Locomotion and Movement

Multiple Choice Questions

Q1. Match the following and mark the correct option.

Column I		Column II	
A.	Fast muscle fibres	(i)	Myoglobin
B.	Slow muscle fibres	(ii)	Lactic acid
C.	Actin filament	(iii)	Contractile unit
D.	Sarcomere	(iv)	I-band

Options:
(a) A—(i), B—(ii), C—(iv), D—(iii)
(b) A—(ii), B—(i), C—(iii), D—(iv)
(c) A—(ii), B—(i), C—(iv), D—(iii)
(d) A—(iii), B—(ii), C—(iv), D—(i)

Ans. (c)

A.	Fast muscle fibres	(ii)	Lactic acid
B.	Slow muscle fibres	(i)	Myoglobin
C.	Actin filament	(iv)	I-band
D.	Sarcomere	(iii)	Contractile unit

Q2. Ribs are attached to
(a) Scapula (b) Sternum (c) Clavicle (d) Ilium
Ans: (b) Ribs are attached to sternum.

Q3. What is the type of movable joint present between the atlas and axis?
(a) Pivot (b) Saddle (c) Hinge (d) Gliding
Ans: (a) Pivot joint: Between atlas and axis called atlanto-axial joint.

Q4. ATPase of the muscle is located in
(a) Actinin (b) Troponin (c) Myosin (d) Actin
Ans: (c) ATPase of the muscle is located in head of myosin.

Q5. Intervertebral disc is found in the vertebral column of
(a) Birds (b) Reptiles (c) Mammals (d) Amphibians
Ans: (c) Intervertebral disc is found in the vertebral column of mammals.

Q6. Which one of the following is showing the correct sequential order of vertebrae in the vertebral column of human beings? '
(a) Cervical — lumbar — thoracic — sacral — coccygeal
(b) Cervical — thoracic — sacral — lumbar — coccygeal
(c) Cervical — sacral — thoracic — lumbar — coccygeal
(d) Cervical — thoracic — lumbar — sacral — coccygeal
Ans: (d) Cervical—thoracic—lumbar—sacral—coccygeal is the correct sequential order of vertebrae in the vertebral column of human beings.

Q7. Which one of the following options is incorrect?
(a) Hinge joint—between humerus and pectoral girdle
(b) Pivot joint—between atlas, axis and occipital condyle
(c) Gliding joint—between the carpals
(d) Saddle joint—between carpel and metacarpals of thumb
Ans: (a) Hinge joint—Knee joint and elbow joint

Q8. Knee joint and elbow joints are examples of
(a) Saddle joint (b) Ball and socket joint
(c) Pivot joint (d) Hinge joint
Ans: (d) Knee joint and elbow joints are examples of hinge joint.

Q9. Macrophages and leucocytes exhibit
(a) Ciliary movement
(b) Flagellar movement
(c) Amoeboid movement
(d) Gliding movement
Ans: (c) Amoeboid movements: Some specialised cells in our body like macrophages and leucocytes in blood exhibit amoeboid movement. It is effected by pseudopodia formed by the streaming of protoplasm (as in Amoeba). Cytoskeletal elements like microfilaments are also involved in amoeboid movement.

Q10. Which one of the following is not a disorder of bone?
(a) Arthritis
(b) Osteoporosis
(c) Rickets
(d) Atherosclerosis
Ans: (d) Atherosclerosis is a disorder of circulatory system.

Q11. Which one of the following statement is incorrect?
(a) Heart muscles are striated and involuntary
(b) The muscles of hands and legs are striated and voluntary
(c) The muscles located in the inner walls of alimentary canal are striated and involuntary
(d) Muscles located in the reproductive tracts are unstriated and involuntary
Ans:(c) The muscles located in the inner walls of alimentary canal are non- striated and involuntary.

Q12. Which one of the following statements is-true**?**
(a) Head of humerus bone articulates with acetabulum of pectoral girdle
(b) Head of humerus bone articulates with glenoid cavity of pectoral girdle
(c) Head of humerus bone articulates with a cavity called acetabulum of pelvic girdle
(d) Head of humerus bone articulates with a glenoid cavity of pelvic girdle

Ans: (b) Below the acromion is a depression called the glenoid cavity which articulates with the head of the humerus to form the shoulder joint.

Q13. Muscles with characteristic striations and involuntary are
(a) Muscles in the wall of alimentary canal
(b) Muscles of the heart
(c) Muscles assisting locomotion
(d) Muscles of the eyelids
Ans: (b) Muscles with characteristic striations and involuntary are muscles of the heart (Cardiac muscles).

Q14. Match the followings and mark the correct option.

Column I		. Column II	
A.	Sternum	(i)	Synovial fluid
B.	Glenoid cavity	(ii)	Vertebrae
C.	Freely movable joint	(iii)	Pectoral girdle
D.	Cartilaginous joint	(iv)	Flat bones

Options:

(a) A—(ii), B—(i), C—{iii), D—(iv)
(b) A—(iv), B—(iii), C—(i), D—(ii)
(c) A—(ii), B—(i), C—(iv), D—(iii)
(d) A—(iii), B—(i), C—(ii), D—(iv)

Ans. (b)

A.	Sternum	(iv)	Flat bones
B.	Glenoid cavity	(iii)	Synovial fluid
C.	Freely movable joint	(i)	Pectoral girdle
D.	Cartilaginous joint	(ii)	Yertebrae

Very Short Answer Type Questions
Q1. Name the cells/tissues in human body which
a. exhibit amoeboid movement

b. exhibit ciliary movement
Ans: a. Macrophages and leucocytes
b. Trachea, fallopian tube and bronchiole

Q2. Locomotion requires a perfect'coordinated activity of muscular _____, _____ , systems.
Ans: Skeletal and Neural

Q3. Sarcolemma, sarcoplasm and sarcoplasmic reticulum refer to a particular type of cell in our body. Which is this cell and to what parts of that cell do these names refer to?
Ans: Each muscle fibre or muscle cell is lined by the plasma membrane called sarcolemma enclosing the sarcoplasm. A muscle fibre is a syncytium as the sarcoplasm (cytoplasm) contains many nuclei. The endoplasmic reticulum, i. e., sarcoplasmic reticulum of the muscle fibres is the store house of calcium ions.

Q4 .Label the different components of actin filament in the diagram given

Ans.

Q5. The. three tiny bones present in middle **ear are called ear ossicles. Write them in correct sequence beginning from** eardrum**.**
Ans: Malleus, incus and stapes.

Q6. What is the difference between the matrix of bones and cartilage?
Ans: Bones have a hard and non-pliable ground substance rich in calcium salts and collagen fibres which give bone its strength.
The inter-cellular material of cartilage is solid and pliable which resists compression. Cell of cartilage are called chondrocytes which are enclosed in a small cavities (lacunae) within the matrix secreted by them.

Q7. Which tissue is afflicted by Myasthenia gravis? What is the underlying cause?
Ans: Myasthenia gravis: Auto-immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle.

Q8. How do our bone joints function without grinding noise and pain?
Ans: Our bone joints function without grinding noise and pain due to the presence of synovial fluid between bones.

Q9. Give the location of a ball and socket joint in a human body.
Ans: Ball and socket joint: Between humerus and pectoral girdle (shoulder joint). Between femur and acetabulum of pelvic girdle (hip joint). Total 4 ball and socket joints present in human body -2 shoulder joint and 2 hip joint.

Q10. Our forearm is made of three different bones. Comment.
Ans: The bones of the forearm are humerus, radius and ulna.

Q1. With respect to rib **cage, explain the following:**
a. Bicephalic ribs
b. True ribs
c. Floating ribs
Ans: a. Bicephalic ribs: Each rib is a thin flat bone connected dorsally to the vertebral column and ventrally to the sternum. It has two articulation surfaces on its dorsal end and is hence called bicephalic.
b. True ribs: First seven pairs of ribs are called true ribs. Dorsally, they are attached to the thoracic vertebrae and ventrally connected to the sternum with the help of hyaline cartilage.
c. Floating ribs: Last 2 pairs (11th and 12th) of ribs are not connected ventrally and are therefore, called floating ribs.

Q2. In old age, people often suffer from stiff and inflamed joints. What is this condition called? What are the possible reasons for these symptoms?
Ans: In old age, people suffer from stiff and inflamed joints, it is due to rheumatoid arthritis (autoimmune disorder)
Causes: (i) Inflammation of synovial membrane
(ii) Genetic factors (50% cases) .
(iii) Smoking
(iv) Vitamin-D deficiency

Q3. Exchange of calcium between bone and extracellular fluid takes place under the influence of certain hormones.

1. **What will happen if more of Ca^{+} is in extracellular fluid?**
2. **What will happen if very less amount of Ca^{++} is in the extracellular fluid?**

Ans: a. If more of Ca^{++} is in extracellular fluid then it will be accumulated on the bones under the influence of thyrocalcitonin (TCT).
b. If very less amount of Ca^{++} is in the extracellular fluid then parathyroid hormone (PTFI) acts on bones and stimulates the process of bone resorption (dissolution/demineralisation). PTH also stimulates reabsorption of Ca^{2+} by the renal tubules and increases Ca^{2+} absorption from the digested food.

Q4. Name at least two hormones which result in fluctuation of Ca^{++}

Ans: Thyrocalcitonin (TCT) and Parathyroid Hormone (PTH).

Q5. Rahul exercises regularly by visiting a gymnasium. Of late he is gaining weight. What could be the reason? Choose the correct answer and elaborate.
a. Rahul has gained weight due to accumulation of fats in body.
b. Rahul has gained weight due to increased muscle and less of fat.
c. Rahul has gained weight because his muscle shape has improved.
d. Rahul has gained weight bdcause he is accumulating water in the body.
Ans: Rahul has gained weight due to increased muscle and less of fat.

Q6. Radha was running on a treadmill at a great speed for 15 minutes continuously. She stopped the treadmill and abruptly came out. For the next few minutes, she was breathing heavily/fast. Answer the following questions:
a. What happened to her muscles when she did strenuously exercise?
b. How did her breathing rate change?
Ans: a. Repeated activation of the muscles can lead to the accumulation of lactic acid due to anaerobic breakdown of glycogen in them, causing fatigue.
b. During strenuous exercise demand of oxygen also increases so breathing rate has been changed.

Q7. Write a few lines about Gout.
Ans: When metabolic waste-uric acid crystals are accumulated in bones, then it results into inflammation of bone and joints thereby causing pain. This disorder of skeletal system is called gout.

Q8. What is the source of energy for muscle contraction?
Ans: ATP (Adenosine Triphosphate)

Q9. What are the points for articulation **of pelvic and pectoral girdles?**
Ans: The components of pelvic girdle are ilium, ischium and pubis. It articulates with, femur through acetabulum. The components of pectoral girdle are scapula and clavicle. It is the glenoid cavity of pectoral girdle in which head . of humerus articulates.

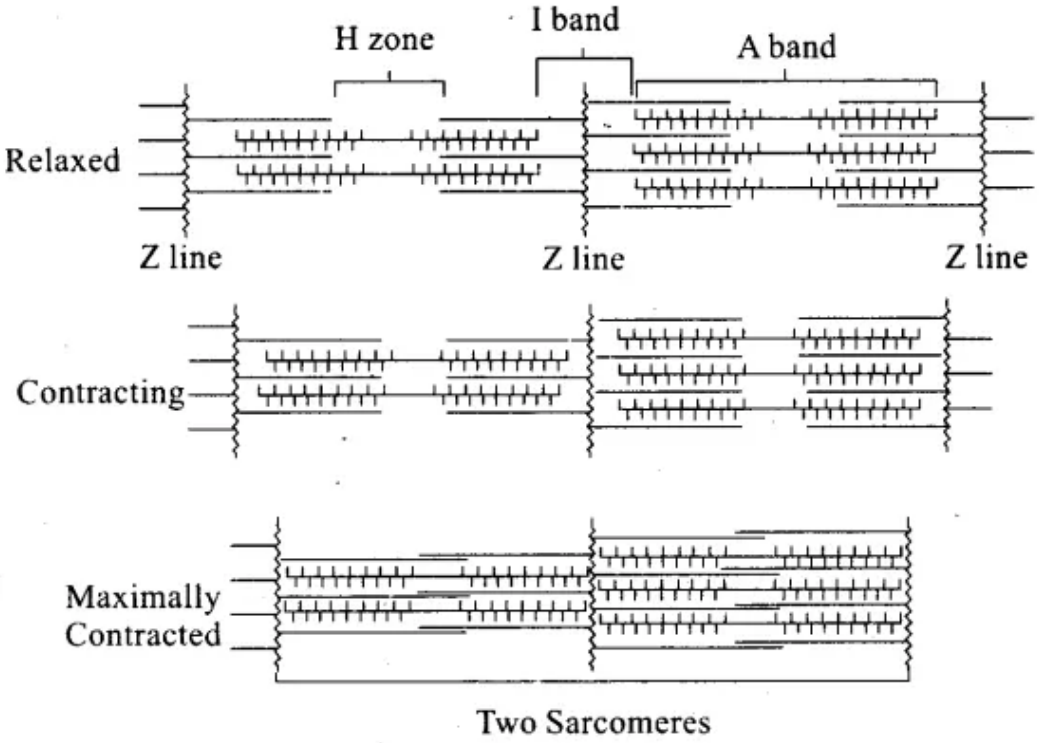
Long Answer Type Questions

Q1. Calcium ion concentration in blood **affects muscle contraction. Does it lead to tetany in certain cases? How will you correlate fluctuation in blood calcium with tetany?**
Ans: Muscle contraction is initiated by a signal sent by the central nervous system (CNS) via a motor neuron. A neural signal reaching this junction releases a neurotransmitter (acetyl choline) which generates an action potential in the sarcolemma. This spreads through the muscle fibre and causes the release of calcium ions into the sarcoplasm. Increase in Ca^{++} level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby remove the masking of active sites for myosin. Utilising the energy from ATP hydrolysis, the myosin head now binds to the exposed active sites on actin to form a cross-bridge. This pulls the attached actin filaments towards the centre of 'A' band. The 'Z' line attached to these actins are also pulled inwards thereby causing a shortening of the sarcomere, i.e., contraction. The process continues till the Ca^{++} ions are pumped back to the sarcoplasmic cisternae resulting in the masking of actin filaments.

Tetany: Rapid spasms (wild contractions) in muscle due to low Ca in body fluid.

Q2. An elderly woman slipped in th£ bathroom and had severe pain in her lower back. After X-ray examination doctors told her it is due to a slipped disc. What does that mean? How does it affect our health?
Ans: Displacement of intervertebral disc from' their normal position is called slipped disc.
Effects:
i. Neck or lower back pain
ii. Muscular weakness
iii. Paralysis
iv. Sciatica

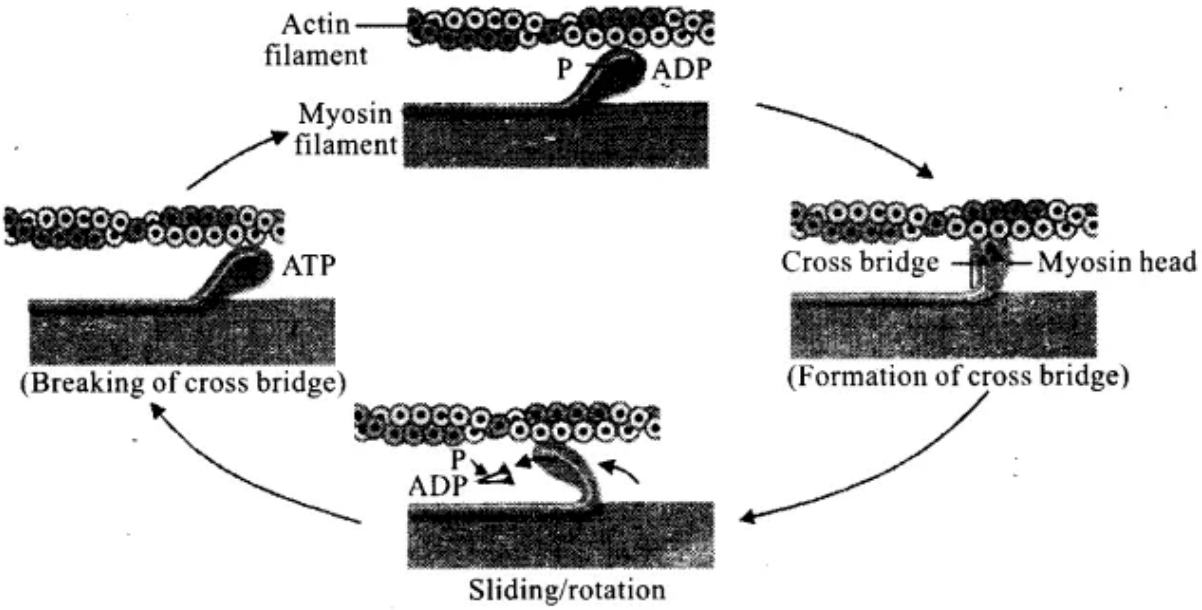
Q3. Explain sliding filament theory of muscle contraction with neat sketches.
Ans. Mechanism of muscle contraction: Mechanism of muscle contraction is best explained by the sliding filament theory which states that contraction of a muscle fibre takes place by the sliding of the thin filaments over the thick filaments. Muscle contraction is initiated by a signal sent by the Central Nervous System (CNS) via a motor neuron. A motor neuron alongwith the muscle fibres connected to it constitute a motor unit. The junction between a motor neuron and the sarcolemma of the muscle fibre is called the neuromuscular junction or motor-end plate. A neural signal reaching this junction releases a neurotransmitter (acetyl choline) which generates an action potential in the sarcolemma. This spreads through the muscle fibre and causes the release of calcium ions into the sarcoplasm. Increase in Ca^{++} level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby remove the masking of active sites for myosin.Utilising the energy from ATP hydrolysis, the myosin head now binds to the exposed active sites on actin to form a cross-bridge. This pulls the attached



Sliding-filament theory of muscle contraction (movement of the thin) filaments and the relative size of the I band and H zones)

actin filaments towards the centre of 'A' band. The 'Z' line attached to these actins are also pulled inwards thereby causing a shortening of the sarcomere, i.e., contraction. It is clear from the above steps, that during shortening of the muscle, i.e., contraction, the 'I' bands get reduced, whereas the 'A' bands retain the length. The myosin, releasing the ADP and P, goes back to its relaxed state. A new ATP binds and the cross-bridge is broken. The ATP is again hydrolysed by the myosin head and the cycle of cross-bridge formation and breakage is repeated causing further sliding. The process continues till the Ca^{++} ions are pumped back to the sarcoplasmic cistemae resulting in the masking of actin filaments. This causes the return of 'Z' lines back to their original position, i.e., relaxation.

Q5. Discuss the role of Ca^{2+} ions in muscle contraction. Draw neat sketches to illustrate your answer.
Ans: Muscle contraction is initiated by a neural signal, which after reaching neuromuscular junction or motor end plate releases a neurotransmitter, as a result an action potential in the sarcolemma is generated. Action potential spreads through muscle fibre and causes the release of calcium ions into the sarcoplasm. Increase in Ca^{2+} level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby removes the masking of active sites for myosin. Utilising the energy from ATP hydrolysis, the myosin head now binds to the exposed active site on actin to form a cross-bridge. This pulls the attached actin filaments towards the centre of 'A' band. The 'Z' line attached to these actins are also pulled inwards thereby causing shortening of the sarcomere, i.e., contraction.



Stages in cross bridge formation, rotation of head and breaking of cross bridge

A new ATP binds to myosin head and the cross-bridge is broken. The ATP is again hydrolysed by the myosin head and the cycle of cross-bridge formation and breakage is repeated causing further sliding. The process continues till the Ca^{++} ions are pumped back to the sarcoplasmic cistemae resulting in masking of actin filaments and breakage of all cross-bridges. This cause the return of 'Z' lines along with filaments back to their original position, i.e., relaxation.

Q6. Differentiate between pectoral and pelvic girdle.

Ans: Pectoral and pelvic girdle help in the articulation of upper and lower limbs respectively. Each girdle is made of two equal halves. Each half of a pectoral girdle consists of clavicle and scapula. Scapula is a large triangular flat bone. There is glenoid cavity at the joint of scapula, clavicle and acromian process, which articulates with the head of humerus to form the shoulder joint. Each half of pelvic girdle is formed by three bones—ilium, ischium and pubis. At the point of their fusion; there is a cavity called acetabulum to which the head of femur articulates.