NCERT Exemplar Solutions For Class 11

Biology

CHAPTER 20 - LOCOMOTION AND MOVEMENT

Multiple Choice Questions (MCQs)

1. Match the following and mark the correct option

Column I	Column II
A. Fast muscle fibers	**(i)Myoglobin**
B. Slow muscle	**(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) $A-(ii)$, $B-(i)$, $C-(iv)$, $D-(iii)$

Explanation: Sarcomere consists of two main protein filaments: actin and myosin. They are also known as basic contractile units. Slow muscle fibers consist of myoglobin as they help in continuous ATP production.

2. Ribs are attached to

(a) Scapula

(b) Sternum

(c) Clavicle

(d) Ilium

Ans: (b) Sternum

Explanation: There are a total twelve ribs out of which seven are true ribs and five are false ribs. The true ribs are attached to the sternum.

3. What is the type of movable joint present between the atlas and axis?

(a) Pivot

(b) Saddle

(c) Hinge

(d) Gliding

Ans: (a) Pivot

Explanation: Pivot consists of one bone being fixed and the other bone being free to articulate which helps in the turning movements of the joint. Pivot joint is present between the atlas and axis and is known as atlantoaxial pivot joint.

4. ATPase of the muscle is located in

(a) Actinic

(b) Troponin

(c) Myosin

(d) Actin.

Ans: (c) Myosin

Explanation: ATPase are a group of enzymes that help in decomposition of ATP. The myosin protein filament has meromyosin which has a head component and a tail component. The head component has the ATPase of the muscle.

5. Intervertebral disc is found in the vertebral column of

(a) Birds.

(b) Reptiles

(c) Mammals

(d) Amphibians

Ans: (c) Mammals

Explanation: Intervertebral disc is found in mammals and helps in absorbing shocks. They protect the nerves running from the brain to the vertebral column.

6. 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

Explanation: The sequential order of the vertebrae in the vertebral column of human beings from top to bottom is cervical, thoracic, lumbar, sacral, and coccygeal. At the top, there is a cervical curve formed by seven vertebrae followed by the thoracic vertebrae formed by twelve vertebrae. Then, there are five lumbar vertebrae forming the lumbar followed by sacral and coccygeal.

7. Which one of the following pairs is incorrect?

(a) Hinge joint - between Humerus and Pectoral girdle

(b) Pivot joint - between atlas and axis,

(c) Gliding joint - between the carpals

(d) Saddle joint - between carpals metacarpals of thumb

Ans: (a) Hinge joint - between Humerus and Pectoral girdle

8. Knee joint and elbow joints are examples of

(a) Saddle joint

(b) Ball and socket joint

(c) Pivot joint

(d) Hinge joint

Ans: (d) Hinge joint

Explanation: Hinge joints allow movement in only one direction. We can move our elbows and knees in one direction and hence these joints are examples of hinge joints.

9. Macrophages and leucocytes exhibit

(a) Ciliary movement

(b) Flagellar movement

(c) Amoeboid movement

(d) Gliding movement

Ans: (c) Amoeboid movement.

Explanation: They are able to do phagocytosis due to amoeboid movement.

10. Which one of the following is not a disorder of bone?

(a) Arthritis

(b) Osteoporosis

(c) Rickets

(d) Atherosclerosis

Ans: (d) Atherosclerosis

Explanation: Atherosclerosis is not a disorder of bones unlike Arthritis, Rickets and Osteoporosis. It is a condition where the walls of the arteries are hardened due to buildup of cholesterol.

11. Which one of the following statements is incorrect?

(a) Heart muscles are striated and involuntary

(b) The mussels 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 the alimentary canal are striated and involuntary.

Explanation: These are smooth muscles which are non-striated.

12. 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) Head of humerus bone articulates with glenoid cavity of pectoral girdle.

Explanation: Head of humerus bone articulates with glenoid cavity of pectoral girdle which results in formation of ball and socket joints.

13. 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 of the heart

Explanation: Cardiac muscles are striated and involuntary.

14. 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 – (IV), B – (i), C – (ii), D – (IV)

Ans: (b) A – (IV), B – (iii), C – (i), D – (ii)

VERY SHORT ANSWER TYPE QUESTIONS

1. Name the cells/tissues in human body which

(a) Exhibit amoeboid movement

Ans: (a) Macrophages

(b) Exhibit ciliary movement

Ans: (b) Ciliated epithelium

2. Locomotion requires a perfect coordinated activity of muscular, _____ systems

Ans: Skeletal and neural

3. 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: This is a cell of the muscle. Sarcolemma is the lining that surrounds muscle fibers. Sarcoplasm is the protoplasm found in muscle fibers. Sarcoplasmic reticulum is a type of endoplasmic reticulum found in muscle fibers.

4. Label the different components of actin filament in the diagram given below.

Ans:

5. The three tiny bones present in the middle ear are called ear ossicles. Write them in the correct sequence beginning from the ear drum.

Ans: Malleus, Incus and Stapes

6. What is the difference between the matrix of bones and cartilage?

Ans: Bones are highly rigid due to the presence of calcium salts in the bone matrix and form the skeleton of the vertebrates. Cartilage are thin and flexible connective tissues whose matrix is pliable due to chondroitin salts.

7. Which tissue is affected by Myasthenia gravis? What is the underlying cause?

Ans: Skeletal muscle is affected by Myasthenia gravis. It happens because of an immune disorder.

8. How do our bone joints function without grinding noise and pain?

Ans: In a moveable joint, the heads of the bones have cartilaginous coverings. Furthermore, the joint is encased in a capsule that contains lubricating fluid. This allows joints to move without making a grinding noise or causing pain.

9. Give the location of a ball and socket joint in a human body

Ans: Between the humerus and the pectoral girdle, there is a ball and socket joint. Between the femur and the pelvic girdle, it is also present.

10. Our fore arm is made of three different bones. Comment.

Ans: Our fore arm is made of three different bones, viz. humerus, radius and ulna

SHORT ANSWER TYPE QUESTIONS

1. With respect to rib cage, explain the following:

(a) Bicephalic ribs

Ans: (a) At its dorsal end, each rib has two articulation surfaces. As a result, ribs are known as bicephalic ribs.

(b) True ribs

Ans:(b) True ribs are the first seven pairs of ribs that are linked to the thoracic vertebrae dorsally and the sternum ventrally.

(c) Floating ribs

Ans:(c) The last two pairs of ribs are called floating ribs because they are not attached ventrally.

2. 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: People in old age often experience pain in their joints due to stiff and inflamed joints. This condition is known as Arthritis and is caused due to wear and tear of the joints. Some possible reasons of these symptoms are:

a) Lack of Vitamin D

b) Lack of Calcium

c) Smoking

d) Genetic factors

e) Less physical activity

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

(a) What will happen if more of Ca^{++} is in extracellular fluid?

Ans: (a) This will result in reduced heart rate and increased contractility of heart.

(b) What will happen if very less amount of Ca^{++} is in the extracellular fluid?

Ans:(b) This will result in tetani which is manifested as rapid spasms in muscles.

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

Ans: The calcium ion level in the blood is influenced by calcitonin and parathyroid hormones. Calcitonin regulates calcium levels in the blood when they exceed a certain threshold. Parathyroid hormone regulates calcium levels in the blood when they fall below a certain threshold.

5. 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 fat.

(c) Rahul has gained weight because his muscle shape has improved.

(d) Rahul has gained weight because he is accumulating water in the body.

Ans: 'c' is the correct answer which says that weight gain is because of improved muscle shape. About 40 – 50% of our body weight is composed of muscles. When a person starts doing intensive exercise, because of these muscles are build up. Due to which excess fat of a person is burnt. These are the reasons that some people tend to gain weight when they begin regular exercise.

6. 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 strenuous exercise?

Ans: (a) Muscles have to work harder during severe exercise. The muscles are put under more tension as a result of this.

(b) How did her breathing rate change?

Ans:(b) While running on a treadmill, her breathing rate went from normal to fast. Muscle energy consumption rose as the demand on the muscles increased. As a result, the muscles had a larger desire for carbs. In addition, the muscles' oxygen consumption increased. An enhanced blood supply to the muscles could meet this need. As a result, the heart and lungs would have to work harder to meet the additional demand

7. Write a few lines about Gout.

Ans: Gout is a recurrent occurrence of acute inflammatory arthritis. It usually affects the big toe but also affects other joints. This happens because of accumulation of uric acid crystals in joints, tendons and surrounding tissues. This is manifested as throbbing pain in the affected area.

8. What is the source of energy for muscle contraction?

Ans: The main source of energy for muscular activity is ATP (Adenosine Triphosphate). Mitochondria can be seen in abundance in red muscles. The muscular contraction requires ATP, which is supplied by these mitochondria. White muscles have a lower amount of mitochondria and receive less ATP as a result. As a result, the white muscles rely on anaerobic respiration for ATP during periods of high demand.

9. What are the points for articulation of Pelvic and Pectoral girdles?

Ans: The acetabulum is the articulation point in the pelvic girdle. The acetabulum is formed by the union of three pelvic girdle component bones. The femur articulates with it. The glenoid cavity is the place of articulation in the pectoral girdle. The humerus articulates with it.

LONG ANSWER TYPE QUESTIONS

1. 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: In muscular contraction, calcium plays a crucial role. A neural signal from the central nervous system sends a signal to a motor neuron, which causes muscle contraction. This arises as a result of a calcium ion gradient. When calcium ions enter muscle cells, actin and myosin filaments begin to slide towards each other. Muscle is considered the contraction that takes place as a result of this. Actin and myosin filaments return to their original locations as calcium ions leave the muscle cells, and the muscle relaxes. As a result, a higher level of calcium ions in the blood

means less calcium in the muscles. Muscle contractility will suffer as a result of this. The person may become drowsy as a result of this. When the calcium level in the blood is low, the calcium level in the muscles is higher. Tetany is the uncontrollable contraction of muscles as a result of this. The level of calcium in body fluids is controlled by parathyroid hormone and calcitonin.

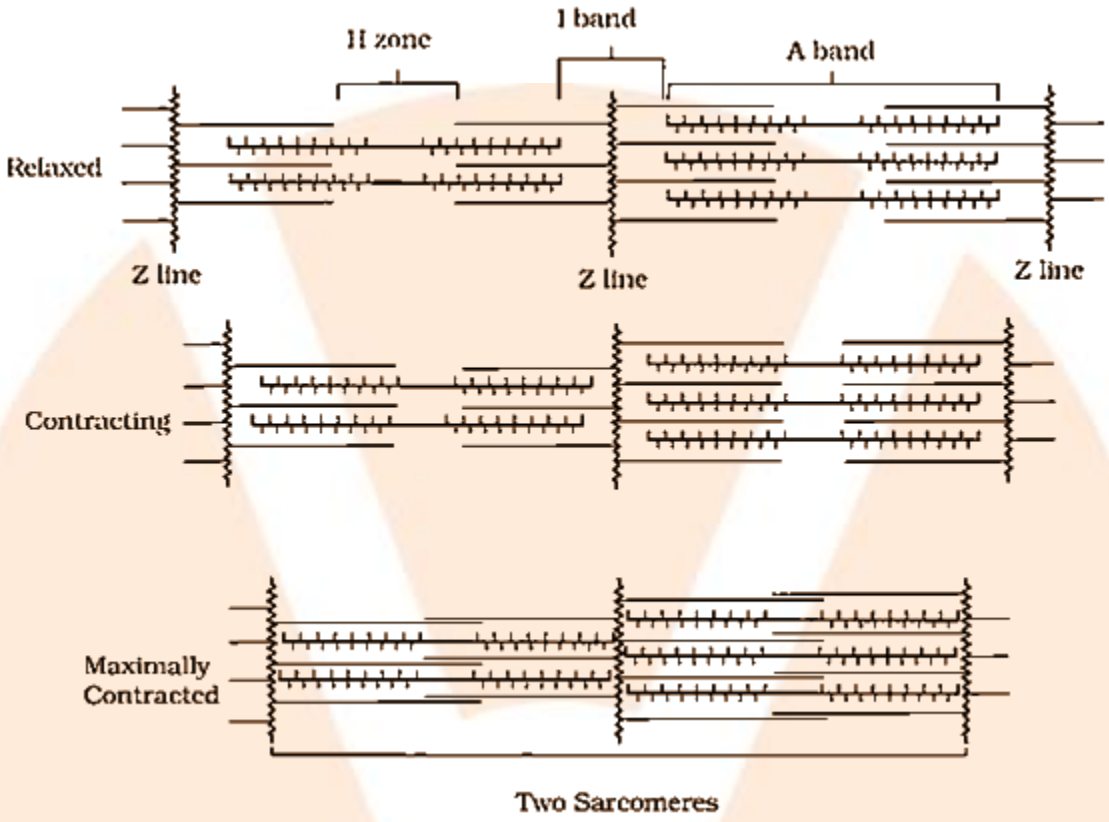
2. An elderly woman slipped in the bathroom and had severe pain in her lower back. After X-ray examination doctors told her it is due to a slipped disc. What does that mean? How does it affect our health?

Ans: Each successive vertebra has a rubber-like disc between them. This disc performs the function of a shock absorber. The disc can become displaced in some situations, resulting in a condition known as slipping disc or prolapsed disc. The nerve exiting the vertebral column is particularly irritated by the slipped disc. This can result in significant back discomfort. This can also result in numbness and pain in the area controlled by the afflicted nerve. Sciatica pain can also be caused by a slipped disc. In this situation, the discomfort starts in the upper thigh and spreads to the lower legs. The sensation of pins and needles might last for a long time in some circumstances. A slipped disc can have a negative impact on a patient's quality of life.

3. Explain sliding filament theory of muscle contraction with neat sketches.

Ans: Muscle is considered to be a contraction when it is known by the sliding filament theory. Two research teams were the first to introduce it in 1954. One team represented the University of Cambridge, while the other represented MIT. Muscle contraction occurs when actin and myosin filaments slide towards one other, according to this idea. When a brain signal reaches the neuromuscular junction, a neurotransmitter (acetylcholine) is released, causing an action potential to be generated in the sarcolemma. Calcium channels in muscle cells open once the action potential is created, allowing calcium ions to enter. Increased \[C{{a}^{++}}\] levels cause calcium to bind to troponin on the actin filament, causing conformational alterations. The masking of active areas on myosin filaments is removed as a result of this. The main elements of myosin, a polymer of meromyosin, are the head, arm, and tail. The head, also known as heavy meromyosin (HMM), uses the energy released by ATP hydrolysis to connect to the protein. A cross bridge between actin and myosin is formed as a result of this. This draws the connected

actin filaments into the 'A' band's core. The Z-line linked to actin is also dragged inwards, resulting in muscle fiber contraction.

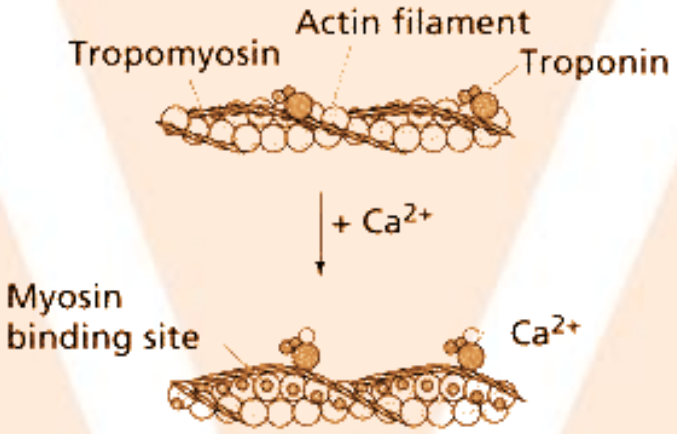


4. How does a muscle shorten during its contraction and return to its original form during relaxation?

Ans: Muscle contraction occurs when actin and myosin filaments slide towards one other, according to the sliding filament theory. Muscle relaxation occurs when actin and myosin filaments glide away from each other. The striations of striated muscles are caused by alternate bands of actin and myosin. The I band of actin is a light-colored band of actin. The A band, which is darker in color, is the myosin band. An elastic band termed Z line holds the actin filaments together in the center. An elastic band termed M line holds the myosin filaments together in the middle. The position of the Z line in reference to the M line changes during contraction, and the muscle fiber becomes shorter. The actin filaments return to their original position after relaxation, making the muscle fiber appear longer.

5. Discuss the role of Ca2+ ions in muscle contraction. Draw neat sketches to illustrate your answer.

Ans: Calcium ions are essential for muscular contraction. Calcium ions enter muscle cells through a network of tiny channels. Calcium channels are what they're called. An action potential is triggered when a neurotransmitter enters a muscle cell. Calcium channels open as a result, allowing calcium ions to enter. The troponin on the action filament binds to calcium ions.



As a result, the masking on myosin's active site is removed. The energy from ATP is then used by myosin to go towards actin and form a cross-bridge. Actin slides towards each other as a result, and the muscle contracts as a result. The calcium ions are then expelled from the muscle cells, and actin is formed.

6. Differentiate between Pectoral and Pelvic girdle.

Ans: The differences are:

Pectoral girdle	Pelvic girdle
(1) It is also known as the shoulder girdle because of its presence in the shoulders.	(1) It is found in the lower abdomen region of the body.
(2) It is composed of four bones: 2 scapula and 2 clavicles.	(2) It is composed of 2 bones: coccyx and sacrum.
(ii) It is present in the anterior portion of the body.	ii) It is present in the posterior portion of the body.

(iii) Glenoid cavity is the articulation point.	(iii) Acetabulum is the articulation point
(iv) Humerus bone articulates with pectoral girdle forming the ball and socket joint of the shoulder.	(iv) Femur articulates with pelvic girdle forming the ball and socket joint of legs.
(v) It helps in lifting and holding.	(v) It helps in walking and standing.