CHAPTER

17 LOCOMOTION AND MOVEMENT

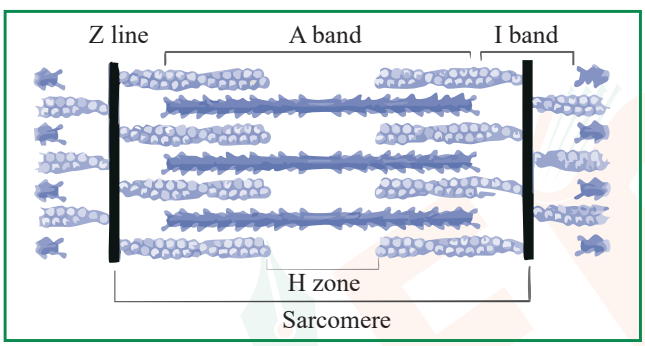
CLASS 11TH

NCERT EXERCISE AND SOLUTIONS - BIOLOGY

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

ANSWER:-

The diagram below illustrates the sarcomere of skeletal muscle, highlighting its various regions:



Q. 2. **Define sliding filament theory of muscle contraction.**

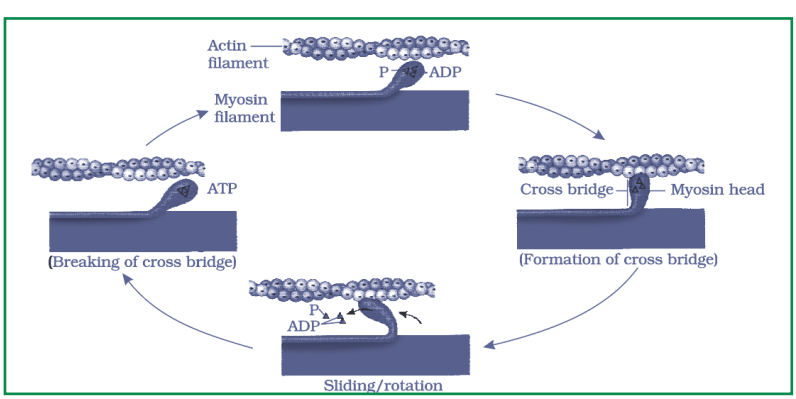
ANSWER:-

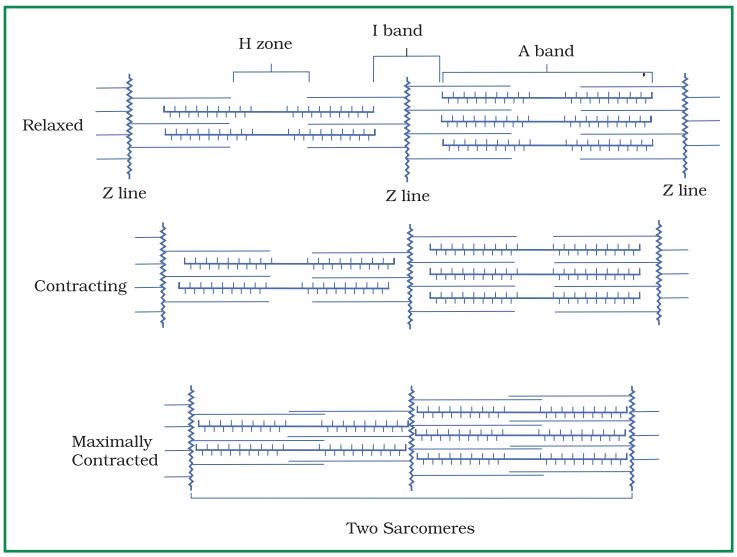
The sliding filament theory explains that muscle fiber contraction results from the thin filaments sliding over the thick filaments.

Q. 3. **Describe the important steps in muscle contraction.**

ANSWER:-

The sliding filament theory effectively explains the mechanism of muscle contraction, stating that muscle fiber contraction occurs as thin filaments slide over thick filaments.





Mechanism of Muscle Contraction:

Step 1 – Depolarization of Sarcolemma

1. A signal from the central nervous system (CNS) travels through a motor neuron and reaches the neuromuscular junction, also known as the motor end plate.
2. The neuromuscular junction is the interface between the motor neuron and the sarcolemma of the muscle fiber.
3. The arrival of the signal triggers the release of a neurotransmitter called acetylcholine, which initiates an action potential in the sarcolemma.

Step 2 – Release of Calcium Ions

1. The action potential propagates through the sarcolemma to the sarcoplasmic reticulum, causing the release of calcium ions into the sarcoplasm.

Step 3 – Conformational Changes in Actin Filaments

1. The released calcium ions bind to troponin and tropomyosin on the actin filaments.
2. This binding induces a conformational change in the actin-troponin-tropomyosin complex, exposing the active binding sites for myosin on the actin filaments.

Step 4 – Activation of Myosin Heads

1. Calcium ions activate the myosin heads, leading to ATP hydrolysis and the release of energy.
2. This energy enables the myosin heads to bind to the exposed active sites on the actin filaments, forming cross-bridges.

Step 5 – Sliding of Actin Filaments Over Myosin

1. The myosin heads rotate as the cross-bridges form, pulling the actin filaments toward the center of the A-band (H-zone).
2. This inward pull also moves the Z-lines, to which the actin filaments are attached, closer together.
3. The sarcomere contracts as actin filaments slide from opposite ends.
4. During contraction, the I-band shortens while the A-band retains its length, leading to overall muscle contraction.

Q. 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.

ANSWER:-

(a) Actin is found in thin filaments – True.
(b) The H-zone in a striated muscle fibre represents both thick and thin filaments – False.
Corrected statement: The H-zone in a striated muscle fibre represents only thick filaments.
(c) The human skeleton consists of 206 bones – True.
(d) A man has 11 pairs of ribs – False.
Corrected statement: A man has 12 pairs of ribs.
(e) The sternum is located on the ventral side of the body – True.

Q. 5. **Write the difference between :**

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

ANSWER:-

(a) Actin and Myosin

Actin	Myosin
Forms the thin filaments (I-bands) of the myofilament	Forms the thick filaments (A-bands) of the myofilament
Composed of globular actin monomers	Composed of meromyosin monomers
Associated with regulatory proteins, troponin, and tropomyosin	Not associated with regulatory proteins; each meromyosin consists of four light chains and two identical heavy chains

(b) Red and White muscles

Parameters	Red Muscles	White Muscles
Myoglobin content	High	Low
Sarcoplasmic reticulum amount	Moderate	High
Fibre structure	Narrow and thin	Broad and thick
Mitochondria	Numerous	Few
Fatigue resistance	Resistant to fatigue	Prone to fatigue
Type of energy-producing respiration	Aerobic	Anaerobic

(c) Pectoral and Pelvic girdle

Pectoral Girdle	Pelvic Girdle
Also referred to as the shoulder girdle	Also referred to as the hip girdle
Each half consists of two bones: the clavicle and scapula	Each half consists of three bones: the ischium, ilium, and pubis
Facilitates articulation of the forelimbs	Facilitates articulation of the hindlimbs
The humerus head articulates with the glenoid cavity of the pectoral girdle	The femur head articulates with the acetabulum of the pelvic girdle

Q. 6. Match Column I with Column II :

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

ANSWER:-

(a) – (iv)
(b) – (ii)
(c) – (i)
(d) – (iii)

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

ANSWER:-

Movement is a fundamental characteristic of living organisms. The various types of movements displayed by human body cells include:

1. Amoeboid Movement: This type of movement is exhibited by leucocytes (white blood cells) in the blood. Leucocytes migrate from the circulatory system to the site of tissue damage to initiate an immune response.
2. Muscular Movement: Muscle cells display this type of movement, enabling body movements and locomotion.
3. Ciliary Movement: This movement is seen in sex cells, such as sperms and ova. It aids in the transport of the ovum through the fallopian tube toward the uterus.

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

ANSWER:-

Skeletal Muscle	Cardiac Muscle
Attached to the bones of the body	Found in the walls of the heart
Voluntary in nature	Involuntary in nature

Nucleus located at the periphery of the cell	Muscle fibers are branched
Muscle fibers are unbranched	Contain intercalated discs in the muscle fibers
No intercalated discs present	Responsible for the contraction and pumping of the heart
Facilitates body movement and maintains posture	Maintains the rhythmic beating of the heart

Q. 9. Name the type of joint between the following:-

(a) atlas/axis
(b) carpal/metacarpal of thumb
(c) between phalanges
(d) femur/acetabulum
(e) between cranial bones
(f) between pubic bones in the pelvic girdle

ANSWER:-

(a) Atlas and axis – Pivot joint
(b) Carpal and metacarpal of the thumb – Saddle joint
(c) Between the phalanges – Hinge joint
(d) Femur and acetabulum – Ball and socket joint
(e) Between cranial bones – Fibrous joint
(f) Between the pubic bones in the pelvic girdle – Cartilaginous joint

Q. 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) Seven
(b) Fourteen
(c) Troponin, tropomyosin
(d) Sarcoplasmic reticulum
(e) Eleventh, twelfth
(f) Eight