptor leads to **Na influx and K efflux at same time**
- 10) Once acetylcholine produces its action , degraded by **cholinesterase** which is present on surface of MEP
- 11) **Miniature EPP** is weak depolarization caused by spontaneous vesicle rupture during rest
- 12) NMT is **one way** because vesicles are present only in nerve terminal
- 13) **Synaptic delay :**
  - 0.5 msec
  - Time needed for release , diffusion of chemical transmitter
- 14) **Synaptic fatigue** caused by depletion of ach vesicles
- 15) **Ca** helps NMT , while **hypercalcemia** decreases NMT
- 16) **Mg** inhibits NMT because it stabilizes ach vesicles
- 17) **K** has an anticholinergic-like action
- 18) **Methacholine and neostigmine** stimulate NMT
- 19) **Botulinum toxin** prevents synthesis and release of ach
- 20) **Hemicholinium** inhibits reuptake of choline
- 21) **Curare** competes with Ach for its nicotinic receptor
- 22) **Succinylcholine** inhibits NMT
- 23) **Myasthenia gravis :**
  - Autoimmune disease of NMJ , Caused mainly by auto-antibody against nicotinic receptor

## MCQ L2

<p>1. The motor unit consists of:</p> <ol style="list-style-type: none"> <li>Single muscle fibers</li> <li>Single nerve fiber and ms fibers supplied by it</li> <li>All motor nerve fibers supplying a skeletal muscle</li> <li>All skeletal ms fibers</li> <li>All motor neurons arising from AHCS supplying several muscles</li> </ol>	B
<p>2. Junctional folds of NMJ:</p> <ol style="list-style-type: none"> <li>Are present at motor end plate</li> <li>At present at axonal terminal</li> <li>Contains vesicles of acetylcholine</li> <li>Contain catechol-orthomethyl transferase (CAT) enzyme</li> <li>Decrease the surface area of postsynaptic membrane</li> </ol>	A
<p>3. Which of the followings increase NMT:</p> <ol style="list-style-type: none"> <li>Hypercalcemia</li> <li>Curare.</li> <li>Mg+2 ions</li> <li>Botulinum toxins.</li> <li>Prostigmine as anticholinesterase</li> </ol>	E
<p>4. The space between the axon terminal &amp; the muscle cell membrane is?</p> <ol style="list-style-type: none"> <li>Motor end-plate.</li> <li>Myelin sheath.</li> <li>Synaptic cleft.</li> <li>Motor neuron.</li> <li>Terminal knob.</li> </ol>	C
<p>5. Synaptic vesicles which help in neuromuscular transmission is filled with?</p> <ol style="list-style-type: none"> <li>100,000 adrenaline molecules.</li> <li>300,00 noradrenaline molecules.</li> <li>10,000 acetylcholine molecules.</li> <li>20,000 dopamine molecules..</li> </ol>	C
<p>6. Which step of neuromuscular transmission appear after Na permeability increase :</p> <ol style="list-style-type: none"> <li>Action potential spread on the membrane.</li> <li>End plate potential develop.</li> <li>Release of acetylcholine.</li> <li>Muscle contraction.</li> <li>Muscle relaxation.</li> </ol>	B

<p>7. In the neuromuscular junction, acetylcholine:</p> <ul style="list-style-type: none"> <li>A. Binds to acetylcholine receptors on the postsynaptic muscle fiber.</li> <li>B. Is actively transported across the synaptic cleft and binds to voltage gated acetylcholine receptors on the postsynaptic muscle fiber.</li> <li>C. Diffuses across the synaptic cleft and causes calcium ions to diffuse into the postsynaptic muscle fiber.</li> <li>D. Diffuses across the synaptic cleft and causes sodium ions to diffuse out of the postsynaptic muscle fiber.</li> <li>E. Is actively transported across the synaptic cleft and causes chloride ions to diffuse into the postsynaptic muscle fiber.</li> </ul>	A
<p>8. An action potential arriving at the presynaptic terminal causes:</p> <ul style="list-style-type: none"> <li>A) Sodium ions to diffuse into the cell.</li> <li>B) Sodium ions to diffuse out of the cell.</li> <li>C) Calcium ions to diffuse into the cell.</li> <li>D) Acetylcholine to diffuse into the cell.</li> <li>E) Ligand-gated sodium channels to open.</li> </ul>	C
<p>9. Synaptic vesicles which help neuromuscular transmission have?</p> <ul style="list-style-type: none"> <li>a- Noradrenaline.</li> <li>b- Dopamine.</li> <li>c-Acetylcholine.</li> <li>d. Adrenaline.</li> <li>e. Muscarine.</li> </ul>	C
<p>10. During neuromuscular transmission, the arrival of nerve action potential at the synaptic knob leads to which of the following?</p> <ul style="list-style-type: none"> <li>A-Opening of Na channels.</li> <li>B-Opening of K channels.</li> <li>C-Opening of voltage gated- Ca channels.</li> <li>D- Opening of Cl channels.</li> <li>E-Closure of all channels.</li> </ul>	C
<p>11. Arrange the following in the proper order in which they occur at the pre-synaptic side of a neuromuscular junction.</p> <ul style="list-style-type: none"> <li>1) Calcium ions are released</li> <li>2) Action potential arrives at the presynaptic terminal</li> <li>3) Neurotransmitter is released</li> </ul> <ul style="list-style-type: none"> <li>a. 3,2,1</li> <li>b. 3.1.2</li> <li>c. 1.3.2</li> <li>d. 1.2.3 e. 2.1.3</li> </ul>	E

<p>12. During neuromuscular transmission, the arrival of nerve action potential at the synaptic knob leads to which of the following?                  A-Opening of Na channels.                  B- Opening of voltage gated Ca channels.                  C-Opening of ligand gate Ca<sup>++</sup> channels                  D-Opening of Cl<sup>-</sup> channels.                  E-Closure of all channels.</p>	B
<p>13. As regard neuro-muscular transmission:                  a. action potential in the motor nerve opens Ca<sup>++</sup> channels, which at last causes acetylcholine vesicles to rupture.                  b. acetyl choline is destroyed in the axonal terminals.                  c. choline esterase enzyme is present inside the muscle fibers.                  d. choline esterase enzyme causes release of acetyl choline from its vesicles.                  e. combination of acetylcholine with its receptor, causes opening of Ca channels.</p>	A
<p>14. At the muscle end plate, acetylcholine (ACh) causes the opening of:                  a. Na<sup>+</sup> channels only.                  b. Ca channels only.                  c. Na<sup>+</sup> and K<sup>+</sup> channels and depolarization to a value halfway between Na<sup>+</sup> and K<sup>+</sup> equilibrium potentials.                  d. Na<sup>+</sup> and K<sup>+</sup> channels and hyperpolarization to a value halfway between Na<sup>+</sup> and K<sup>+</sup> equilibrium potentials.</p>	C
<p>15. Which of the following is thought to be an autoimmune disease of acetylcholine receptors?                  a. Myasthenia gravis.                  b. Myotonic dystrophy.                  c. Multiple sclerosis.                  d. Muscular dystrophy.                  e. Fibromyalgia.</p>	A
<p>16. As regard neuro-muscular transmission all are true except:                  A- it shows fatigue due to depletion of acetylcholine vesicles.                  B- occurs from nerve to muscle i.e. one way conduction.                  C- it is stimulated by succinylcholine.                  D- it is blocked by botulinum toxins.</p>	C
<p>17. Neuromuscular transmission is characterized by:                  a) bi-directional.                  b) blocked by succinyl choline.                  c) inhibited by increased Ca<sup>++</sup>.                  d) the chemical transmitter is noradrenaline. E. stimulated by curare.</p>	B

<p>18. During neuromuscular transmission:</p> <ul style="list-style-type: none"><li>a) Ach release can be inhibited by excess Mg<sup>++</sup>.</li><li>b) Ach release can be inhibited by hypercalcemia.</li><li>c) Ach acts on voltage gated Na<sup>+</sup> channels in the synaptic gutter.</li><li>d) Ach is released by simple diffusion.</li><li>e) acetyl choline esterase enzyme blocks Ach gated ion channels.</li></ul>	A
<p>19. Neuromuscular transmission is inhibited by:</p> <ul style="list-style-type: none"><li>a) acetylcholine.</li><li>b) curare.</li><li>c) noradrenaline.</li><li>d) methacholine ions.</li><li>e) calcium ions.</li></ul>	B
<p>20. Myasthenia gravis is due to:</p> <ul style="list-style-type: none"><li>a) loss of ATP.</li><li>b) decrease of acetylcholine in synaptic knobs.</li><li>c) hyperpolarization of sarcolemma.</li><li>d) destruction of myosin heads.</li><li>e) destruction of acetylcholine-gated ion channels on synaptic gutter (destruction of Ach receptors).</li></ul>	E
<p>21. Myasthenia gravis:</p> <ul style="list-style-type: none"><li>a) means muscle stiffness.</li><li>b) is a disease of the nerve.</li><li>c) is a disease of the muscle.</li><li>d) is a disease of the neuromuscular junction.</li><li>e) is due to loss of ATP.</li></ul>	D

## MCQ notes L3

- 1) One of functions of sk ms is **maintaince of body temperature**
- 2) **Ms fiber or cell** is the structural unit of s kms , diameter is 10-100 um
- 3) **T-tubule** :
  - Tubular extension of sarcolemma , continuous with ECF
  - Help spread of depolarization wave to the interior of ms
- 4) **Terminal cistern of SR** store Ca , release it during contraction
- 5) **Triad** is 2 terminal cistern with T-tubule in between
- 6) **Myofibril** is longitudinal fibers extend from one end to other end of ms fiber , diameter 1 um
- 7) **Sarcomere** :
  - Functional unit of s kms
  - Distance ( ) 2 Z-lines
- 8) **Thick filament** is mysin , **while thin filament** is actine , tropoinin , tropomyosin
- 9) **Cross bridge** is component of myosin
- 10) **Head of myosin contain** ATP binding site , actine binding site
- 11) **Rigor mortis** is stifness of ms due to failure of detachment due to depletion of ATP after death
- 12) **Malignant hyperthermia** is genetic mutation in ryanodine receptor
- 13) Regulatory protein of sk and cardiac ms is **troponin** while smooth ms is **calmodulin**
- 14) Source of Ca for **smooth ms and cardiac mss** is ECF and SR , **while sk ms** from SR.
- 15) **NO tetanus** in cardiac ms
- 16) **TRopomysin** is a relaxing protein
- 17) **A Band** remain constant during ms contraction
- 18) **I band and H zone** shorten during contraction
- 19) **2 Z line** approximates during contraction

## MCQ L3

<p>1. Which of the following increase NMT:</p> <p>a. Hypocalcemia b. Curare c. Mg<sup>2+</sup> ions. d. Botulinum toxins e. Hypoxia</p>	A
<p>2. Synaptic delay is caused by:</p> <p>a. Formation of Ach b. Packing of Ach into vesicles. c. Breakdown of Ach d. Ach diffusion across the synaptic cleft. e. Reuptake of choli</p>	D
<p>3. About Sarcomere, which of the following statements is correct?</p> <p>A. Consisted of one transverse tubule and 2 terminal cisterne B. Contains thick myofilaments only C. includes a whole I band and two hales of A band on each side. D. is the area that has between two A band. E. Represent the functional contracile unit of skeletal myofibrils</p>	E
<p>4. Which of the following is a character of Malignant Hyperthermia?</p> <p>A. Excessive sweating B. Vasodilation C. Production of Cytokines D. Massive increase in metabolic rate E. Brown fat thermogenesis</p>	D
<p>5. Excitation contraction coupling involves all the following except</p> <p>a. release of Ca<sup>2+</sup> from troponin. b. formation of cross bridges between actin and myosin. c. spread of depolarization along the transverse tubules. d. hydrolysis of ATP to ADP.</p>	A
<p>6. In skeletal muscle, which of the Following events occurs before depolarization of the T tubules in the mechanism of excitation-contraction coupling?</p> <p>a) Depolarization of the sarcolemmal membrane. b) Opening of Ca<sup>++</sup> release channels on the sarcoplasmic reticulum (SR). c) Uptake of Ca<sup>++</sup> into the SR by Ca<sup>++</sup> adenosine triphosphatase (ATPase). d) Binding of Ca<sup>++</sup> to troponin C (e) Binding of actin and myosin. e) Cross bridging of actin over myosin.</p>	A

<p>7. The function of Tropomyosin in skeletal muscle include:</p> <ul style="list-style-type: none"> <li>a. Binding to myosin during contraction</li> <li>b. Acting as a relaxing protein at rest by covering binding sites on actin.</li> <li>c. Sliding on actin shortening to produce</li> <li>d. Releasing Ca<sup>++</sup> after propagation of action potential</li> <li>e. Reuptake of Ca<sup>++</sup> during muscle relaxation</li> </ul>	B
<p>8. Among the steps of skeletal muscle relaxation:</p> <ul style="list-style-type: none"> <li>a. Binding of cross bridges to actin</li> <li>b. Pumping of Ca<sup>++</sup> back into the sarcoplasmic reticulum.</li> <li>c. Binding of Ca<sup>++</sup> to troponin C.</li> <li>d. inward spread of the depolarization waves along the transverse tubules.</li> <li>e. Binding of Ca<sup>++</sup> to troponin C.</li> </ul>	B
<p>9. Functions of skeletal muscles include:</p> <ul style="list-style-type: none"> <li>a. Regulation of food intake</li> <li>b. Regulation of arterial blood pressure</li> <li>c. Regulation of body temperature</li> <li>d. Regulation of urine formation</li> <li>e. Regulation of blood glucose level</li> </ul>	C
<p>10. The myosin head contain:</p> <ul style="list-style-type: none"> <li>a. AMP binding sites</li> <li>b. ATP binding sites</li> <li>c. ADP binding sites</li> <li>d. GTP binding sites</li> </ul>	B
<p>11. The main protein that form the thick muscle protein is:</p> <ul style="list-style-type: none"> <li>a. troponin</li> <li>b. tropomyosin</li> <li>c. actin</li> <li>d. myosin</li> </ul>	D
<p>12. One of the following is NOT a protein that forms the thin muscle protein is :</p> <ul style="list-style-type: none"> <li>a. troponin C</li> <li>b. tropomyosin</li> <li>c. actin</li> <li>d. myosin</li> <li>e. troponin T</li> </ul>	D
<p>13. Cross bridges of sarcomere in skeletal muscles are made up of:</p> <ul style="list-style-type: none"> <li>a. actin.</li> <li>b. troponin.</li> <li>c. tropomyosin. D. myosin.</li> </ul>	D

<p>14. The T tubule:</p> <ul style="list-style-type: none"> <li>a) helps in longitudinal distribution of fluids, ions and substances synthesized within the sarcoplasm or mitochondria.</li> <li>b) releases Ca ions during muscle contraction and store it during ms relaxation.</li> <li>c) runs parallel to the myofibrils.</li> <li>d) transmits chemical substances from the nerve to the muscle.</li> <li>e) allows the depolarization wave to pass rapidly inside the muscle fiber to activate deep myofibrils.</li> </ul>	E
<p>15. The Sarcomere:</p> <ul style="list-style-type: none"> <li>a. is the distance between myasin and actin.</li> <li>b. is the distance between two 2 H zones.</li> <li>c. is the cause of the cross striation of the skeletal muscle.</li> <li>d. does not shorten when the muscle contracts.</li> <li>e. is the part of the myofibril present between the 2 Z discs.</li> </ul>	E
<p>16. The myofibrils:</p> <ul style="list-style-type: none"> <li>a) are about 10 um in diameter</li> <li>b) extend from one end of the muscle fiber to the other giving the muscle fiber its longitudinal striation.</li> <li>c) the thick filaments contain the contractile protein actin, troponin and tropomyosin.</li> <li>d) the thin filaments contain the contractile protein myosin.</li> <li>e) each sarcomere contains two sets of thick filaments, one at each end.</li> </ul>	B
<p>17. As regard transverse tubules, all are true except:</p> <ul style="list-style-type: none"> <li>a. it increases the surface area of the cell membrane.</li> <li>b. it transmits action potential to inside the fiber.</li> <li>c. it acts as Ca+2 stores.</li> <li>d. it's absent in smooth muscle fibers.</li> </ul>	C
<p>18. The action potential of skeletal muscles:</p> <ul style="list-style-type: none"> <li>a. has a prolonged plateau phase.</li> <li>b. spreads inwards to all parts of the muscle via T tubules.</li> <li>c. is longer than the action potential in the cardiac muscle.</li> <li>d. causes reuptake of Ca+2 into terminal cisternae.</li> </ul>	B
<p>19. Lambert-Eaton syndrome is caused by autoantibodies that target:</p> <ul style="list-style-type: none"> <li>a) Acetylcholine receptors</li> <li>b) Nicotinic receptors</li> <li>c) Voltage-gated calcium channels</li> <li>d) GABA receptors</li> </ul>	C

<p>20. Cholinesterase enzyme is an important molecule in the neuromuscular junction because it:</p> <ul style="list-style-type: none"> <li>a) Stimulates receptors on the presynaptic terminal.</li> <li>b) Synthesizes acetylcholine from acetic acid and choline.</li> <li>c) Stimulates receptors within the postsynaptic membrane.</li> <li>d) Breaks down acetylcholine.</li> <li>e) Causes the release of Ca ++ from the sarcoplasmic reticulum.</li> </ul>	D
<p>21. Rigors mortis is due to:</p> <ul style="list-style-type: none"> <li>a. Failure of detachment between actin and myosin</li> <li>b. Excessive release of Ca++ from SR</li> <li>c. Damage of troponin protein molecules.</li> <li>d. Lack of binding sites of myosin on actin</li> <li>e. Failure of propagation of action potential along muscle fibres</li> </ul>	A
<p>22. During muscle contraction:</p> <ul style="list-style-type: none"> <li>a) the A bands remain constant.</li> <li>b) the Z lines move further apart.</li> <li>c) the tropomyosin molecules remain in place.</li> <li>d) the bands are elongated.</li> <li>e) the H zones become wider.</li> </ul>	A
<p>23. Which of the following causes rigor in skeletal muscle?</p> <ul style="list-style-type: none"> <li>a) Lack of action potentials in motoneurons.</li> <li>b) An increase in intracellular Ca++ level.</li> <li>c) A decrease in intracellular Ca++ level</li> <li>d) An Increase in adenosine triphosphate (ATP) level.</li> <li>e) A decrease in ATP level.</li> </ul>	E
<p>24. In skeletal muscle, the:</p> <ul style="list-style-type: none"> <li>a) A bands are broader than the I bands and contain both actin and myosin.</li> <li>b) H zones contain only actin and increase in width during contraction.</li> <li>c) Z membranes are phase in the middle of the H zones.</li> <li>d) I bands contain myosin only.</li> <li>e) Sole feet at the motor end plate are myelinated branches of the nerve.</li> </ul>	A
<p>25. Which of the following decrease in length during contraction:</p> <ul style="list-style-type: none"> <li>a) A band of sarcomere.</li> <li>b) I band of sarcomere.</li> <li>c) Z disc of sarcomere.</li> <li>d) Thick filament.</li> <li>e) Thin Filament.</li> </ul>	B

<p>26. Detachment of head of myosin from actin molecules:</p> <ul style="list-style-type: none"> <li>a. Needs ADP molecules</li> <li>b. Due to reuptake of Ca<sup>+2</sup> from SR</li> <li>c. needs ATP molecule</li> <li>d. due to release of Ca<sup>+2</sup> from SR</li> <li>e. is a passive process</li> </ul>	C
<p>27. About the activity of skeletal muscles, one of the following is incorrect:</p> <ul style="list-style-type: none"> <li>a) Hypertrophy develops as a result of forced repeated contractions.</li> <li>b) The function of the T system is the rapid transmission of the action potential from the cell membrane to inside the muscle fiber.</li> <li>c) During the spike potential, the muscle excitability is normal.</li> <li>d) Acetylcholine released at the M.E.P. is rapidly hydrolyzed by cholinesterase.</li> <li>e) Pale muscle fibers show rapid fatigue.</li> </ul>	C
<p>28. In skeletal muscles, the transverse tubules and adjacent cisterns constitute:</p> <ul style="list-style-type: none"> <li>a) A triad.</li> <li>b) The sarcolemma.</li> <li>c) A myofibril.</li> <li>d) A muscle fiber.</li> <li>e) The sarcomere.</li> </ul>	A
<p>29. Skeletal muscles can maintain contraction without fatigue due to the:</p> <ul style="list-style-type: none"> <li>a) Treppe phenomenon.</li> <li>b) Summation of contractions.</li> <li>c) Alternation of the muscle fiber contraction.</li> <li>d) Presence of tight gap junctions between the muscle fibers.</li> <li>e) Increased consumption of lactic acid</li> </ul>	C
<p>30. Repeated stimulation of a skeletal muscle fiber causes a sustained contraction (tetanus). Accumulation of which solute in intracellular fluid is responsible for the tetanus (continuous contraction)?</p> <ul style="list-style-type: none"> <li>a) Na<sup>+</sup></li> <li>b) K<sup>+</sup></li> <li>c) Cl<sup>-</sup></li> <li>d) mg<sup>++</sup></li> <li>e) Ca<sup>++</sup></li> </ul>	E
<p>31. Calmodulin is structurally related to:</p> <ul style="list-style-type: none"> <li>a) Actin</li> <li>b) Myosin light chain</li> <li>c) Tropomyosin</li> <li>d) Troponin C</li> </ul>	D

## MCQ notes L4

- 1) RMP of sk ms is **-90 mv**
- 2) Duration of spike potential of sk ms is **3-5 msec**
- 3) Most of energy liberated is converted into **heat (50-60%)**
- 4) **Initial heat include** activation heat , shortening heat , work heat
- 5) **Shortening heat** produced during isotonic contraction is greater than during isometric contraction
- 6) **Delayed heat :**
  - Equal initial heat
  - Continue for about 30 min after end of ms contraction
- 7) **Isotonic contraction : (the reverse is isometric contraction)**
  - Mild load
  - Work done
  - Maximum mechanical efficacy
  - Ms shorten
  - Tension increase at first than constant
  - Greater O<sub>2</sub> and nutrient consumption
- 8) Velocity of shortening during isotonic contraction is **inversely proportional** to wight of load
- 9) Maximum tension developed when length of ms equal to **resting length** (length of sarcomere 2-2.2 um) , there is maximal number of cross bridge ( ) actine and myosine
- 10) Series elastic part present in **tendon**
- 11) Ms can contract **both isometrically and isotonicly**

## MCQ L4

<p>1. In skeletal muscles, there is an inverse relationship between:</p> <ul style="list-style-type: none"> <li>a) The muscle length and force of contraction.</li> <li>b) The load opposing the contraction and velocity of contraction.</li> <li>c) The cross sectional area and strength of the muscle.</li> <li>d) All of the above.</li> </ul>	B
<p>2. In isometric contractions, the initial heat is:</p> <ul style="list-style-type: none"> <li>a) Too small to measure.</li> <li>b) Approximately equal to the activation heat.</li> <li>c) Equal to the shortening heat.</li> <li>d) More than the relaxation heat.</li> </ul>	B
<p>3. Maximal tension is developed in skeletal muscles when they are at:</p> <ul style="list-style-type: none"> <li>a) The equilibrium length,</li> <li>b) The resting length.</li> <li>c) More than the resting length.</li> <li>d) 3 times the equilibrium length.</li> </ul>	B
<p>4. Concerning isometric and isotonic muscle contractions:</p> <ul style="list-style-type: none"> <li>a) Isometric contraction does not require sliding of actin filaments.</li> <li>b) During isometric contraction a load is moved and work is done.</li> <li>c) During isotonic contraction a greater amount of energy is needed.</li> <li>d) During isotonic contraction the muscle length is not changed.</li> <li>e) in isometric contraction the series and parallel elastic elements are not stretched</li> </ul>	C
<p>5. The contractile response in skeletal muscles:</p> <ul style="list-style-type: none"> <li>a) Starts after the action potential is over.</li> <li>b) Lasts for a similar period as the action potential.</li> <li>c) Produces more tension when the muscle contracts isotonicly.</li> <li>d) Produces more work when the muscle contracts isotonicly</li> </ul>	D
<p>6. About activation of skeletal muscles, all the following is true except:</p> <ul style="list-style-type: none"> <li>a) The resting membrane potential is about -90 mV.</li> <li>b) The magnitude of the action potential is more than that in nerves.</li> <li>c) The firing level is reached after about 40 mV of depolarization.</li> <li>d) Shortening occurs simultaneously with the onset of depolarization.</li> <li>e) The spike is propagated along ms surface at a speed of 5 m/second.</li> </ul>	D

<p>7. The duration of action potential of skeletal muscle fiber is:</p> <ul style="list-style-type: none"> <li>a. 5 msec.</li> <li>b. 25 msec.</li> <li>c. 200 msec.</li> <li>d. 250 msec.</li> </ul>	A
<p>8. The contractile response in skeletal muscle</p> <ul style="list-style-type: none"> <li>a) starts after the action potential is over.</li> <li>b) does not last as long as the action potential.</li> <li>c) produces more tension when the muscle contracts isometrically than when the muscle contracts isotonicly.</li> <li>d) produces more work when the muscle contracts isometrically than when the muscle contracts isotonicly.</li> <li>e) decreases in magnitude with repeated stimulation.</li> </ul>	C
<p>9. In isometric contraction of skeletal muscles:</p> <ul style="list-style-type: none"> <li>a. Muscle shortens.</li> <li>b. Work is done.</li> <li>c. Muscle tension is markedly increased.</li> <li>d. Mechanical efficiency is maximum,</li> <li>e. Muscle tension is maintained constant during major part of contraction.</li> </ul>	C
<p>10. Skeletal muscle action potential is not characterized by:</p> <ul style="list-style-type: none"> <li>a. RMP at -90 mv..</li> <li>b. Magnitude of the spike at 105 mv</li> <li>c. Firing level at -50 mv.</li> <li>d. Velocity of conduction up to 3-5 m/sec.</li> <li>e. Duration of spike 3-5 m sec.</li> </ul>	B
<p>11. The absolute refractory period:</p> <ul style="list-style-type: none"> <li>a) is a period during which excitability is completely lost.</li> <li>b) is a period during which stronger stimulus is needed to excite the muscle fiber.</li> <li>c) is coincided with the descending limb of the spike.</li> <li>d) is a period during which the excitability is less than normal.</li> <li>e) none of the above.</li> </ul>	A
<p>12. Strength of contraction of skeletal muscle is high when it is stimulated at:</p> <ul style="list-style-type: none"> <li>a) resting length.</li> <li>b) equilibrium length.</li> <li>c) lower temperature.</li> <li>d) a length more than the resting length.</li> <li>e) a length less than the resting length.</li> </ul>	A

<p>13. Isometric contraction is characterized by:</p> <ul style="list-style-type: none"> <li>a) constant tension.</li> <li>b) constant length.</li> <li>c) decrease in length.</li> <li>d) high mechanical efficiency.</li> <li>e) low tension in the muscle.</li> </ul>	B
<p>14. Isotonic contraction differs than isometric contraction in that it:</p> <ul style="list-style-type: none"> <li>a) shows constant length.</li> <li>b) shows increased tension.</li> <li>c) performs no work.</li> <li>d) has zero mechanical deficiency.</li> <li>e) needs more energy.</li> </ul>	E
<p>15. When shortening of the contractile element of the skeletal muscle fiber is compensated by equal lengthening of series elastic element, accompanied by increase in muscle tension, this is considered:</p> <ul style="list-style-type: none"> <li>a. Isotonic contraction.</li> <li>b. Isometric contraction.</li> <li>c. Preloading.</li> <li>d. All or none law.</li> <li>e. Afterloading.</li> </ul>	B
<p>16. Force of skeletal muscle contraction:</p> <ul style="list-style-type: none"> <li>a. Is independent on number of motor units.</li> <li>b. Increases with increasing the load facing the muscle.</li> <li>c. Is directly proportional to the number of Ca<sup>++</sup> ions in the muscle.</li> <li>d. Is independent on summation.</li> <li>e. Is inversely proportional to the initial length of the muscle.</li> </ul>	C
<p>17. Which of the following describes the Force-Velocity Relationship:</p> <ul style="list-style-type: none"> <li>a. It is applied during the isometric contraction.</li> <li>b. Velocity of shortening depends on the initial length of the muscle fiber.</li> <li>c. Velocity of shortening is minimal at zero load.</li> <li>d. Velocity of shortening is directly proportional to the load.</li> <li>e. Shortening velocity is determined by the rate at which cross bridges undergo their cycle activity.</li> </ul>	E
<p>18. During isotonic contraction:</p> <ul style="list-style-type: none"> <li>a. The mechanical efficiency is zero.</li> <li>b. The muscle length is unchanged.</li> <li>c. The external work done by the muscle is zero.</li> <li>d. The energy required is high.</li> <li>e. The heat production is maximal.</li> </ul>	D

<p>19. During isometric contraction:</p> <ol style="list-style-type: none"> <li>The duration of contraction is long.</li> <li>The muscle tension is constant.</li> <li>The external work done by the muscle is zero.</li> <li>The heat production is minimal.</li> <li>The energy required is high.</li> </ol>	C
<p>20. Absolute Refractory Period electrically occupies:</p> <ol style="list-style-type: none"> <li>Ascending limb of depolarization only.</li> <li>Ascending limb of depolarization + upper 1/3 of repolarization.</li> <li>Lower 2/3 of repolarization only.</li> <li>Ascending limb of depolarization + upper 2/3 of repolarization.</li> <li>Descending limb of repolarization only.</li> </ol>	B
<p>21. Relative Refractory Period electrically occupies:</p> <ol style="list-style-type: none"> <li>Ascending limb of depolarization only.</li> <li>Ascending limb of depolarization + upper 1/3 of repolarization.</li> <li>Lower 2/3 of repolarization only.</li> <li>Ascending limb of depolarization + upper 2/3 of repolarization.</li> <li>Descending limb of repolarization only.</li> </ol>	C
<p>22. A skeletal muscle contracting isometrically generates the greatest tension at its normal resting length because at that length:</p> <ol style="list-style-type: none"> <li>The cellular concentration of ATP is highest</li> <li>Sarcoplasmic reticulum is most precisely aligned with the thick filaments</li> <li>The rate of conduction of the action potential across the cell membrane is most rapid</li> <li>The greatest number of cross bridges is aligned with actin binding sites</li> </ol>	D
<p>23. The force of contraction of a skeletal muscle depends on all of the following factors EXCEPT:</p> <ol style="list-style-type: none"> <li>Its initial length</li> <li>The number of motor units activated</li> <li>The type of muscle fiber it contains</li> <li>The extracellular Ca<sup>++</sup> concentration</li> </ol>	D
<p>24. The contractile response of the skeletal muscle:</p> <ol style="list-style-type: none"> <li>Starts after the AP is over</li> <li>Lasts for a similar period as AP</li> <li>Produces more tension when the muscle contracts isotonicly</li> <li>Produces more work when he muscle contracts isometrically</li> <li>Can increase with repeated stimuli</li> </ol>	E

<p>25. Which of the following best describes the contractile response of skeletal muscle?</p> <p>A. It starts after the action potential</p> <p>B. It does not last as long as the action potential</p> <p>C. It produces more tension when the muscle contract isometrically than isotonicly</p> <p>D. It produces more tension when the muscle contract isotonicly than isometrically</p> <p>E. It decreases in magnitude with repeated stimulation</p>	C
<p>26. During the resting state, a single skeletal muscle sarcomere can exist at a number of lengths. During an isometric contraction, the length at which it can exert its maximum force in response to stimulation is:</p> <p>(A) 1.7 <math>\mu\text{m}</math></p> <p>(B) 2.2 <math>\mu\text{m}</math></p> <p>(C) 3.0 <math>\mu\text{m}</math></p> <p>(D) All of the them</p> <p>(E) Both B and C</p>	B
<p>27. Which one of the following values represents that of resting membrane potential of a skeletal muscle?</p> <p>A. -50 mV.</p> <p>B. -70 mV.</p> <p>C. -90 mV.</p> <p>D. -110 mV.</p>	C
<p>28. About the properties of various types of muscles:</p> <p>a) Tetanus of the type seen in skeletal muscles may occur in the heart.</p> <p>b) The excitation-contraction coupling is more rapid in smooth muscles than in skeletal muscles.</p> <p>c) An isometric contraction means a contraction without shortening.</p> <p>d) Acetylcholine is not released at the MEP during rest.</p> <p>e) Curare blocks the neuromuscular transmission by preventing the release of acetylcholine from the nerve terminals</p>	C
<p>29. Contraction of skeletal muscles:</p> <p>a) produces more work when the muscle contracts isometrically than when the muscle contracts isotonicly.</p> <p>b) depends on external <math>\text{Ca}^{++}</math>.</p> <p>c) decrease in magnitude with rapid repeated stimulation.</p> <p>d) does not depend on action potential.</p> <p>e) It increases by overstretch of the muscle.</p>	C

## MCQ Notes L5

### 1) Type 1 slow oxidative ms fiber (the reverse is type 2b , fast glycolytic) :

- Present in Back , solus
- Red color , rich in blood supply , myoglobin , mitochondria
- Aerobic , no fatigue
- Small diameter , less developed SR
- Long duration SMT

### 2) Increased ms size in human due to **hypertrophy not hyperplasia**

### 3) **Satellite cell** is myogenic cell responsible for regeneration of ms fibers

### 4) Anerobic training increases **type 2 fiber** while arobic training increases **type 1 fibers**

### 5) Improved ms coordination **not just about ms and tissue but also nerves**

### 6) Sprint training alter neuromuscular control by :

- Modify relative sequencing of ms activation
- Fire frequency of fast twich motor units

### 7) Metabolic adaptation enhance energy transfer by increasing :

- Mitochondrial size and number
- Enzymes of krebs cycle
- Ms buffer capacity which is the 1<sup>st</sup> line of defence against lactic acidosis

## MCQ L5

<p>1. Which of the following myogenic cells responsible for muscle remodeling:</p> <ul style="list-style-type: none"> <li>a) von kupper cell</li> <li>b) microglia</li> <li>c) alveolar macrophage</li> <li>d) satellite cell</li> <li>e) fibroblast</li> </ul>	D
<p>2. Which of the following correctly describe the term motor unit?</p> <ul style="list-style-type: none"> <li>a) All motor neurons supplying single skeletal muscle</li> <li>b) All muscle fibers of a skeletal muscle and its motor nerve supply</li> <li>c) Single muscle fiber and all nerve fibers supplying it</li> <li>d) Single nerve fiber and all muscle fibers supplied by it</li> <li>e) Single nerve fiber and single muscle fiber</li> </ul>	D
<p>3. The fast of muscles is characterized by all the following except :</p> <ul style="list-style-type: none"> <li>a) High ATPase activity in the mitochondria.</li> <li>b) Specialization for posture maintenance</li> <li>c) Innervation by large motor neurons (A alpha fibers that conduct at a velocity of 70-120 meters/second).</li> <li>d) Rapid fatigue.</li> <li>e) Absence of myoglobin</li> </ul>	B
<p>4. Skeletal, muscles can maintain contraction without fatigue due to the:</p> <ul style="list-style-type: none"> <li>a) Treppe phenomenon.</li> <li>b) Summation of contractions.</li> <li>c) Asynchronous firing of motor units.</li> <li>d) Presence of light gap junctions between the muscle fibers.</li> <li>e) Increased consumption of lactic acid</li> </ul>	C
<p>5. The slow twitch muscle fiber differs from the fast twitch fiber because the slow twitch fiber:</p> <ul style="list-style-type: none"> <li>A. Has a smaller number of muscle fibers in each motor unit but equally powerful</li> <li>B. Has a higher concentration of myoglobin and mitochondria</li> <li>C. Has a higher ATPase activity</li> <li>D. In a large limb serves as a reserve which can be recruited if there is a forceful contraction</li> <li>E. Is more readily fatigued</li> <li>F. Is part of a motor unit that consists mainly of red fibers</li> </ul>	B

<p>6. Weightlifting can result in a dramatic increase in skeletal muscle mass. This increase in muscle mass is primarily attributable to which of the following?</p> <ul style="list-style-type: none"> <li>a) Fusion of sarcomeres between adjacent myofibrils</li> <li>b) Hypertrophy of individual muscle fibers</li> <li>c) Increase in skeletal muscle blood supply</li> <li>d) Increase in the number of motor neurons</li> <li>e) Increase in the number of neuromuscular junctions</li> </ul>	<p>B</p>
<p>7. Fast-twitch muscle fibers:</p> <ul style="list-style-type: none"> <li>A. Are more resistant to fatigue than slow- twitch fibers</li> <li>B. Have a richer blood supply than slow- twitch fibers</li> <li>C. Have a larger amount of stored glycogen than slow twitch fibers</li> <li>D. Have more mitochondria than slow twitch fibers</li> <li>E. Have more myoglobin than slow-twitch fibers</li> </ul>	<p>C</p>
<p>8. Which of these characteristics is typical of a slow-twitch muscle fiber?</p> <ul style="list-style-type: none"> <li>A. Large number of mitochondria</li> <li>B. Few capillaries</li> <li>C. Low myoglobin content</li> <li>D. Largely anaerobic</li> <li>E. B, C, and D</li> </ul>	<p>A</p>
<p>9. Which of these conditions would one expect to find within the leg muscle cells of a world-class marathon runner?</p> <ul style="list-style-type: none"> <li>A. Myoglobin-poor</li> <li>B. Contract very quickly</li> <li>C. Primarily anaerobic</li> <li>D. Numerous mitochondria</li> <li>E. Large deposits of glycogen</li> </ul>	<p>D</p>
<p>10. An exercise regimen which includes running and swimming long distances will promote an increase in the:</p> <ul style="list-style-type: none"> <li>A. Number of fast glycolytic fibers in skeletal muscle</li> <li>B. Size of existing fast glycolytic fibers in skeletal muscle</li> <li>C. Number of slow oxidative fibers in skeletal muscle</li> <li>D. Mitochondrial content and blood supply of slow oxidative fibers in skeletal muscle</li> </ul>	<p>D</p>
<p>11. Compared to type II b (fast-glycolytic) muscle fibers, type I (slow oxidative) muscle fibers have:</p> <ul style="list-style-type: none"> <li>a) Less liability to fatigue.</li> <li>b) Fewer capillaries.</li> <li>c) Fewer mitochondria.</li> </ul>	<p>A</p>

<p>d) Larger diameter. e) Less amount of myoglobin.</p>	
<p>12. Regular exercise training does not involve increase in: a) Contractile proteins b) Glycolytic enzymes c) Muscle fiber number d) Capillaries and mitochondria.</p>	C
<p>13. Fast (pale) muscle fibers are characterized by which of followings: a) Contain much blood capillaries. b) Glycogen stores are low. c) Contains high concentration of myoglobin. d) Depends on anaerobic oxidation. e) Show delayed onset of fatigue.</p>	D
<p>14. Pale (fast) fibers are characterized by the following: a. Contain much blood capillaries. b. Glycogen stores are low. c. Contain high concentration of myoglobin. d. Depend on anaerobic oxidation.</p>	D
<p>15. Red muscle differs from pale muscle in what respect? a. Microvessel density is lower in the red muscle b. Velocity of contraction is faster in red muscle c. Myoglobin levels are higher in red muscles d. Red muscle fatigues more easily than pale muscles</p>	C
<p>16. Adaptation of fast glycolytic fibers of skeletal muscle takes place in the form of an increase in: a. Number of capillaries. b. Myoglobin content. c. Aerobic ATP production. d. Number of mitochondria. e. Number of cross bridges.</p>	E
<p>17. Short duration, high intensity exercise causes the following change in the muscle fibers: a. Increase number of mitochondria. b. Increase glycolytic enzymes. c. Increase number of capillaries. d. Increase myoglobin content. e. Increase aerobic ATP production.</p>	B

<p>18. Fast skeletal muscle fibers differ from slow fibers in that fast fibers:</p> <ul style="list-style-type: none"> <li>a) are adapted for short rapid muscle contractions.</li> <li>b) have less glycolytic enzymes.</li> <li>c) have more extensive blood supply.</li> <li>d) contain more mitochondria.</li> <li>e) have more myoglobin.</li> </ul>	A
<p>19. Which of the followings is the correct number of muscle fiber in each motor unit in human leg muscles?</p> <ul style="list-style-type: none"> <li>a) 3-6 skeletal muscle fibers</li> <li>b) 160 skeletal muscle fibers</li> <li>c) 260 skeletal muscle fibers</li> <li>d) 600 skeletal muscle fibers</li> <li>e) 6000 skeletal muscle fibers</li> </ul>	D
<p>20. Which of the following is a physiological effect of resistance training on skeletal muscles?</p> <ul style="list-style-type: none"> <li>a) Increased muscle fiber size</li> <li>b) Decreased muscle strength</li> <li>c) Reduced muscle flexibility</li> <li>d) Decreased muscle endurance</li> </ul>	A
<p>21. Which of the following is a common effect of resistance training on skeletal muscles?</p> <ul style="list-style-type: none"> <li>a) Increased muscle size (hypertrophy)</li> <li>b) Decreased muscle strength</li> <li>c) Reduced muscle flexibility</li> <li>d) Decreased muscle endurance</li> </ul>	A
<p>22. Type I skeletal muscle fibers:</p> <ul style="list-style-type: none"> <li>a) Contain less myoglobin than type II fibers.</li> <li>b) Are invariably recruited late in graded muscle responses.</li> <li>c) Are found in the largest motor units.</li> <li>d) Contain more mitochondria than type II fibers.</li> <li>e) Generate fewer actin-- myosin bonds per second than type II fibers.</li> </ul>	D
<p>23. Slow muscle fibers:</p> <ul style="list-style-type: none"> <li>a) Main type in extraocular muscle</li> <li>b) Have less developed sarcoplasmic reticulum.</li> <li>c) Have a large diameter.</li> <li>d) Have few mitochondria.</li> <li>e) Have few blood capillaries.</li> </ul>	B
<p>24. Regarding skeletal muscle fibers, which is correct?</p>	D

<ul style="list-style-type: none"> <li>a) Most body muscles are composed of only one type of muscle fiber.</li> <li>b) Muscles that react rapidly are composed mainly of Type I.</li> <li>c) Muscles that react slowly are composed mainly of Type IIB.</li> <li>d) Type IIA muscle fibers have high ATPase activity.</li> <li>e) Type IIA muscle fibers maintain shorter contraction than the fast fibers.</li> </ul>	
<p>25. Regrading effect of training on muscle size, which is incorrect:</p> <ul style="list-style-type: none"> <li>a) Accompanied by increase in actin, myosin, &amp; other contractile proteins.</li> <li>b) ↑quantity of enzymes &amp; stored nutrients.</li> <li>c) ↑number and size of myofibrils per muscle fiber</li> <li>d) occurs mainly by hyperplasia in humans.</li> </ul>	D
<p>26. Slow ms. fibers are characterized by when compared to fast ms. fibers :</p> <ul style="list-style-type: none"> <li>a) Adapted for rapid contraction.</li> <li>b) Composed of large ms. fibers</li> <li>c) Fewer mitochondria</li> <li>d) Innervated by smaller no of nerve fibers.</li> <li>e) Less blood capillaries</li> </ul>	D
<p>27. Pale muscle fibers:</p> <ul style="list-style-type: none"> <li>a) Have a small diameter.</li> <li>b) Have a shorter latent period in SMT.</li> <li>c) Have slow ATPase activity.</li> <li>d) Main type in soleus muscle</li> <li>e) Maintain the body posture.</li> </ul>	B
<p>28. Type IIA muscle fibers:</p> <ul style="list-style-type: none"> <li>a) Main type in extraocular muscle</li> <li>b) Are fast oxidative glycolytic.</li> <li>c) Uses anaerobic oxidation only.</li> <li>d) Main type in soleus muscle</li> <li>e) Shows rapid fatigue.</li> </ul>	B

- **Enumerate function of integumentary system?** \*\*\*
  - a) Protection
  - b) Cutaneous sensation
  - c) Metabolic
  - d) Blood reservoir
  - e) Excretion of waste product
  - f) Regulation of body temperature
  
- **Mention role of skin in protection against organism?** \*\*\*
  - **Low pH** of skin secretions
  - **Bactericidal** substances in sebum.
  - **Human defensin**
  - **Cathelicidins** that prevent infection by **group A streptococcus bacteria**.
  - **Melanin** that protect skin from UV rays.
  - **Thick epidermis**.
  
- **Mention metabolic functions of skin ?** \*\*\*
  1. **Synthesis of Vit D3** from 7-dehydro cholesterol under the effect of UV rays
  2. **Detoxify** many cancer-causing chemicals.
  3. **Prevent Conversion harmless** chemicals into **carcinogens**.
  4. **Activate** some **steroid hormones** as cortisone
  
- **Discuss role of skin as blood reservoir ?**
  - Blood vessels in dermis store 5% of blood volume
  - During exercise or hemorrhage , blood vessels constrict to shift blood to vital organs.

- **Some substances can penetrate skin but in limited amount , mention three of them?**
  - *Lipid-soluble substances, such as O<sub>2</sub>, CO<sub>2</sub>, fat-soluble vitamins*
  - *Organic solvents*
  - *Salts of heavy metals, such as mercury*
  - *Penetration enhancers that help entry other drugs into the body.*
  
- **Mention content or component of dermis?**
  - *Sweat gland , sebaceous gland*
  - *Nerve , blood vessel*
  - *Elastic , connective tissue*
  - *Hair , pilo erector ms*
  
- **Mention 2 functions of hypodermis?**
  - *Heat insulator*
  - *Source of energy during starvation*
  
- **Mention role of skin in regulation of body temperature ?**
  - *Normal body temperature (36.5 - 37.2°C)*
  - **It is responsible for heat loss by:**
    1. **Radiation**
    2. **Evaporation** of sweat
  - *Also **subcutaneous fat acts as a heat insulator** for the body.*
  - *The insulating properties of the normal male body are about equal to **3/4 the insulating properties** of a usual suit of clothes.*
  - *In women, this insulation is even better*

# Neuromuscular Transmission

- Give a short note on Mechanism of neuromuscular transmission ? \*\*\*
- Mention presynaptic events of NMT?
- Mention postsynaptic events of NMT?
- What is the ionic mechanism that underlie the end plate potential produced by acetylcholine release?
  1. When nerve impulse reach nerve terminal , it opens voltage- activated  $\text{Ca}^{2+}$  channels → **Ca influx** into axon terminal and rupture to release A.ch into the synaptic cleft by **exocytosis**.
  2. Ach bind to nicotinic receptor leading to opening **ligand gated channels**.
  3. More  $\text{Na}^+$  move in, than  $\text{K}^+$  moves out, producing **a partial depolarization** at the motor end plate, called **End Plate Potential (EPP)** >> **action potential** >> **contraction**
  4. Once, acetylcholine produces its action, it is **rapidly hydrolyzed** by the **True Cholinesterase enzyme** prevent it from causing **multiple muscle contractions**.
- Enumerate Characteristics of neuromuscular transmission? \*\*\*
  - a) One way
  - b) Synaptic delay
  - c) Synaptic fatigue
- Effect and mechanism of rapid repeated stimulation of NMJ?
  - **Effect:** decline or even stoppage of NMT (synaptic fatigue)
  - **Mechanism:** depletion of ach vesicles

▪ **Mention Effect and mechanism of the following ions on NMT:**

<b>Ca:</b> ***	<ul style="list-style-type: none"> <li>• <b>Ca ions</b> help NMT.</li> <li>• <b>Hypercalcemia:</b> decreases NMT by blocking Na<sup>+</sup> channels in neurons</li> <li>• <b>Hypocalcemia:</b> increase neuromuscular excitability or tetany.</li> </ul>
<b>Mg:</b>	<ul style="list-style-type: none"> <li>• Inhibits NMT by <b>stabilizing Ach vesicles</b>, so prevent release of Ach.</li> </ul>
<b>K:</b>	<ul style="list-style-type: none"> <li>• <b>Anti-curare action</b> on the motor end plate.</li> </ul>

▪ **Mention three drugs that decrease and three drugs that increase NMT?**

▪ **Enumerate different neuromuscular blockers ? \***

▪ **Effect and mechanism of succinylecholine on NMT?**

**1. Stimulants:**

<b>Example:</b>	<b>Action:</b>
<b>Methacholine</b>	<ul style="list-style-type: none"> <li>• Direct Stimulation of Nm receptors.</li> </ul>
<b>Neostigmine</b>	<ul style="list-style-type: none"> <li>• <b>Inhibit cholinesterase = anti-cholinesterase.</b></li> </ul>

**2. Inhibitors: \*\*\***

<b>Example:</b>	<b>Action:</b>
<b>Botulinum toxin</b>	<ul style="list-style-type: none"> <li>• <b>Prevent synthesis and release of Ach</b></li> </ul>
<b>Hemicholinium</b>	<ul style="list-style-type: none"> <li>• <b>Interfere with choline uptake</b></li> </ul>
<b>Curare</b>	<ul style="list-style-type: none"> <li>• <b>Competes with Ach at nicotinic (Nm) receptors at MEP.</b></li> </ul>
<b>Succinyl-choline</b>	<ul style="list-style-type: none"> <li>• Bind to Nm receptors to produce <b>initial depolarization</b> followed by <b>maintained depolarization</b> of MEP</li> </ul>

▪ **Def myasthenia gravis ?**

- Rare autoimmune dse that affect NMJ leading to ms weakness and fatigue on mild exercise

▪ **Mention causes or mechanism of Myasthenia gravis? \*\*\***

1. ↓ **number of Ach vesicles** in axonal terminals.
2. ↓ **Ach content** of synaptic vesicles.
3. **Widening** of synaptic cleft.
4. ↓ **number of junctional folds**
5. ↓ **number of Ach receptors** on MEP due to production of auto antibodies against them

▪ **Diagnosis and treatment of myasthenia gravis ?**

- **Diagnosis:** anti acetylcholine antibodies , EMG
- **Treatment:** pyridostigmine

▪ **Mention functional anatomy of NMJ ?**

▪ **Mention content of motor end plate ?**

- **Presynaptic neuron :** contain vesicles for ach , mitochondria , voltage gated Ca channel
- **Synaptic cleft :** space ( ) pre and postsynaptic membrane , diameter 10-30 nm
- **Postsynaptic membrane = MEP :** has junctional folds , nicotinic receptor for A.Ch , cholinesterase enzyme on its surface

▪ **Def synaptic delay and its causes ?**

- **Time ( )** arrival of nerve impulse to nerve terminal and ms action potential
- **Duration:** 0.5 ms
- **Causes:** release , diffusion and action of ach on postsynaptic membrane

▪ Compare () Myasthenia gravis and Lambert Eaton syndrome ?

	<b>Myasthenia gravis</b>	<b>Lambert Eaton syndrome</b>
<b>Antibody against</b>	AchR antibody	Voltage gated Ca <sup>2+</sup> channels
<b>Associated with</b>	Thymic tumor	Small cell lung cancer
<b>Weakness</b>	<b>Worsens</b> on prolonged exercise.	<b>Improves</b> on prolonged exercise.
<b>deep tendon reflex</b>	Normal	Decreased or absent
<b>Autonomic dysfunction</b>	absent	present
<b>On repeated nerve stimulation</b>	Decremental response	Incremental response
<b>1<sup>st</sup> ms affected</b>	Facial ms	Proximal limb ms

▪ Def miniature end plate potential (MEPP) ? \*\*\*

- Spontaneous rupture of few vesicles at rest leading to release acetylcholine into synaptic cleft causing weak **Localized** at MEP and disappears rapidly and occurs **one per second**.

▪ Def motor unit and name types of innervation to sk ms ?

- Is a motor neuron plus multiple ms fibers supplied by it.
- **The Number of ms fibers in each unit:**

	<b>Ms for fine &amp; delicate movements</b>	<b>Ms for coarse movements</b>
<b>Number</b>	Few (Less than 10 ms fibers)	1000-2000 ms fibers
<b>Example</b>	Eye muscle – hand	Gastrocnemius muscle

## Skeletal Muscles:

### ▪ Mention structure and Function of T- tubule ? \*\*\*

<b>Structure:</b>	<ul style="list-style-type: none"> <li>• Tubular extensions of sarcolemma at the junction of A-I band which is continuous with ECF.</li> </ul>
<b>Function:</b>	<ol style="list-style-type: none"> <li>1. ↑ <b>surface area</b> of the sarcolemma many folds.</li> <li>2. Help the <b>movement of ions</b> into and out of the cell.</li> <li>3. Help the <b>spread of depolarization wave</b> to inside of ms fiber.</li> </ol>

### ▪ Mention structure and Functions of sarcoplasmic reticulum ?

<b>Structure:</b>	<ul style="list-style-type: none"> <li>• Formed of anastomosing longitudinal tubules with two terminal cisterns</li> </ul>
<b>Function:</b>	<ol style="list-style-type: none"> <li>1. Help <b>longitudinal distribution</b> of ions</li> <li>2. Releases <b>Ca<sup>+2</sup> ions</b> during ms contraction &amp; stores it during ms relaxation.</li> </ol>

**N.B.: Sarco-tubular system include: T-tubule and sarcoplasmic reticulum**

### ▪ Def sarcomere and its structure ? \*\*

<b>Def:</b>	<ul style="list-style-type: none"> <li>• It is the part of the myofibril present between the 2 Z lines , functional unit of the muscle.</li> </ul>
<b>Structure:</b>	<ul style="list-style-type: none"> <li>• <b>Thick filament:</b> myosin</li> <li>• <b>Thin filament:</b> <ol style="list-style-type: none"> <li>a) <b>Actin.</b></li> <li>b) <b>Troponin:</b> T (bind to tropomyosin), I (bind to actine), C (bind to Ca)</li> <li>c) <b>Tropomyosin:</b> act as relaxing protein, cover myosin binding site on actin</li> </ol> </li> </ul>

▪ **Mention changes that occur in sarcomere during ms contraction ?** \*\*

- Two Z-line approximate to each other
- H zone shortens
- I band shortens
- A band constant

▪ **Def and Enumerate steps of excitation contraction coupling ?**

▪ **Mention role of Ca in ms contraction?** \*\*\*

<b>Def:</b>	<ul style="list-style-type: none"> <li>• Conversion of action potential into mechanical response by s kms</li> </ul>
<b>Steps:</b>	<ul style="list-style-type: none"> <li>• <b>Propagation of action potential and release of Ca</b></li> <li>• <b>Binding of Ca to troponin c:</b> this form complex leading to displacement of tropomyosin from its blocking site, and binding of head of myosin to actine and cross bridge cycle.</li> <li>• <b>Cross bridge cycle (see later)</b></li> <li>• <b>Relaxation (see later)</b></li> </ul>

▪ **Mention steps of cross bridge cycle?** \*\*\*

- a) **Binding:** head of myosin bind to actin.
- b) **Bending:** sliding of the actin over myosin by help of ATP
- c) **Detachment:** decrease affinity () head of myosin and actine by help of ATP
- d) **Return to original position**

▪ **Def rigor mortis ? and mention other types of rigor ?**

- Ms stifness after death due to failure of detachment between actin and myosin due to depletion of ATP.
- **Other types:** Ca rigor, heat rigor.

▪ **Mention role of ATP in sk ms contraction and relaxation ?** \*\*

- ***In contraction:*** ATP is required for bending and detachment
- ***In relaxation:*** Reuptake of Ca into sarcoplasmic reticulum by Ca ATPase (active process require ATP).

▪ **Mention function of sk ms ?**

- Movement
- Maintain body posture by ms tone
- Maintain body temperature

## Comparison ( ) muscle types

Feature	Skeletal Muscle	Smooth Muscle	Cardiac Muscle
<b>Appearance</b>	Striated	No striations	Striated
<b>Regulation</b>	Nervous control	Nervous & hormonal control	Pacemaker cells by nervous & hormonal control
<b>Action potential</b>	<ul style="list-style-type: none"> <li>• Spike AP (no plateau).</li> <li>• Upstroke due to <math>\text{Na}^+</math> current.</li> <li>• <b>Duration:</b> <ul style="list-style-type: none"> <li>➤ 1 msec</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Spike AP (no plateau).</li> <li>• Upstroke due to <math>\text{Ca}^{2+}</math> current.</li> <li>• <b>Duration:</b> <ul style="list-style-type: none"> <li>➤ 10 msec</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• AP with plateau (due to inward <math>\text{Ca}^{2+}</math> current).</li> <li>• Upstroke due to <math>\text{Na}^+</math> current.</li> <li>• <b>Duration:</b> <ul style="list-style-type: none"> <li>➤ 150 msec in atria</li> <li>➤ 300 msec in ventricles</li> </ul> </li> </ul>
<b>Regulatory proteins</b>	Troponin	Calmodulin	Troponin
<b>Source of <math>\text{Ca}^{2+}</math></b> ***	<ul style="list-style-type: none"> <li>• SR</li> </ul>	<ul style="list-style-type: none"> <li>• ECF (80%)</li> <li>• SR (20%)</li> </ul>	<ul style="list-style-type: none"> <li>• ECF (20%)</li> <li>• SR (80%)</li> </ul>
<b>Speed of contraction</b>	Fast to slow	Very slow	Slow

# Changes occurring as a result of muscle contraction

- Compare ( ) electrical changes of skeletal ms & thick myelinated nerve?\*\*\*

	<b>Skeletal muscle fibers</b>	<b>Thick myelinated nerve fibers</b>
<b>Resting membrane potential:</b>	-90 m.v	-70 m.v
<b>Firing level (Threshold):</b>	-50 m.v.	-55 m.v.
<b>Magnitude of spike potential:</b>	130 m.v	105 m.v
<b>Duration of spike potential:</b>	3-5 m.sec	0.5 - 1 m.sec
<b>Duration of negative &amp; positive after potentials:</b>	Relatively <b>longer</b>	Relatively <b>shorter</b>
<b>Velocity of conduction:</b>	3-5 meters/sec	up to 120 met/sec

- Enumerate excitability changes ocuring in sk ms ? \*\*\*

- Absolute refractory period
- Relative refractory period
- Super normal phase of excitability
- Subnormal phase of excitability

- Mention component of myogram (SMT) ?

- **Latent period (refractory period):** period ( ) start of stimulation and start of ms response
- **Contraction phase:** ms shorten
- **Relaxation phase**

- Mention component of initial heat ?\*\*\*
- Give a short account on thermal changes during & after ms contraction?
- Mention causes of activation heat ?

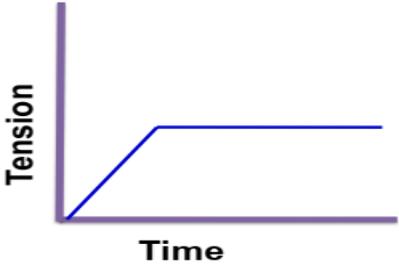
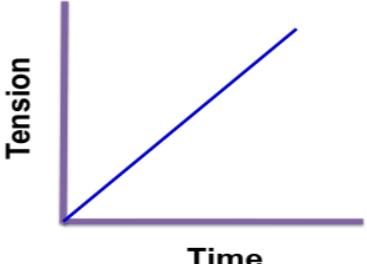
A) Initial heat: This includes:

<b>1. Activation heat:</b>	<ul style="list-style-type: none"> <li>• <u>It results from:</u> <ol style="list-style-type: none"> <li>a) Release of <math>Ca^{++}</math> from the terminal cisternae,</li> <li>b) Binding of <math>Ca^{++}</math> to troponin</li> <li>c) Movements of cross-bridges</li> <li>d) Active reuptake of <math>Ca^{++}</math> by the sarcoplasmic reticulum</li> </ol> </li> </ul>
<b>2. Shortening heat:</b>	<ul style="list-style-type: none"> <li>• The heat production during isotonic contraction is <u>greater than</u> the heat production during isometric contraction.</li> </ul>
<b>3. Work heat:</b>	<ul style="list-style-type: none"> <li>• If the muscle performs work.</li> </ul>

B) Delayed (recovery) heat:

- It results from the **metabolic reactions** needed to **reform the energy stores** and to **remove lactic acid**.
- It is nearly **equals to** the initial heat
- **Continues** for about **30 minutes**

- **Def isometric contraction ?**
- **Def isotonic contraction ?**
- **Compare ( ) isotonic and isometric contraction ? \*\*\***

	<b>Isotonic contraction</b>	<b>Isometric contraction</b>
<b>Occur when muscle:</b>	Contract against <b>light or moderate</b> load	Contract against <b>heavy</b> load
<b>Muscle:</b>	Shortens	Not shortens
<b>Load:</b>	Move	Not move
<b>Work:</b>	<b>Done</b>	<b>No work done</b>
<b>Mechanical efficiency (% ratio of work to total energy expenditure):</b>	<b>Maximum (40-50%)</b> i.e. energy is converted into work and heat	<b>Zero</b> i.e. energy is converted into heat only
<b>Muscle tension:</b>	<p><b>Increase at 1st then maintained constant</b> during major part of contraction (isotonic)</p> 	<p><b>Markedly increased</b></p> 
<b>O2 and nutrient requirement:</b>	<b>Greater</b>	<b>Lesser</b>
<b>Relationship:</b>	<b>Force velocity relationship</b>	<b>Length tension relationship</b>

▪ **Give a short account on Force - velocity relationship?**

▪ **Mention the effect of load on velocity of shortening?**

➤ Velocity of shortening is **inversely** proportional to the weight of the load.

a) If the ms is unloaded,	• It shortens with maximum velocity
b) As the weight of load increase	• The velocity of shortening decrease
c) When the load reaches a maximum	• Ms contract without shortening (i.e. isometrically)

▪ **Mention how initial length affect ms contraction ?** \*\*\*

▪ **Give a short account on Length - tension relationship ?**

➤ A maximum tension is obtained when the length of the muscle is nearly equal to the **resting length** (optimal length).

➤ **At optimal length (when sarcomere length is 2-2.2 um):** maximum number of cross bridges connecting thin and thick filaments.

➤ **Length higher or lower than this length :** decreased number of cross bridge ( ) actine and myosine >> decreased contraction.

▪ **Mention mechanism of isometric contraction ?** \*\*\*

➤ **Muscle is composed of 2 components:**

1. Contractile components (sarcomers).
2. Elastic components in tendon

➤ **When the muscle contracts against a heavy load (isometric contraction):**

- The contractile components **shorten**.
- In the same time the elastic components are **stretched to the same degree**.
- So, the length of the muscle remains **constant**, but its tension is **markedly increased**.

▪ **Compare () types of muscle fibers?** \*\*\*

		<b>Type I = red</b>	<b>Type IIB = pale or white</b>
<b>Other names</b>		Slow oxidative (SO)	Fast glycolytic (FG)
<b>Example</b>		Back ms, Soleus ms	Extraocular ms
<b>Colour</b>		Red (myoglobin)	Pale or white
<b>Diameter of MFs</b>		Small	Larger
<b>Mitochondria</b>		Numerous	Few
<b>Blood capillaries</b>		Numerous	Few
<b>Myoglobin</b>		Rich	Absent
<b>ATPase activity</b>		Slow	High
<b>Glycolytic capacity</b>		Moderate	High
<b>SR</b>		Less developed	Well developed
<b>Oxidative capacity</b>		High	Low
<b>SMT</b>	<b>Duration</b>	100 msec	Less than 10 msec
	<b>Latent period</b>	Longer	Shorter
	<b>Contraction</b>	Slow	Rapid
	<b>Relaxation</b>	Slow	Rapid
<b>Adapted for</b>		Long slow contractions which maintain the body posture (support body against gravity)	Rapid fine movements
<b>Fatigue</b>		<ul style="list-style-type: none"> <li>• <b><u>Resist fatigue due to:</u></b> <ol style="list-style-type: none"> <li>Are slowly contracting</li> <li>Rich blood vessel</li> <li>use aerobic oxidation</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• <b><u>Rapidly fatigued because:</u></b> <ol style="list-style-type: none"> <li>Are rapidly contracting</li> <li>Less blood supply</li> <li>use anaerobic oxidation</li> </ol> </li> </ul>

**N.B. Type IIA (fast oxidative glycolytic) :** Intermediate between type I and type IIB

- Mention in brief effect of training on skeletal ms?
- Discuss effect of training on ms size , neuromuscular control, metabolic adaptation? \*\*\*

<p><b>1. Muscle size:</b></p>	<p>a. <u>Skeletal muscle hyperplasia</u></p> <p>b. <u>Hypertrophy</u> (more prominent), appears after 3 weeks of training.</p> <p>➤ <u>Growth takes place in the form of :</u></p> <p>a. Increased actin, myosin.</p> <p>b. Increased number and size of myofibrils.</p> <p>c. Increased connective tissue, tendon and ligament</p> <p>d. Increased enzymes and nutrients</p>
<p><b>2. Muscle remodeling</b></p>	<ul style="list-style-type: none"> <li>• Skeletal muscle is a <b>dynamic</b> tissue , muscle fiber undergoes regeneration by <b>satellite cells</b></li> <li>• <b>Anaerobic training</b> increased the percentage of <b>type II fibers</b> and and the opposite occurs with aerobic training.</li> </ul>
<p><b>3. Muscle coordination:</b></p>	<ul style="list-style-type: none"> <li>• <b>Frequent exercise</b> and especially use of specific muscle for the same or similar skilled tasks lead to <b>improved coordination</b>.</li> <li>• When the prime mover <b>contracts</b> more rapidly the antagonist (muscle) must <b>relax quickly</b> to prevent blocking the movement.</li> <li>• Improved muscle coordination is <b>not just about muscle cells and tissues but also the nerves</b> that innervate those muscles.</li> </ul>
<p><b>4. Neuro-muscular control:</b></p>	<ul style="list-style-type: none"> <li>• <u>Sprint training may alter the neuromuscular control by:</u> <ol style="list-style-type: none"> <li>a) Modifying the <b>relative sequencing</b> of muscle activation.</li> <li>b) Increasing the <b>recruitment or firing frequency</b> of fast fibers.</li> </ol> </li> <li>• <b>resistance training</b>, the initial increase in muscle strength is due to <b>hypertrophy</b>.</li> </ul>

**5. Significant metabolic adaptations:**

- **There is increase in:**
  - a. Mitochondrial size and number
  - b. Enzymes of krebs cycle.
  - c. Muscle buffer capacity, which is **the first line** of defense against lactic acidosis.

▪ **Discuss ms fiber type difference among athelete ?**

▪ **Mention factors that control ms fiber type among atheletes ?**

- Athletes of aerobic and endurance sports: **have slow-twitch fiber (90-95%)**.
- Athletes of anaerobic capacities, strength, and power sports (e.g., weight lifting and sprinting): **have fast twitch fibers (60-80%)**.
- **Differences in muscle fiber-type distribution due to a combination of two factors: \*\*\***
  - a. Natural selection
  - b. Training-induced fiber-type transformation (small effect).