# UGC NET Physical Education Memory Based Question -7 JAN 2026 SHIFT -2

**Q1.** Which of the following is the correct order of skeletal muscle fiber types, arranged from LEAST resistant to fatigue to MOST resistant to fatigue?

(a) Type IIb → Type I → Type IIa

(b) Type IIa → Type IIb → Type I

(c) Type I → Type IIa → Type IIb

(d) Type IIb (IIx) → Type IIa → Type I

Sol. d

Introduction:

Muscle fiber types are specialized to perform different functions, and their resistance to fatigue varies significantly. Understanding this spectrum—from quick, powerful movements to sustained, endurance activities—is fundamental in exercise physiology and athletic training.

Information Booster:

Skeletal muscles contain three primary fiber types, each with distinct metabolic and functional properties that determine how quickly they fatigue:

1. Type IIx (formerly IIb) – Fast-Twitch Glycolytic (FTG): Least fatigue-resistant. These fibers are built for maximum power and speed. They rely on anaerobic glycolysis for rapid energy, have very few mitochondria and capillaries, and fatigue within seconds to a minute due to lactic acid buildup. They are dominant during a 100m sprint or a 1-rep max lift.
2. Type IIa – Fast-Twitch Oxidative-Glycolytic (FTOG): Moderately fatigue-resistant. These are versatile "hybrid" fibers. They use both anaerobic and aerobic energy systems, have a moderate number of mitochondria and capillaries, and support activities of medium duration and intensity, such as a 400m run or repeated weightlifting sets.
3. Type I – Slow-Twitch Oxidative (SO): Most fatigue-resistant. These fibers are endurance specialists. They rely primarily on aerobic metabolism (oxidative phosphorylation), have a high density of mitochondria and capillaries, and contain myoglobin for oxygen storage. They are slow to contract but can sustain activity for hours, making them essential for marathon running, cycling, and posture maintenance.

The fatigue resistance hierarchy is therefore: Type IIx (Least Resistant) → Type IIa (Intermediate) → Type I (Most Resistant).

Additional Knowledge:

This classification explains key athletic principles:

- Recruitment Order (Henneman's Size Principle): The nervous system recruits fibers from most to least fatigue-resistant (I → IIa → IIx) as force demands increase.
- Training Adaptations: Endurance training can enhance the aerobic capacity of Type IIa fibers, making them more fatigue-resistant. Strength/power training increases the size and power output of Type II fibers.
- Genetic Predisposition: Athletes often have a natural predominance of one fiber type, influencing their suitability for different sports.

Interesting Fact:
While genetics determine the baseline ratio of fiber types, training can induce significant changes in their characteristics—a concept known as "fiber type plasticity." For instance, through long-term endurance training, some Type IIx fibers can take on the more oxidative properties of Type IIa fibers, demonstrating the body's remarkable adaptability to physical demands.

**Q2.** In the context of the sliding filament theory of muscle contraction, myosin is best described as the:
(A) Filament that provides binding sites for calcium ions.
(B) Passive structural element that is pulled inward towards the center of the sarcomere.
(C) Molecular motor that hydrolyzes ATP to generate the "power stroke."
(D) Ion channel in the sarcoplasmic reticulum that initiates contraction.
Sol. c
Explanation: Myosin is the thick filament that functions as an active molecular motor. Its globular heads bind to actin (thin filaments), hydrolyze ATP, and undergo a conformational change to produce the power stroke. This action pulls the thin filaments toward the center of the sarcomere, causing contraction.
(A) Incorrect: Binding sites for calcium are on troponin, which is part of the thin filament (actin complex).
(B) Incorrect: Myosin is the active element that does the pulling; it is not passive nor is it the filament being pulled.
(D) Incorrect: Ion channels in the sarcoplasmic reticulum (e.g., ryanodine receptors) release calcium, but they are not composed of myosin.

**Q3.** What is the correct sequence of neurotransmitter release from stimulus to response?
1.Acetylcholine (ACh) is released at the neuromuscular junction.
2.Glutamate is released from sensory neuron terminals in the spinal cord ventral horn.
3.An action potential arrives at the sensory neuron's central terminal.
Codes:
(a) 3 → 2 → 1
(b) 1 → 3 → 2
(c) 2 → 1 → 3
(d) 3 → 1 → 2
Sol. a (3 → 2 → 1)
Explanation:
The correct sequence is (A) 3 → 2 → 1.
Step 3: The stimulus generates an action potential in the sensory (afferent) neuron, which propagates to its central terminal in the spinal cord.
Step 2: At the central terminal, the sensory neuron releases an excitatory neurotransmitter (typically glutamate) onto the cell body/dendrites of the motor neuron in the ventral horn.
Step 1: This excites the motor (efferent) neuron, which then sends an action potential to the muscle, where it releases Acetylcholine (ACh) at the neuromuscular junction to trigger contraction.
Why other options are incorrect:
(B) 1 → 3 → 1: Incorrectly starts with the final step (ACh release) before the sensory neuron is activated.
(C) 2 → 1 → 3: Suggests the sensory neuron releases its neurotransmitter (Step 2) before its action potential arrives (Step 3), which is impossible.
(D) 3 → 1 → 2: Incorrectly states that ACh is released (Step 1) before the sensory neuron activates the motor neuron in the spinal cord (Step 2), violating the sequence of synaptic transmission.

**Q4.** The most logical and effective sequence for conducting a qualitative biomechanical analysis of a sports skill is:
1.Interpretation & Feedback
2.Focused Observation
3.Preparation
4.Evaluation & Intervention
Codes:
(A) 3 → 2 → 1 → 4
(B) 2 → 3 → 1 → 4
(C) 1 → 3 → 2 → 4
(D) 2 → 1 → 3 → 4
Sol. a (3 → 2 → 1 → 4)
Explanation:
The correct sequence is (A) 3 → 2 → 1 → 4.
Step 3 (Preparation): Any scientific analysis must begin with a clear goal and established criteria (What are we looking for? Why?).
Step 2 (Focused Observation): Once the purpose is set, the analyst can make targeted, systematic observations rather than passive watching.
Step 1 (Interpretation): The collected observations are then analyzed against known mechanical principles (e.g., Newton's Laws, projectile motion) to form a diagnosis.
Step 4 (Evaluation & Intervention): The final step is to communicate the findings and implement changes, closing the analysis loop.
Why other options are incorrect:
(B) 2 → 3 → 1 → 4: Incorrectly begins with observation before defining the purpose, leading to unfocused and potentially irrelevant data collection.
(C) 1 → 3 → 2 → 4: Illogically starts with interpretation and diagnosis (Step 1) before any preparation or observation has occurred.
(D) 2 → 1 → 3 → 4: Attempts to interpret (Step 1) immediately after observation, skipping the crucial preparatory phase needed to guide a valid interpretation.

**Q5.** Which of the following physiological adaptations to high altitude typically occurs within the first few days of exposure?
1.Decrease in plasma volume
2.Increased mitochondrial density in skeletal muscle fibers
3.Increased production of red blood cells
4.Conversion of fast-twitch to slow-twitch muscle fibers
Codes:
(a) 1 only
(b) 1 and 2
(c) 2 and 3
(d) 3 and 4

Sol. a
Explanation:
The correct answer is (A) 1 only.
Adaptation 1 (Plasma Volume): This is an early, rapid response (within 48-72 hours). The body reduces plasma volume through diuresis and fluid shifts, leading to hemoconcentration, which temporarily increases oxygen-carrying capacity per unit of blood.
Why the others are not early adaptations:
Adaptation 2 (Mitochondrial Density): This is a long-term (weeks to months) metabolic adaptation to improve aerobic efficiency.
Adaptation 3 (Erythropoiesis): While erythropoietin (EPO) release increases within hours, a significant rise in red blood cell count is a slower, sustained process that takes weeks to manifest.
Adaptation 4 (Fiber Type Conversion): This is not a typical adaptation to high altitude. While metabolic characteristics within fibers can change, the fundamental conversion of one fiber type to another does not occur through acclimatization.

**Q6.** Match the following Sport Psychology Theories
Column I (Theory)
1. Inverted U Hypothesis
2. Drive Theory (Hull-Spence)
3. Individual Zones of Optimal Functioning (IZOF)
4. Catastrophe Theory
Column II (Key Concept)
A. Individual-specific optimal anxiety zone.
B. Linear arousal-performance relationship.
C. Peak performance at moderate arousal.
D. Sudden drop under high cognitive anxiety.
Codes:
(a) 1-C, 2-B, 3-A, 4-D
(b) 1-B, 2-C, 3-D, 4-A
(c) 1-C, 2-A, 3-B, 4-D
(d) 1-D, 2-B, 3-C, 4-A
Key: A (1-C, 2-B, 3-A, 4-D)
Explanation:
1-C: The Inverted U Hypothesis states performance is optimal at moderate arousal levels.
2-B: Drive Theory posits a simple linear relationship: higher arousal (drive) leads to better performance.
3-A: IZOF Theory emphasizes that optimal anxiety is a unique zone for each athlete, not a single point.
4-D: Catastrophe Theory explains how high cognitive anxiety can lead to an abrupt, catastrophic drop in performance after a certain arousal threshold is crossed.

**Q7.** In the context of direct laboratory measurement, which of the following is the correct formula for calculating an individual's absolute $VO_2$ max (Maximal Oxygen Consumption)?
(a) $VO_2$ max (L/min) = Maximal Cardiac Output (L/min) × (a-$vO_2$ difference)
(b) $VO_2$ max (mL/kg/min) = Tidal Volume (L) × Respiratory Rate (breaths/min)
(c) $VO_2$ max (L/min) = (Heart Rate × Stroke Volume) + (Arterial $O_2$ content)
(d) $VO_2$ max (mL/kg/min) = (VE × $FiO_2$) – (VE × $FeO_2$) / Body Weight (kg)

Sol:a
Explanation:
(A) Correct: This is the direct application of the Fick Principle: $VO_2$ = Cardiac Output (Q) × Arteriovenous Oxygen Difference (a-$vO_2$ diff). For $VO_2$ max, maximal cardiac output and the widest achievable a-$vO_2$ difference are used.
(B) Incorrect: This formula calculates Pulmonary Minute Ventilation (VE), not oxygen consumption. It completely ignores the extraction and transport of oxygen in the blood.
(C) Incorrect: While Heart Rate × Stroke Volume correctly calculates Cardiac Output, adding Arterial $O_2$ content is nonsensical. The correct second variable is the difference between arterial and venous oxygen content (a-$vO_2$ diff), not arterial content alone.
(D) Incorrect: This closely resembles the Open-Circuit Spirometry formula for measuring $VO_2$, but it is incorrectly presented and rearranged. The standard formula is $VO_2$ = VE (STPD) × ($FiO_2$ - $FeO_2$), where $FeO_2$ is the expired fraction of $O_2$. Dividing by body weight converts it to relative $VO_2$ max. This option's structure is flawed and misleading.

**Q8.** Which of the following triads best represents the fundamental purpose and values that an iconic Olympic moment is intended to embody, according to the Olympic Charter?
(a) Faster, Higher, Stronger
(b) Excellence, Friendship, Respect
(c) Sport, Culture, Education
(d) Peace, Unity, Competition
Key: B
Explanation:
(B) Correct: This is the central triad of Olympic Values. "Excellence" represents striving for one's personal best, "Friendship" builds bridges between people and cultures, and "Respect" includes respect for oneself, others, and the rules.
(A) Incorrect: "Faster, Higher, Stronger" is the official Olympic Motto, which expresses the athletic pursuit of improvement, but it does not encapsulate the broader educational and humanistic purpose of Olympic moments.
(C) Incorrect: While "Sport, Culture, Education" are key pillars of the Olympic Movement's activities, they describe the means or domains of action, not the core ethical values and purpose themselves.
(D) Incorrect: "Peace" and "Unity" are significant aspirations of the Games, and "Competition" is the format. However, this specific combination is not the formally stated triad of core values that define the purpose of Olympic endeavors and moments.

**Q9.** Question: Match the following Indian Athletes (Column I) with their respective Sports (Column II).

| Column I (Athlete) | Column II (Sport) |
|---|---|
| 1. Jyoti Yarraji | A. Swimming |
| 2. Sweety Bora | B. Shooting |
| 3. Aventika Agarwal | C. Boxing |
| 4. Anjum Moudgil | D. Athletics |

Codes:
(a) 1-D, 2-C, 3-A, 4-B
(b) 1-A, 2-B, 3-D, 4-C
(c) 1-B, 2-A, 3-C, 4-D
(d) 1-C, 2-D, 3-B, 4-A

Key: A (1-D, 2-C, 3-A, 4-B)
Explanation:
Jyoti Yarraji is a national record holder in women's 100m hurdles (Athletics).
Sweety Bora represents India in women's boxing.
Aventika Agarwal is a competitive swimmer who participated in the 2022 Asian Games.
Anjum Moudgil is an Indian shooter specializing in rifle events.
Hence, the correct matching is 1-D, 2-C, 3-A, 4-B.

**Q10.** Question: The Ponderal Index (PI), often used in anthropometry for a more linear assessment of body mass relative to height, is calculated using which of the following formulas?
(a) Weight (kg) / [Height (m)]$^2$
(b) Weight (kg) / [Height (m)]$^3$
(c) [Height (cm)]$^3$ / Weight (kg)
(d) Weight (kg) / [Height (cm)]
Key: b
Explanation:
(B) Correct: This is the standard formula for the Ponderal Index (also known as the Rohrer's Index). It is defined as body mass (in kilograms) divided by the cube of height (in meters): PI = weight / height$^3$. It is particularly used in pediatrics to assess body proportionality and leanness.
(A) Incorrect: This is the formula for the Body Mass Index (BMI), which uses height squared, not cubed.
(C) Incorrect: This inverts the relationship, placing height cubed in the numerator, which is not the correct formula for the Ponderal Index.
(D) Incorrect: This is an oversimplified and non-standard ratio that does not account for the three-dimensional nature of body volume that the Ponderal Index aims to approximate.

**Q11.** Which of the following presents the correct sequence of cardiac phases during ventricular filling, starting immediately after the closure of the aortic valve?
(a) Rapid Ventricular Filling → Diastasis → Isovolumetric Relaxation → Atrial Systole
(b) Isovolumetric Relaxation → Atrial Systole → Diastasis → Rapid Ventricular Filling
(c) Isovolumetric Relaxation → Rapid Ventricular Filling → Diastasis → Atrial Systole
(d) Isovolumetric Contraction → Rapid Ventricular Filling → Atrial Systole → Diastasis
Sol: c
Explanation:
(c) Correct: This is the accurate sequence of ventricular diastole and filling:
Isovolumetric Relaxation: All valves are closed; ventricular pressure drops without a change in volume (immediately follows aortic valve closure).
Rapid Ventricular Filling: When ventricular pressure falls below atrial pressure, the mitral/tricuspid valves open, causing a rapid, passive inflow of blood.
Diastasis: A slower, passive filling phase where little additional blood enters the ventricles.
Atrial Systole: The "atrial kick" that actively tops off the ventricles just before systole begins.
(A) Incorrect: It starts incorrectly with Rapid Filling, which cannot occur until after the isovolumetric relaxation phase lowers ventricular pressure enough to open the AV valves.
(B) Incorrect: It incorrectly places Atrial Systole (the final phase of filling) immediately after Isovolumetric Relaxation, skipping the primary passive filling phases.
(D) Incorrect: It incorrectly begins the sequence with Isovolumetric Contraction (a systolic phase) and again misplaces the order of the diastolic filling phases.

**Q12.** A laboratory worker accidentally spills a corrosive chemical on their forearm. What is the most appropriate and immediate first aid action?
(a) Apply a neutralizing agent (e.g., a weak acid for a base burn) to counteract the chemical.
(b) Immediately flush the affected area under gently running, cool to lukewarm water for at least 15-20 minutes.
(c) Rub the area with a clean cloth to wipe off the chemical, then apply an antiseptic burn ointment.
(d) Apply ice packs directly to the burn to cool the skin and constrict blood vessels, minimizing damage.
Key: b
Explanation:
(B) Correct: This is the universally recommended first aid. Copious and prolonged irrigation dilutes and removes the chemical, stops the burning process, and minimizes tissue damage. The water should be cool to lukewarm to prevent hypothermia, especially for large burns.
(A) Incorrect: Never attempt neutralization. The heat generated by the chemical reaction can cause a thermal burn on top of the chemical burn, worsening the injury.
(C) Incorrect: Rubbing can spread the chemical and drive it deeper into the skin. Ointments or creams should not be applied until the chemical is completely and thoroughly rinsed off and the burn has been assessed by a medical professional.
(D) Incorrect: Direct application of ice can cause frostbite and further tissue damage. The goal is dilution and removal with flowing water, not extreme cooling.

**Q13.** Which of the following statements correctly describe the core purpose of management in an organization?
1.Management aims to achieve organizational goals effectively and efficiently through planning, organizing, and controlling resources.
2.The sole purpose of management is to coordinate interpersonal relationships and ensure harmony among employees.
3.Management involves guiding, directing, and supervising human effort toward accomplishing common objectives.
4.It seeks to optimize the use of available resources—human, financial, physical, and informational—to maximize output.
Codes:
(a) 1, 2 and 3
(b) 1, 3 and 4
(c) 2, 3 and 4
(d) 1, 2 and 4
Key: B (1, 3 and 4)
Explanation:
Statement 1 is correct: This is a foundational definition, emphasizing goal attainment via key managerial functions.
Statement 2 is incorrect: While coordination and harmony are important, they are not the sole purpose of management. This statement is too narrow and ignores the broader goals of efficiency, effectiveness, and resource optimization.

Statement 3 is correct: Directing and guiding human effort toward shared goals is a central purpose of management.
Statement 4 is correct: Resource optimization to maximize productivity and output is a key managerial purpose.
Thus, the correct combination is 1, 3, and 4.

**Q14.** Question: Match the following Diseases (Column I) with their Primary Mode of Transmission (Column II).

| Column I (Disease) | Column II (Mode of Transmission) |
|---|---|
| 1. Chickenpox | A. Saliva |
| 2. Rabies | B. Respiratory droplets |
| 3. Common Cold | C. Direct contact with skin lesions |
| 4. Epstein-Barr Virus | D. Intimate contact |

Codes:
(a) 1-A, 2-B, 3-D, 4-C
(b) 1-C, 2-A, 3-B, 4-D
(c) 1-D, 2-C, 3-A, 4-B
(d) 1-B, 2-D, 3-C, 4-A
Sol. b (1-C, 2-A, 3-B, 4-D)
Explanation:
Chickenpox is primarily spread by direct contact with the fluid from skin blisters (C) and also by respiratory droplets.
Rabies is transmitted through infected saliva entering the body via bites or licks on broken skin (A).
Common Cold is mainly transmitted via airborne respiratory droplets (B).
Epstein-Barr Virus (causing infectious mononucleosis) is often called the "kissing disease" and spreads through intimate contact with saliva (D).
Thus, the correct matching is 1-C, 2-A, 3-B, 4-D.

**Q15.** In the context of motor learning and sports training, which of the following best describes negative transfer?
(a) When previous learning has no effect on the learning of a new skill.
(b) When skills learned in one sport or activity hinder the learning or performance of a new skill.
(c) When the practice of a skill improves performance in another similar skill due to common elements.
(d) When an athlete fails to learn a new skill due to lack of motivation or fatigue.
Sol. b
Explanation:
(B) Correct: This is the accurate definition of negative transfer. It occurs when prior learning interferes with or slows down the acquisition of a new, different skill (e.g., a badminton player's wrist strokes negatively transferring when learning the more rigid forearm drives of tennis).
(A) Incorrect: This describes zero transfer, where there is no measurable influence between skills.
(C) Incorrect: This describes positive transfer, which is the beneficial effect of prior learning on a new skill.

(D) Incorrect: This describes a failure in learning, but it attributes it to motivational or physiological factors, not to the interference between learned skills, which is the core of the transfer concept.

**Q16.** In epidemiology, which of the following correctly represents the typical sequential phases of a generalized infectious disease in an individual?
(a) Illness → Prodromal → Convalescence → Incubation
(b) Prodromal → Illness → Incubation → Convalescence
(c) Incubation → Prodromal → Illness → Convalescence
(d) Incubation → Illness → Decline → Prodromal
Sol. c
Explanation:
(C) Correct: This is the standard sequence:
Incubation: Time between pathogen entry and first symptom.
Prodromal: Initial, mild, non-specific symptoms.
Illness (Acute): Period where specific, severe symptoms are at their peak.
Convalescence: Symptoms decline, and recovery occurs.
(A) Incorrect: It starts in the middle (Illness) and incorrectly places Incubation at the end.
(B) Incorrect: Begins with Prodromal and places the initial Incubation phase third, disrupting the cause-and-effect order.
(D) Incorrect: Jumps from Incubation to Illness (skipping Prodromal) and incorrectly places the Prodromal phase at the end, after the Decline.

**Q17.** In biomechanics, the mechanical advantage (MA) of a lever system is calculated using the lengths of the lever arms. Which one of the following is the correct formula?
(a) MA = Load Arm / Effort Arm
(b) MA = Effort Arm × Load Arm
(c) MA = Effort Arm / Load Arm
(d) MA = $(\text{Effort Arm})^2$ / $(\text{Load Arm})^2$
Sol. c
Explanation:
The mechanical advantage (MA) of a lever is defined as the ratio of the effort arm (distance from the fulcrum to the point where effort is applied) to the load arm (distance from the fulcrum to the load). This ratio indicates how much the lever multiplies the input force.
(A) Incorrect: This is the inverse of the correct formula and would represent a mechanical disadvantage.
(B) Incorrect: Multiplication of the two arms does not yield a meaningful ratio for force amplification.
(D) Incorrect: Squaring the arms is not relevant to the basic principle of levers.

**Q18.** In kinesiology and biomechanics, non-axial movement is also known as:
(a) Rotary movement
(b) Angular movement
(c) Translatory movement
(d) Oscillatory movement
Sol. c

Explanation:
(C) Correct: Translatory (or linear/gliding) movement occurs when an object moves in a straight line from one point to another without angular or rotational displacement. This is characteristic of plane/gliding joints (e.g., intercarpal joints).
(A) Incorrect: Rotary movement involves rotation around a central axis (e.g., shoulder rotation).
(B) Incorrect: Angular movement involves changes in the angle between bones (e.g., flexion, extension).
(D) Incorrect: Oscillatory movement refers to repeated back-and-forth motion, which is a type of movement pattern, not a specific joint-based classification.

**Q19.** Match the following Speed Endurance Training Methods (Column I) with their Primary Physiological Adaptation (Column II).
Column I (Training Method) Column II (Primary Adaptation)
1. Interval Training A. Improves lactate tolerance and clearance
2. Fartlek Training B. Enhances aerobic power ($VO_2$ max) and pacing
3. Tempo Runs C. Develops anaerobic capacity and speed reserve
4. Repetition Method D. Increases oxidative energy production and efficiency
Codes:
(a) 1-B, 2-D, 3-A, 4-C
(b) 1-C, 2-A, 3-B, 4-D
(c) 1-A, 2-B, 3-D, 4-C
(d) 1-D, 2-C, 3-A, 4-B
Key: a (1-B, 2-D, 3-A, 4-C)
Explanation:
1-B: Long intervals (e.g., 800m repeats) primarily enhance aerobic power ($VO_2$ max) and pacing ability.
2-D: Fartlek involves varied pace and terrain, boosting oxidative energy production and efficiency.
3-A: Tempo runs (at lactate threshold) improve lactate tolerance and clearance.
4-C: Short, fast repetitions (e.g., 200m sprints) develop anaerobic capacity and speed reserve.
Thus, the correct matching is 1-B, 2-D, 3-A, 4-C.

**Q20.** Arrange the following Commonwealth multi-sport events in the chronological order of their first edition, starting from the earliest.
1.Commonwealth Winter Games
2.Commonwealth Youth Games
3.Commonwealth Para Games
4.Commonwealth Games
Codes:
(a) 4 → 1 → 2 → 3
(b) 4 → 2 → 1 → 3
(c) 1 → 4 → 3 → 2
(d) 4 → 3 → 2 → 1
Sol. a (4 → 1 → 2 → 3)
Explanation:

- Commonwealth Games were first held in 1930 (as the British Empire Games).

- Commonwealth Winter Games had their first and only official edition in 2010.
- Commonwealth Youth Games began in 2000.
- Commonwealth Para Games (originally held as demonstration events, then integrated as a separate event) were formally introduced much later, with the first standalone event occurring after the Youth Games.

Thus, the correct sequence based on the first edition is Commonwealth Games → Commonwealth Winter Games → Commonwealth Youth Games → Commonwealth Para Games.

**Q21.** In corrective exercise for genu valgum (knock knees), strengthening which of the following muscles is considered most essential to help realign the knee joint?
(a) Hamstrings
(b) Hip abductors
(c) Quadriceps
(d) Gastrocnemius
Sol. b
Explanation:
(B) Correct: Genu valgum is often associated with weak hip abductors, particularly the gluteus medius. Strengthening these muscles helps control femoral adduction and internal rotation, thereby reducing the inward pull on the knee and encouraging proper alignment of the lower limb.
(A) Incorrect: While hamstrings are important for knee stability, they are not the primary correctors of genu valgum alignment.
(C) Incorrect: Quadriceps strengthening, if done without addressing hip control, can sometimes exacerbate the valgus stress if imbalances persist.
(D) Incorrect: The gastrocnemius is a calf muscle that acts on the ankle; it does not directly influence hip or knee alignment in the frontal plane.

**Q22.** In corrective exercise for excessive lumbar lordosis, strengthening which of the following muscles is considered most essential to help reduce the excessive inward curvature of the lower back?
(a) Erector spinae
(b) Hip flexors
(c) Abdominal muscles
(d) Quadriceps
Sol. c
Explanation:
(c) Correct: Excessive lumbar lordosis is often associated with weak abdominal muscles and tight lower back/hip flexors. Strengthening the abdominals (especially the rectus abdominis and obliques) helps produce a posterior pelvic tilt, which directly reduces the excessive anterior curvature (lordosis) of the lumbar spine.
(a) Incorrect: The erector spinae are already overactive and tight in hyperlordosis. Strengthening them would increase the excessive extension and lordotic curve.
(b) Incorrect: Hip flexors (like the iliopsoas) are typically tight and shortened in this condition. The goal is to stretch them, not strengthen them.
(d) Incorrect: The quadriceps primarily act on the knee joint and do not directly influence the pelvic tilt or lumbar spine alignment in the sagittal plane.

**Q23.** For the action of elbow flexion, identify the correct pair of its primary muscle and that muscle's distal insertion point.
(a) Biceps Brachii — Radial Tuberosity
(b) Brachialis — Ulnar Tuberosity
(c) Brachioradialis — Styloid Process of Radius
(d) Triceps Brachii — Olecranon Process of Ulna
Sol. b
Explanation:
(B) Correct: The brachialis is widely considered the primary (or "workhorse") elbow flexor because:
It is the most powerful flexor, with the largest cross-sectional area dedicated solely to elbow flexion.
It is effective in all positions of forearm pronation and supination.
Its distal tendon inserts onto the ulnar tuberosity and the coronoid process of the ulna.
(A) Incorrect: While the biceps brachii is a major flexor, it is not the primary flexor. Its primary roles are supination of the forearm and flexion of the shoulder. It inserts on the radial tuberosity.
(C) Incorrect: The brachioradialis is a flexor of the elbow, but it is most active during rapid flexion or when lifting a load with a neutral forearm. It is a secondary/synergist muscle, not the primary. It inserts on the styloid process of the radius.
(D) Incorrect: The triceps brachii is the antagonist for this action; it is the primary extensor of the elbow, not a flexor.

**Q24.** Match the following Types of Muscle Contraction (Column I) with their Defining Characteristic (Column II).

| Column I (Type of Contraction) | Column II (Characteristic) |
|---|---|
| 1. Eccentric | A. Muscle shortens while producing tension |
| 2. Isometric | B. Muscle length remains constant |
| 3. Isotonic | C. Muscle lengthens while under tension |
| 4. Concentric | D. Muscle tension remains constant |

Codes:
(a) 1-C, 2-B, 3-D, 4-A
(b) 1-A, 2-C, 3-B, 4-D
(c) 1-B, 2-D, 3-A, 4-C
(d) 1-D, 2-A, 3-C, 4-B
Key: a (1-C, 2-B, 3-D, 4-A)
Explanation:
1-C: Eccentric contraction occurs when the muscle lengthens while under tension (e.g., lowering a weight).
2-B: Isometric contraction occurs when muscle tension is produced but no change in length takes place (e.g., holding a plank).
3-D: Isotonic contraction (a broad category) is defined by constant tension throughout the movement, though in practice, tension often varies.
4-A: Concentric contraction occurs when the muscle shortens while producing tension (e.g., lifting a weight).
Thus, the correct matching is 1-C, 2-B, 3-D, 4-A.

**Q25.** Match the following Types of Mechanical Stress (Column I) with their Defining Characteristics (Column II).

| Column I (Type of Stress) | Column II (Characteristic) |
|---|---|
| 1. Tension | A. Force that tends to twist a material about its axis |
| 2. Shear | B. Force that tends to pull a material apart |
| 3. Compression | C. Force that tends to compress or squeeze a material |
| 4. Torsion | D. Force that tends to cause sliding of one part over another |

Codes:

(a) 1-B, 2-D, 3-C, 4-A

(b) 1-A, 2-B, 3-D, 4-C

(c) 1-C, 2-A, 3-B, 4-D

(d) 1-D, 2-C, 3-A, 4-B

Sol a (1-B, 2-D, 3-C, 4-A)

Explanation:

1-B: Tension is a pulling force that stretches or elongates a material.

2-D: Shear involves parallel forces acting in opposite directions, causing one part to slide over another.

3-C: Compression is a pushing force that reduces the volume or shortens a material.

4-A: Torsion is a twisting force that rotates one end of a material relative to the other.

Thus, the correct matching is 1-B, 2-D, 3-C, 4-A.

**Q26.** In the periodization of sports training, which of the following presents the correct sequential order of the major phases, including the maintenance phase?

1.Maintenance Phase

2.Competitive Phase

3.Preparatory Phase

4.Transition Phase

Codes:

(a) 3 → 2 → 1 → 4

(b) 3 → 1 → 2 → 4

(c) 1 → 3 → 2 → 4

(d) 3 → 2 → 4 → 1

Sol. a (3 → 2 → 1 → 4)

Explanation:

The standard sequence in classical periodization is:

Preparatory Phase (3): Base building, focusing on general conditioning, hypertrophy, and strength.

Competitive Phase (2): Peak performance phase, involving sport-specific intensity and tapering.

Maintenance Phase (1): Occurs during the competitive season; the aim is to maintain the fitness and performance levels achieved, with reduced volume.

Transition Phase (4): Active rest and recovery after the competition season, allowing physical and mental recuperation.

Thus, the correct order is Preparatory → Competitive → Maintenance → Transition.