

Locomotion and Movement — Assignment 2

Class 11 Biology · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Types of Movement

1. Distinguish between movement and locomotion.
2. Name the three types of movement in the human body.
3. Describe the types of movement.

The Human Skeletal System

1. State two functions of the skeletal system.
2. Name the two main divisions of the human skeleton.
3. Describe the human skeletal system and its functions.

Axial and Appendicular Skeleton

1. Distinguish between axial and appendicular skeleton.
2. Name the components of the appendicular skeleton.
3. Describe the axial and appendicular skeleton.

The Vertebral Column, Ribs and Sternum

1. Distinguish between true ribs and false ribs.
2. Name the regions of the vertebral column.
3. Describe the vertebral column and its regions.

Joints

1. Distinguish between fibrous and synovial joints.
2. Give one example each of a hinge and a pivot joint.
3. Describe the classification of joints with examples.

Muscle Tissue and Its Organisation

1. Distinguish between skeletal and smooth muscle.
2. Describe the structure of a muscle fibre.
3. Describe the three types of muscle tissue.

Sliding Filament Mechanism and Energy

1. State the sliding filament mechanism.
2. What is the role of ATP in muscle contraction?
3. Explain the sliding filament mechanism of muscle contraction.

Locomotion and Movement Disorders

1. State two disorders of the muscular system.
2. Distinguish between gout and osteoporosis.
3. Describe the disorders of locomotion and movement.

Part B — Integrated problems (multi-topic)

1. Distinguish between movement and locomotion and name the types of movement.
2. Describe the axial and appendicular skeleton, giving the bone count of each.
3. Describe the vertebral column and classify the ribs.
4. Classify joints with one example of each type.
5. Describe skeletal muscle structure from muscle to sarcomere and explain the sliding filament mechanism.
6. Describe any three disorders of locomotion and movement.

Answer Key

Types of Movement

Movement is a change in position of a body part; locomotion is movement that changes the place of the whole organism. Three types: amoeboid (e.g. macrophages), ciliary (e.g. gametes/airways) and muscular (limbs). Types of movement in the body: amoeboid, ciliary and muscular.

The Human Skeletal System

Functions: support, protection of organs, movement and mineral storage. The two divisions: axial and appendicular skeleton. The human skeleton has 206 bones, provides the framework, protects organs (e.g. skull, rib cage), stores minerals and, with muscles, enables movement.

Axial and Appendicular Skeleton

Axial skeleton (80 bones): skull, vertebral column, ribs and sternum. Appendicular skeleton (126 bones): limbs and girdles. The appendicular skeleton consists of the pectoral girdle, pelvic girdle, forelimbs and hindlimbs.

The Vertebral Column, Ribs and Sternum

True ribs (first 7 pairs) attach directly to the sternum; false ribs (8th–10th) attach indirectly; floating ribs (11th–12th) do not attach to the sternum. The vertebral column has 26 vertebrae in the adult (33 in the embryo) in regions: cervical, thoracic, lumbar, sacral and caudal (coccygeal); the ribs (12 pairs) and sternum form the thoracic cage.

Joints

Fibrous joints are immovable (e.g. skull sutures); synovial joints are freely movable (e.g. shoulder). Examples: hinge — knee/elbow; pivot — between atlas and axis. Joints are classified into fibrous (immovable), cartilaginous (slightly movable) and synovial (freely movable). Synovial joints include ball-and-socket, hinge, pivot, gliding, saddle and condyloid.

Muscle Tissue and Its Organisation

Skeletal muscle is striated and voluntary; smooth muscle is unstriated and involuntary. A muscle fibre is a long multinucleated cell containing myofibrils made of sarcomeres. Three types: skeletal (striated, voluntary), smooth (unstriated, involuntary) and cardiac (striated, involuntary). Each muscle fibre contains many myofibrils; each myofibril is made of repeating sarcomeres with actin and myosin filaments.

Sliding Filament Mechanism and Energy

The sliding filament mechanism: actin filaments slide over myosin filaments, shortening the sarcomere. ATP provides energy for the myosin heads to detach and reattach. On stimulation, calcium is released, exposing myosin-binding sites on actin; the myosin head binds actin, the power stroke slides actin, and ATP is needed for detachment — the A band stays constant while the I band and H zone shorten.

Locomotion and Movement Disorders

Two muscular disorders: myasthenia gravis and muscular dystrophy. Gout: uric acid crystals accumulate in joints; osteoporosis: decreased bone mass. Myasthenia gravis is an autoimmune disorder affecting the neuromuscular junction causing fatigue; muscular dystrophy is progressive degeneration of skeletal muscle; gout is inflammation from uric acid crystals in joints.

Integrated problems

1: Movement — change of position of a part; locomotion — change of place; types: amoeboid, ciliary, muscular. 2: Axial 80 (skull, vertebral column, ribs, sternum); appendicular 126 (girdles and limbs). 3: 26 vertebrae; 12 rib pairs — true (1–7), false (8–10), floating (11–12). 4: Fibrous (immovable, sutures), cartilaginous (slightly movable), synovial (freely movable, e.g. shoulder). 5: Muscle → fibre → myofibril → sarcomere (actin + myosin); contraction by sliding filaments, calcium-triggered, ATP-driven. 6: Myasthenia gravis, muscular dystrophy, gout, osteoporosis.