



NCERT TEXTBOOK QUESTIONS FROM SOLVED

1. Draw the diagram of a sarcomere of skeletal muscle showing different regions.

Solution:

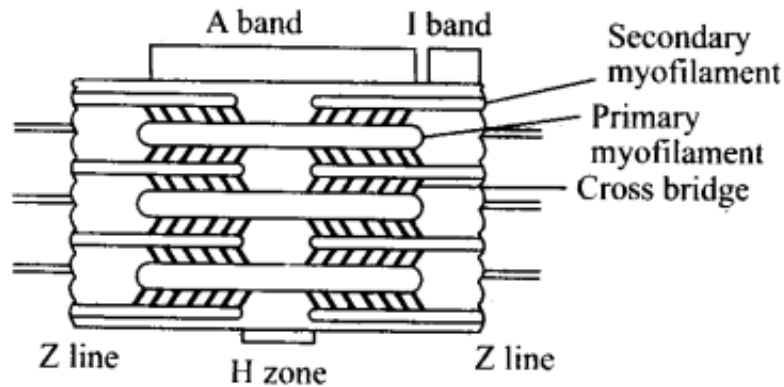


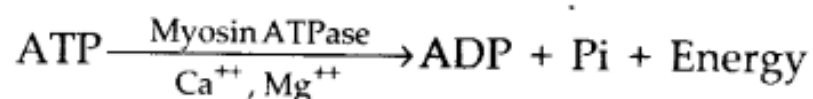
Fig.: Structure of a sarcomere.

2. Define sliding filament theory of muscle contraction.

Solution: According to sliding filament theory of muscle contraction, the actin and myosin filaments slide past each other with the help of cross-bridges to reduce the length of the sarcomeres.

3. Describe the important steps in muscle contraction.

Solution: Mechanism of muscle contraction is explained by sliding filament theory which states that contraction of a muscle fibre takes place by the sliding of the thin filaments over the thick filaments. As a nerve impulse reaches the terminal end of the axon, synaptic vesicles fuse with the axon membrane and release a chemical transmitter, acetylcholine and binds to receptor sites of the motor end plate. When depolarization of the motor end plate reaches a certain level, it creates an action potential. An action potential (impulse) passes from the motor end plate over the sarcolemma and then into the T-tubules and sarcoplasmic reticulum and stimulates the sarcoplasmic reticulum to release calcium ions into the sarcoplasm. The calcium ions bind to troponin causing a change in its shape and position. This in turn alters shape and the position of tropomyosin, to which troponin binds. This shift exposes the active sites on the F-actin molecules. Myosin cross-bridges are then able to bind to these active sites. The heads of myosin molecules project laterally from thick myofilaments towards the surrounding thin myofilaments. These heads are called cross bridges. The head of each myosin molecule contains an enzyme myosin ATPase. In the presence of myosin ATPase, Ca^{++} and Mg^{++} ions, ATP breaks down into ADP and inorganic phosphate, releasing energy in the head. Energy from ATP causes energized myosin cross bridges to bind to actin.



The energized cross-bridges move, causing thin myofilaments to slide along the thick myofilaments.

4. Write true or false. If false change the statement so that it is true.

- (a) Actin is present in thin filament.
- (b) H-zone of striated muscle fibre represents both thick and thin filaments.
- (c) Human skeleton has 206 bones.
- (d) There are 11 pairs of ribs in man.
- (e) Sternum is present on the ventral side of the body.

Solution:

- (a) True
- (b) False - H-Zone of striated muscle fibres represents only thick filaments.
- (c) True
- (d) False - There are 12 pairs of ribs in man.
- (e) True

5. Write the differences between:

- (a) Actin and Myosin
- (b) Red and White muscles
- (c) Pectoral and Pelvic girdle

Solution:

- (a) Actin filaments and myosin filaments can be differentiated as follows:

	Actin filaments (Thin myofilaments)	Myosin filaments (Thick myofilaments)
(i)	Found in both A and I bands.	Found only in A band of sarcomere.
(ii)	Thinner (0.005 mm) but shorter (2–2.6 mm) than myosin filaments.	Thicker (0.01 mm) but longer (4.5 mm) than actin filaments.
(iii)	Cross bridges absent, hence have smooth surface.	Cross bridges present, hence have rough surface.
(iv)	More numerous than myosin filaments, six of them surround each myosin filament.	Fewer than actin filaments.
(v)	Free at one end and are joined to Z-line by other end.	Free at both the ends.
(vi)	Consist of 3 proteins : actin, tropomyosin and troponin.	Consist of 2 proteins : myosin and meromyosin.
(vii)	Slide into H-zone during muscle contraction.	Do not slide during muscle contraction.

(b) Differences between red muscle fibres and white muscle fibres are given in the following table:

	Red muscle fibres	White muscle fibres
(i)	They are thin.	They are much thicker.

(ii)	They contain abundant mitochondria, low glycogen content and poorly formed sarcoplasmic reticulum.	They are poor in mitochondria, and have abundant glycogen granules and well formed sarcoplasmic reticulum.
(iii)	They are dark red as they contain abundant pigment myoglobin.	They are light in colour as they have very little myoglobin.
(iv)	Their myoglobin stores O_2 as oxymyoglobin that releases O_2 for oxidation during muscle contraction.	They have little or no store of oxygen.
(v)	They get energy for contraction by aerobic respiration.	They get energy for contraction mainly by anaerobic respiration.

(vi)	They accumulate little lactic acid.	They accumulate lactic acid during strenuous work.
(vii)	They undergo slow sustained contractions for long periods.	They undergo fast contractions for short periods.
(viii)	They are not fatigued with work	They soon get fatigued with work.
(ix)	They are innervated by thin, slow-conducting nerve fibres. Example : Extensor muscles of the back in man.	They are innervated by thick, fast-conducting nerve fibres. Example : Eyeball muscles.

(c) Differences between pectoral and pelvic girdles are given in the following table:

	Pectoral girdle	Pelvic girdle
(i)	It lies on the postero-lateral aspect of the upper region of the thorax.	It is located in the lower part of the trunk.
(ii)	It consists of 2 dissimilar bones: scapula and clavicle.	It consists of 2 similar bones, innominate.
(iii)	Scapula and clavicle are not further divided into any type of bone.	Each innominate bone consists of three bones : ilium, ischium and pubis.
(iv)	It provides articulation to the arm bones.	It provides articulation to the bones of the leg.
(v)	It has at its lateral angle a shallow concavity, the glenoid cavity, for articulation of the head of the humerus.	It has at the middle of its lateral surface a deep, cup-shaped hollow, acetabulum.

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