**Topic 11.2: Movement**

**Essential Idea: The roles of musculoskeletal system are movement, support and protection.**

**Statements & Objectives:**

**11.2.U1 Bones and exoskeletons provide anchorage for muscles and act as levers.**

**State the function of bones and exoskeletons.**

Contrast bones with exoskeletons.

(**Contrast** Give an account of the differences between two (or more) items or situations, referring to

both (all) of them throughout.)

Identify the fulcrum, effort force and resultant force in the motion of the spine and the grasshopper leg.

(**Identify** Provide an answer from a number of possibilities. Recognize and state briefly a distinguishing factor or feature.)

Determine the class of motion of a lever.

**(Determine** Obtain the only possible answer.)

**11.2.U2 Movement of the body requires muscles to work in antagonistic pairs.**

Define antagonistic pairs in relation to muscle movement.

**(Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

State an example of an antagonistic pair of muscles.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**1.2.U3 Synovial joints allow certain movements but not others.**

Compare the motion of hinge joints with the motion of a ball and socket joint.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

Outline motion of the human knee, shoulder and hip in terms of flexion, extension, rotation, abduction and adduction.

(**Outline** Give a brief account or summary.)

**11.2.U4 Skeletal muscles fibres are multinucleated and contain specialized endoplasmic reticulum.**

List three types of muscle tissue found in the human body.

(**List** Give a sequence of brief answers with no explanation.)

Label a diagram of a muscle fibre cell, including the sacrolemma, nuclei, sacroplasmic reticulum and mitochondria.

(**Label** Add title, labels or brief explanation(s) to a diagram or graph.)

**11.2.U5 Muscle fibres contain many myofibrils.**

Outline the relationship between muscles, muscle fibre cells and myofibrils.

(**Outline** Give a brief account or summary.)

**11.2.U6 Each myofibrils is made up of contractile sarcomeres.**

Outline the relationship between myofibrils and sacromeres.

(**Outline** Give a brief account or summary.)

Describe a structure of a sarcomere., including the Zline, thin actin filaments, thick myosin filaments, light band and dark band.​

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**11.2.U7 The contraction of the skeletal muscle is achieved by the sliding of actin and myosin filaments.**

Explain the sliding-filament mechanism of muscle contraction, including the role of myosin heads, cross bridges and ATP.

(**Explain**: Give a detailed account including reasons or causes)

**11.2.U8 Calcium ions and the proteins tropomyosin and troponin control muscle contractions.**

Explain the exposure of myosin head binding sites on actin, including the role of the sarcoplasmic reticulum, calcium, troponin and tropomyosin.

(**Explain**: Give a detailed account including reasons or causes)

**11.2.U9 ATP hydrolysis and cross bridge formation are necessary for the filaments to slide.**

List the events that occur during cross-bridge cycles.

(**List** Give a sequence of brief answers with no explanation.)

Describe the role of ATP in muscle contraction.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**1.2.A1 Antagonistic pairs of muscles in an insect leg.**

Label the tibia, femur, tarsus, flexor muscle and extensor muscle on a diagram of a grasshopper hindlimb.

(**Label** Add title, labels or brief explanation(s) to a diagram or graph.)

Describe the contraction of muscles and movement of hindlimb structures that produces a grasshopper jump.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**11.2.S1 Annotations of a diagram of the human elbow.**

Label a diagram of the human elbow inclusive of: humerus, triceps, biceps, joint capsule, synovial fluid, radius, cartilage and ulna.

(**Label** Add title, labels or brief explanation(s) to a diagram or graph.)

State the function of structures found in the human elbow, including: humerus, triceps, biceps, joint capsule, synovial fluid, radius, cartilage and ulna.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**11.2.S2 Drawing labelled diagrams of the structure of a sarcomere.**

Draw a diagram of the structure of a sarcomere.

**(Draw** :Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

Label a sarcomere diagram, including Z lines, actin filaments, myosin filaments with heads and the resultant light and dark bands.

(**Label** Add title, labels or brief explanation(s) to a diagram or graph.)

**11.2.S3 Analysis of electron micrographs to find the state of concentration of muscle fibres.**

Compare a relaxed sarcomere to a contracted sarcomere, referring to Z line distance and size of light bands.

**(Compare** Give an account of the similarities and differences between two (or more) items or situations,

referring to both (all) of them throughout.)

Determine of a sarcomere is contracted or relaxed given an electron micrograph image.

(**Determine** Obtain the only possible answer)

**11.2.NOS Developments in scientific research follow improvements in apparatus-fluorescent calcium ions have been used to study the cyclic interactions in muscle contraction.**

Describe the use of fluorescence to study muscle contraction.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

Explain the bioluminescence observed in muscle contraction studies using calcium sensitive aequorin.

(**Explain**: Give a detailed account including reasons or causes)

Explain the bioluminescence observed in muscle contraction studies using fluorescently tagged myosin molecules.​

(**Explain**: Give a detailed account including reasons or causes)

**Key Terms**

Antibody

memory cells

primary immunity

zoonosis

​hybridoma cells

​hemolysis

​epidemiology

​myeloma cells

immunity

B-lymphocytes

secondary immunity

​histamine

​ABO blood antigens

smallpox

Jenner

Antigen

T lymphocytes

​vaccination​

​anti-histamine

​red blood cells

​eradicate

​opsonization

​

​challenge and response

helper T cells

​pathogen

​allergic symptoms

​​monoclonal antibody

​pregnancy

​blood transfusion

​macrophage

​plasma B cells

​crossing species

​tumor cell

​agglutination

​HCG

​toxin