

Locomotion and Movement — NEET MCQs with Solutions

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Q1. Which of the following represents locomotion at the organismal level?

- (A) Beating of the heart
- (B) Swimming of fish
- (C) Cytoplasmic streaming in algae
- (D) Movement of chromosomes during cell division

Q2. In earthworm, locomotion is primarily achieved by:

- (A) Ciliary beating of body surface
- (B) Hydrostatic skeleton alone
- (C) Alternate contraction of circular and longitudinal muscles aided by hydrostatic skeleton
- (D) Flagellar propulsion from tail

Q3. Which of the following is an example of movement that is neither ciliary, flagellar, nor muscular?

- (A) Peristalsis in the gut
- (B) Ovum transport in oviduct
- (C) Sperm swimming in female tract
- (D) Cytoplasmic streaming in plant cells

Q4. Flagellar movement in human sperm occurs due to:

- (A) Actin-myosin interaction at the midpiece
- (B) Sarcomere shortening along the tail
- (C) Contraction of plasma membrane
- (D) Microtubule sliding within the axoneme

Q5. The sarcoplasm of a muscle fibre contains abundant:

- (A) Golgi bodies
- (B) Mitochondria
- (C) Centrioles
- (D) Lysosomes

Q6. The region within the A band where thin filaments do not reach is:

- (A) I band
- (B) Z line
- (C) M line
- (D) H zone

Q7. Which event directly follows release of Ca^{2+} from sarcoplasmic reticulum?

- (A) ATP hydrolysis by myosin head
- (B) Thick filament shortening
- (C) M line disintegration
- (D) Exposure of active sites on actin

Q8. The neurotransmitter released at the neuromuscular junction is:

- (A) Dopamine
- (B) Noradrenaline
- (C) GABA
- (D) Acetylcholine

Q9. Which of the following correctly describes the role of T-tubules in muscle contraction?

- (A) They store Ca^{2+} for release during contraction
- (B) They conduct action potential deep into muscle fibre
- (C) They form cross-bridges with myosin
- (D) They synthesise ATP for contraction

Q10. Which of the following correctly describes the role of ATP in the cross-bridge cycle?

- (A) ATP triggers Ca^{2+} release from SR
- (B) ATP directly exposes actin active sites
- (C) ATP hydrolysis cocks myosin; ATP binding causes detachment
- (D) ATP polymerises actin for cross-bridge contact

Q11. Binding of Ca^{2+} to troponin results in:

- (A) Detachment of myosin cross-bridge
- (B) Tropomyosin shift exposing actin active sites
- (C) ATP synthesis at myosin head
- (D) Thick filament shortening

Q12. The vertebral canal, which encloses and protects the spinal cord, is formed by:

- (A) Sternum
- (B) Ribs
- (C) Skull
- (D) Vertebral column

Q13. Which of the following correctly identifies the components of the axial skeleton?

- (A) Skull, limb bones and sternum
- (B) Skull, vertebral column, ribs and sternum
- (C) Skull, pectoral girdle and vertebral column
- (D) Pelvic girdle, skull and coccyx

Q14. Spongy bone differs from compact bone primarily in that spongy bone:

- (A) Contains concentrically arranged osteons
- (B) Lacks well-developed Haversian systems
- (C) Has no marrow spaces
- (D) Is completely avascular

Q15. Which of the following pairs of ribs are called floating ribs?

- (A) 1st and 2nd pairs
- (B) 8th and 9th pairs
- (C) 11th and 12th pairs
- (D) 9th and 10th pairs

Q16. The hyoid bone is unique among all bones in the human body because it:

- (A) Articulates with the atlas vertebra
- (B) Is the smallest bone in the body
- (C) Does not articulate with any other bone
- (D) Is a paired bone

Q17. The synovial membrane lining the joint capsule primarily functions to:

- (A) Secrete synovial fluid for lubrication
- (B) Store calcium for bone repair
- (C) Produce red blood cells
- (D) Anchor tendons to bone

Q18. The articulation between adjacent carpal bones is an example of:

- (A) Pivot joint
- (B) Hinge joint
- (C) Gliding joint
- (D) Ball and socket joint

Q19. The joint between the first metacarpal bone and the trapezium carpal bone (carpometacarpal joint of the thumb) is:

- (A) Hinge joint
- (B) Pivot joint
- (C) Saddle joint
- (D) Gliding joint

Q20. Which of the following components is exclusive to synovial joints and absent in fibrous and cartilaginous joints?

- (A) Periosteum
- (B) Lacunae
- (C) Synovial fluid
- (D) Trabeculae

Q21. The term arthritis most precisely refers to:

- (A) Inflammation of muscle fibres
- (B) Inflammation of bone marrow
- (C) Inflammation of joints
- (D) Inflammation of tendons

Q22. Which condition results in painful inflammation of synovial joints specifically due to monosodium urate crystal deposition?

- (A) Rheumatoid arthritis
- (B) Osteoporosis
- (C) Osteomalacia
- (D) Gout

Q23. Which of the following best explains why neuromuscular transmission fails progressively in myasthenia gravis?

- (A) ACh synthesis decreases due to mitochondrial dysfunction
- (B) Autoantibodies destroy ACh receptors on motor end plate reducing signal reception
- (C) Axonal demyelination slows motor nerve conduction velocity
- (D) Calcium-dependent ACh vesicle release is blocked presynaptically

Q24. The disorder causing progressive degeneration of muscle fibres due to a genetic defect in the dystrophin gene is:

- (A) Myasthenia gravis
- (B) Rheumatoid arthritis
- (C) Gout
- (D) Muscular dystrophy

Answer key and explanations

Q1. Answer: (B) Swimming of fish

Swimming of fish results in displacement of the whole organism — this is locomotion. Heartbeat and cytoplasmic streaming are movements confined to organs/cells; chromosomal movement is intracellular.

Q2. Answer: (C) Alternate contraction of circular and longitudinal muscles aided by hydrostatic skeleton

Earthworm locomotion uses coelomic fluid as a hydrostatic skeleton; alternating contraction of circular muscles (elongates body) and longitudinal muscles (shortens body) with setae for grip produces forward movement. Ciliary and flagellar mechanisms are absent.

Q3. Answer: (D) Cytoplasmic streaming in plant cells

Cytoplasmic streaming (cyclosis) in plant cells is driven by actin-myosin interaction but is classified separately — it is neither ciliary, flagellar, nor muscular movement as defined in NCERT. Peristalsis is muscular; ovum transport is ciliary; sperm swimming is flagellar.

Q4. Answer: (D) Microtubule sliding within the axoneme

Flagellar bending results from dynein-powered sliding of microtubule doublets within the 9+2 axoneme. Actin-myosin interaction drives muscular movement, not flagellar movement.

Q5. Answer: (B) Mitochondria

Muscle fibres have a very high ATP demand for contraction; abundant mitochondria meet this energy requirement. The sarcoplasm also contains sarcoplasmic reticulum and myofibrils.

Q6. Answer: (D) H zone

The H zone is the central pale region of the A band containing only thick filaments with no overlap from thin filaments. During contraction, as thin filaments slide in, the H zone narrows and may disappear.

Q7. Answer: (D) Exposure of active sites on actin

Ca^{2+} binds to troponin on the thin filament, causing tropomyosin to shift and uncover myosin-binding active sites on actin. ATP hydrolysis occurs subsequently to cock the myosin head for the power stroke.

Q8. Answer: (D) Acetylcholine

Acetylcholine (ACh) is released from synaptic vesicles in the motor neuron terminal into the synaptic cleft, where it binds receptors on the motor end plate to generate an action potential in the muscle fibre.

Q9. Answer: (B) They conduct action potential deep into muscle fibre

T-tubules are continuous with the sarcolemma and penetrate deep into the muscle fibre. They rapidly transmit the electrical action potential to the SR, ensuring simultaneous Ca^{2+} release throughout the fibre. Ca^{2+} storage is the SR's role.

Q10. Answer: (C) ATP hydrolysis cocks myosin; ATP binding causes detachment

ATP serves two distinct roles: its hydrolysis (by myosin ATPase) re-energises and re-cocks the myosin head; its binding to myosin causes detachment from actin after the power stroke. Without ATP, detachment cannot occur — causing rigor.

Q11. Answer: (B) Tropomyosin shift exposing actin active sites

Ca^{2+} binds to troponin C, causing a conformational change that moves tropomyosin away from the myosin-binding sites on actin. This exposes active sites and allows cross-bridge formation. Myosin head detachment requires ATP, not Ca^{2+} .

Q12. Answer: (D) Vertebral column

The neural arches of successive vertebrae together form the vertebral canal that runs the length of the vertebral column, enclosing the spinal cord. The skull encloses the brain, not the spinal cord. Sternum and ribs form the thoracic cage.

Q13. Answer: (B) Skull, vertebral column, ribs and sternum

The axial skeleton consists of skull (22), vertebral column (26), and thoracic cage — ribs (24) and sternum (1) = 80 bones total. Girdles and limbs are appendicular. Pectoral and pelvic girdles are never axial.

Q14. Answer: (B) Lacks well-developed Haversian systems

Spongy (cancellous) bone consists of an irregular network of trabeculae and does not have the organised Haversian systems characteristic of compact bone. Marrow spaces are abundant in spongy bone. It has its own blood supply via nearby vessels.

Q15. Answer: (C) 11th and 12th pairs

The 11th and 12th pairs are floating ribs — they attach to thoracic vertebrae posteriorly but have no anterior attachment to sternum or cartilage. The 8th–10th pairs are false ribs (attached via cartilage of 7th rib, not sternum directly).

Q16. Answer: (C) Does not articulate with any other bone

The hyoid is a U-shaped bone in the neck that is suspended by muscles and ligaments but does not directly articulate with any other bone — unique in the skeleton. The smallest bones are the ear ossicles (malleus, incus, stapes). Hyoid is unpaired.

Q17. Answer: (A) Secrete synovial fluid for lubrication

The synovial membrane secretes synovial fluid — a viscous, albumin-rich fluid that lubricates articular cartilage, reduces friction and nourishes the avascular cartilage. Calcium storage is a bone matrix function; RBC production is red marrow's role; tendons are anchored by periosteum.

Q18. Answer: (C) Gliding joint

Intercarpal joints are gliding (plane) joints where flat or slightly curved articular surfaces slide against each other with minimal range of movement. Pivot joints allow rotation; hinge joints allow flexion/extension; ball and socket joints are multiaxial — none describe intercarpal movement.

Q19. Answer: (C) Saddle joint

The carpometacarpal joint of the thumb is a saddle joint — both articulating surfaces are concave in one direction and convex in the other, allowing biaxial movement including flexion, extension, abduction, adduction and opposition. Opposition (thumb touching fingers) is the unique movement enabled by this joint.

Q20. Answer: (C) Synovial fluid

Synovial fluid — secreted by the synovial membrane — is present only in synovial joints, lubricating the articular surfaces and reducing friction. Periosteum covers all bone; lacunae house osteocytes in bone/cartilage matrix; trabeculae are spongy bone structures — none are joint-specific.

Q21. Answer: (C) Inflammation of joints

Arthritis = inflammation of joints (arthr- = joint, -itis = inflammation), causing pain, swelling, and stiffness. Muscle fibre inflammation = myositis; bone marrow inflammation = osteomyelitis; tendon inflammation = tendinitis.

Q22. Answer: (D) Gout

Gout involves precipitation of monosodium urate crystals in joints (commonly the first metatarsophalangeal joint) due to hyperuricaemia. Rheumatoid arthritis involves autoimmune synovial inflammation without crystal deposition.

Q23. Answer: (B) Autoantibodies destroy ACh receptors on motor end plate reducing signal reception

In myasthenia gravis, IgG autoantibodies bind and internalise ACh receptors on the postsynaptic motor end plate, reducing available receptors for each nerve impulse. Demyelination describes multiple sclerosis; presynaptic Ca^{2+} blockade describes Lambert-Eaton syndrome — a critical NEET-level distinction.

Q24. Answer: (D) Muscular dystrophy

Duchenne muscular dystrophy is caused by a mutation in the X-linked dystrophin gene, leading to absence of dystrophin protein and progressive skeletal muscle wasting. Myasthenia gravis is autoimmune, not genetic in the same sense.

Muscle, skeleton and joints

Topic	Key fact
Types of movement	Amoeboid (macrophages, leucocytes); ciliary (trachea, fallopian tubes); muscular (limbs, jaws, tongue)

Muscle types	Skeletal: striated, voluntary; visceral: smooth, involuntary; cardiac: striated, involuntary
Sarcomere	Between two Z lines; A band (myosin, dark), I band (actin, light), H zone and M line in the middle of the A band
Contraction	Ca ²⁺ binds troponin, exposing actin sites; myosin heads form cross-bridges using ATP; thin filaments slide over thick ones
Red vs white fibres	Red: rich in myoglobin and mitochondria (aerobic); white: less myoglobin (anaerobic)
Bones	206 in total — axial skeleton 80, appendicular skeleton 126
Skull	29 bones: 8 cranial, 14 facial, 1 hyoid, 6 ear ossicles
Vertebral column	26 vertebrae: cervical 7, thoracic 12, lumbar 5, sacral 1 (fused), coccygeal 1 (fused)
Ribs	12 pairs: true ribs 1–7, false (vertebrochondral) 8–10, floating 11–12
Joints	Fibrous: skull sutures; cartilaginous: between vertebrae; synovial: ball and socket (humerus and pectoral girdle), hinge (knee), pivot (atlas and axis), gliding (between carpals), saddle (carpal and metacarpal of thumb)
Myasthenia gravis	Autoimmune disorder of the neuromuscular junction; fatigue and paralysis of skeletal muscle
Muscular dystrophy	Progressive degeneration of skeletal muscle, mostly genetic
Tetany	Rapid spasms due to low Ca ²⁺ in body fluid
Bone and joint disorders	Arthritis (inflamed joints); osteoporosis (low bone mass); gout (uric acid crystals in joints)