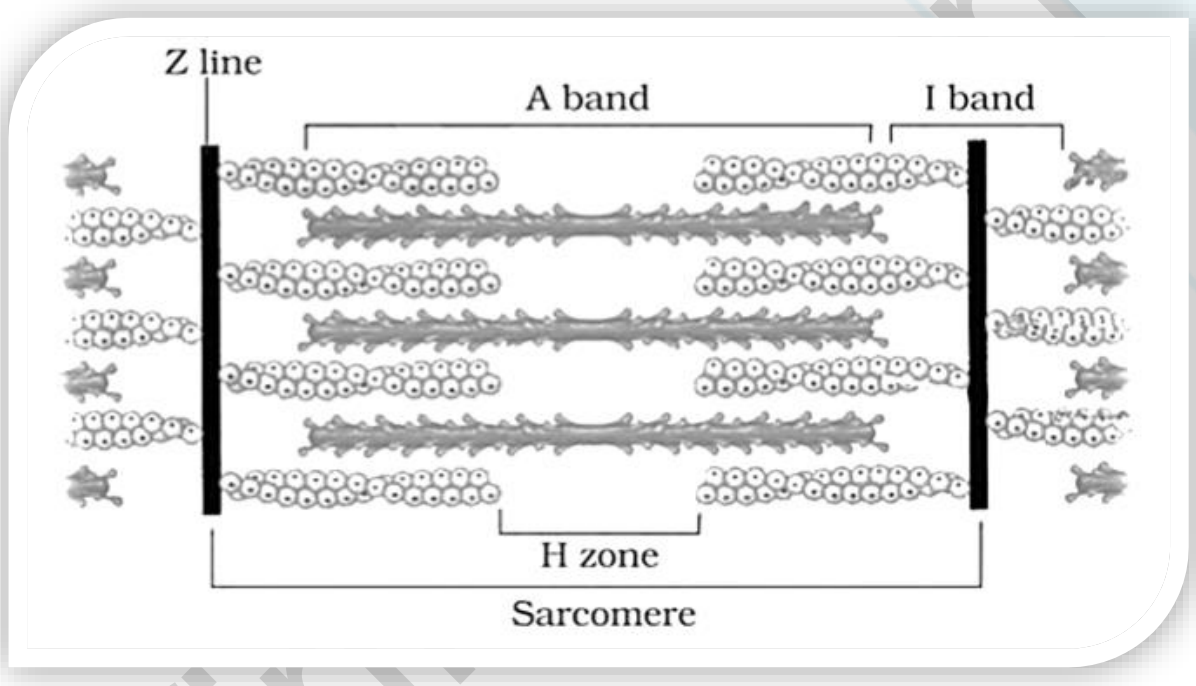
Chapter: LOCOMOTION AND MOVEMENT

Exercise

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

Answer:

The diagrammatic representation of a sarcomere is as follows:



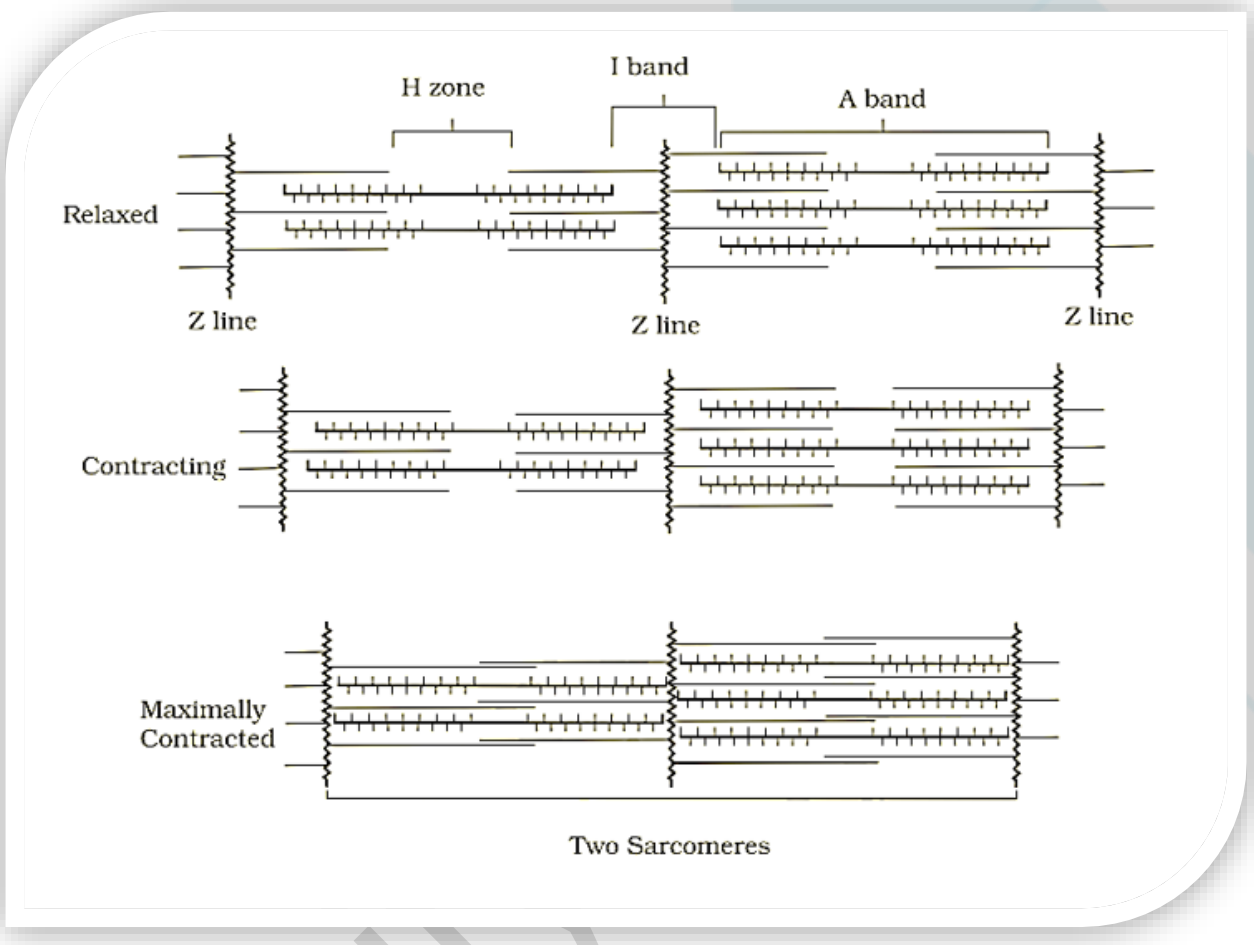
Question 2. Define sliding filament theory of muscle contraction?

Answer:

The sliding filament theory explains how muscle contraction occurs when thin filaments slide over thick filaments, shortening the myofibril. Each muscle fiber has an alternate light and dark band that contains a special contractile protein called actin or myosin. Myosin is a thick contractile protein that is present in the dark band and is known as the A-band. Actin is a thin contractile protein that is present in the light band and is known as the I-band. Each I-band is bisected by an elastic fiber known as the z line. The thin filament is securely fastened to the z line.

The H-zone is the central part of the thick filament that is not overlapped by the thin filament.

Myosin heads or cross bridges come into close contact with thin filaments during muscle contraction. As a result, the thin filaments are drawn towards the sarcomere's centerTroponin. The Z line attached to the actin filaments is also pulled, causing the sarcomere to shorten. As a result, the band's length remains constant as its original length decreases, the I-band shortens, and the H-zone disappears.



Question 3. Describe the important steps in muscle contraction?

Answer:

During skeletal muscle contraction, the thick filament slides over the thin filament and releases myosin along the filament due to repeated bending. This entire process takes place in sequential order.

Step 1: Signals that travel along the axon and reach the neuromuscular junction or motor endplate cause muscle contraction. A neuromuscular junction is a connection between a neuron and a muscle fiber's sarcolemma. As a result of the action potential in the sarcolemma, acetylcholine (a neurotransmitter) is released into the synaptic cleft.

Step 2: The generation of this action potential causes calcium ions to be released from the sarcoplasmic reticulum.

Step 3: The increased calcium ions in the sarcoplasm lead to the activation of actin

sites. Calcium ions bind to the troponin on actin filaments and remove the tropomyosin,

wrapped around actin filaments. Hence, active actin sites are exposed and this allows

myosin heads to attach to this site.

Step 4: In this stage, the myosin head attaches to the exposed site of actin and forms cross bridges by utilizing energy from ATP hydrolysis. The actin filaments are pulled. As a result, the H-zone reduces. It is at this stage that the contraction of the muscle occurs.

Step 5: After muscle contraction, the myosin head pulls the actin filament and releases ADP along with inorganic phosphate. ATP molecules bind and detach myosin and the cross-bridges are broken.

Stage 6: This process of formation and breaking down of cross-bridges continues until there is a drop in the stimulus, which causes an increase in calcium. As a result, the concentration of calcium ions decreases, thereby masking the actin filaments and leading to muscle relaxation.

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

(a)Actin is present in the thin filament

(b)H-zone of striated muscle fiber 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.

Answer:

(a) True

(b) False

(c) True

(d) False

(e) True

Question 5. Write the difference between:

(a) Actin and Myosin

(b) Red and White muscles

(c) Pectoral and Pelvic girdle

Answer:

Actin	Myosin
The myofilament forms thin filaments (I-bands).	Thick filaments (A-bands) of the myofilament are formed
It is made up of monomers of globular actin.	It is made up of monomers of meromyosin.
Troponin and tropomyosin, two regulatory proteins, are connected to actin.	Instead of being joined together, each meromyosin is made up of four light chains and two similar heavy chains.

Parameters	Red muscles	White muscles
Myoglobin content	High	Low
Amount of sarcoplasmic reticulum	Moderate	High
Fibers	Narrow and thin	Broad and thick
Mitochondria	Possess many	Few
Fatigue	Not fatigued	Fatigued
Type of respiration from which energy is derived	Aerobic	Anaerobic

Pectoral girdle	Pelvic girdle
The shoulder girdle is otherwise known as the pectoral girdle.	The hip girdle is also known as the pelvic girdle.

The clavicle and scapula are the two bones that make up each half of the girdle.	The ischium, ilium, and pubis bones make up each side of the girdle.
Articulation of the forelimbs is available.	The ability to articulate the hindlimbs is available.
The glenoid cavity of the pectoral girdle articulates with the head of the humerus.	The acetabulum of the pelvic girdle articulates with the head of the femur.

Question 6.

Column I	**Column II**
(a) Smooth muscle	**(i) Myoglobin**
(b) Tropomyosin	**(ii) Thin filament**
(c) Red muscle	**(iii) Sutures**
(d) Skull	**(iv) Involuntary**

Answer:

Column I	**Column II**
(a) Smooth muscle	(iv) Involuntary
(b) Tropomyosin	(ii) Thin filament
(c) Red muscle	(i) Myoglobin
(d) Skull	(iii) Sutures

Question 7. What are the different types of movements exhibited by the cells of the human body?

Answer:

Movement is a distinguishing feature of all living organisms. Cells in the human body exhibit the following types of movement:

Amoeboid movement: Leucocytes in the blood exhibit amoeboid movement. These blood cells move from the circulatory system to the injury site during tissue damage to initiate an immune response.

Ciliary movement: It is exhibited by reproductive cells such as sperms and ova. This movement aids the passage of the ova through the fallopian tube and into the uterus.

Muscular movement: It is demonstrated by muscle cells.

Question 8. How do you distinguish between a skeletal muscle and a cardiac muscle?

Answer:

Skeletal muscle	Cardiac muscle
The cells of skeletal muscles are unbranched.	The cells of cardiac muscles are branched.
Intercalated disks are absent	The cells are joined with one another by intercalated disks that help in coordination or synchronization of the heart beat.
Alternate light and dark bands are present.	Faint bands are present.
They are voluntary muscles	They are involuntary muscles
They contract rapidly and get fatigued in a short span of time	They contract rapidly and but don’t get fatigued in a short span of time
They are present in body parts such as the legs, tongue, hands, etc.	These muscles are present in the heart and control the contraction and relaxation of the heart.

Question 9. Name the type of joint between the following:

(a) Atlas/axis

(b) carpal/metacarpal of the thumb

(c) between phalanges

(d) femur/acetabulum

(e) between cranial bones

(f) between pubic bones in the pelvic girdle

Answer:

(a) atlas/axis: Pivotal joint

(b) carpal/metacarpal of thumb: Saddle joint

(c) between phalanges: Hinge joint

(d) femur/acetabulum: Ball and socket joint

(e) between cranial bones: Fibrous joint

(f) between pubic bones in the pelvic girdle: Ball and socket joint

Question 10. Fill in the blank spaces:

(a)All mammals (except a few) have _____ cervical vertebra.

(b)The number of phalanges in each limb of human is _____

(c) Thin filament of myofibril contains 2 'F' actins and two other proteins namely _____ and _____.

(d) In a muscle fibre Ca++ is stored in _____

(e) _____ and _____ pairs of ribs are called floating ribs.

(f) The human cranium is made of _____ bones.

Answer:

(a) All mammals (except a few) have Seven cervical vertebrae.

(b) The number of phalanges in each limb of a human is 14.

(c) Thin filament of myofibril contains 2 'F' actins and two other proteins, namely troponin and tropomyosin.

(d) In a muscle fiber, Ca++ is stored in the sarcoplasmic reticulum.

(e) The 11th and 12th pairs of ribs are called floating ribs.

(f) The human cranium is made up of eight bones.