

PRACTICE EXAM 3: CSCS FULL-LENGTH SIMULATION

SECTION 1 — SCIENTIFIC FOUNDATIONS

95 Questions | 1.5 Hours Recommended

EXERCISE SCIENCE (Questions 1–52)

1. A strength and conditioning specialist is reviewing a muscle biopsy report that indicates an athlete's vastus lateralis contains approximately 60% Type II fibers and 40% Type I fibers. Based solely on this fiber type profile, which athletic population does this distribution most closely resemble?
 - A. Elite distance runners who compete in events lasting longer than 2 hours
 - B. Sprinters and power athletes who rely on explosive, short-duration efforts
 - C. Untrained sedentary individuals who perform no regular physical activity
 - D. Elite endurance cyclists who compete in multi-stage road races

2. The sarcoplasmic reticulum within a skeletal muscle fiber is a specialized organelle whose primary function during excitation-contraction coupling is which of the following?
 - A. Synthesizing myosin heavy chains for thick filament assembly during hypertrophy
 - B. Conducting action potentials from the sarcolemma deep into the fiber interior
 - C. Producing ATP through oxidative phosphorylation to fuel the cross-bridge cycle
 - D. Storing and releasing calcium ions that initiate and terminate muscle contraction

3. A novice athlete completes a 10-week resistance training program and increases their leg press 1RM by 45%. Ultrasound imaging reveals only a 3% increase in quadriceps cross-sectional area. The disproportionate strength gain relative to the modest structural change is best explained by which adaptation?

- A. Neural adaptations including increased motor unit recruitment, improved rate coding, and enhanced intermuscular coordination
- B. Significant hyperplasia that produced new muscle fibers too small to detect on ultrasound
- C. A measurement error in the ultrasound that underestimated the true structural change
- D. Sarcoplasmic hypertrophy that increased fluid volume without adding contractile protein

4. The epimysium, perimysium, and endomysium all converge at the ends of a muscle to form which structure that transmits muscular force directly to bone?

- A. The sarcolemma that encases each individual muscle fiber
- B. The sarcoplasmic reticulum that stores calcium for contraction
- C. The tendon that connects muscle to bone at the origin and insertion
- D. The motor end plate that receives neural signals at the neuromuscular junction

5. During a maximal concentric biceps curl, the athlete reaches a point in the range of motion where the weight cannot be lifted further despite continued maximal effort. According to the length-tension relationship, this sticking point occurs because of which condition?

- A. The biceps have reached their maximum shortening velocity and cannot contract faster
- B. The actin-myosin overlap is suboptimal at this joint angle, reducing the number of cross-bridges that can form simultaneously
- C. The antagonist triceps are co-contracting with excessive force at this specific joint angle
- D. The Golgi tendon organ has activated autogenic inhibition to prevent tendon rupture

6. An exercise physiologist measures the force output of an isolated muscle preparation at three different lengths: shorter than resting length, at resting length, and longer than resting length. At which length does the preparation produce the least force due to excessive actin filament overlap that interferes with cross-bridge formation?

- A. At the resting length where actin-myosin overlap is optimized for maximal cross-bridge formation
- B. At the longest length where minimal filament overlap provides the fewest cross-bridge opportunities
- C. At all three lengths equally because force production is independent of sarcomere length
- D. At the shortest length where actin filaments overlap each other and compress against the Z-lines

7. Which regulatory protein on the thin filament physically blocks the myosin binding sites on actin when the muscle is in a resting state, preventing cross-bridge formation until calcium is released?

- A. Tropomyosin
- B. Titin
- C. Nebulin
- D. Myosin light chain

8. An athlete performs five consecutive maximal vertical jumps with 10 seconds of rest between each jump. By the fifth jump, performance has declined by 15% from the first jump. Which energy system's depletion is the most likely explanation for this progressive decline?

- A. The oxidative system's inability to supply adequate oxygen to the mitochondria
- B. Complete glycogen depletion in the quadriceps after only five maximal efforts
- C. The phosphagen system's inability to fully replenish phosphocreatine stores in 10 seconds of rest
- D. Protein catabolism from amino acid deamination during the brief maximal efforts

9. A certified athletic trainer reports that an athlete has returned from a 4-week period of complete bed rest following surgery. According to the principle of reversibility, which physiological system has likely experienced the most rapid and measurable decline during this period of inactivity?

- A. Bone mineral density, which requires years to show measurable changes
- B. The cardiovascular system, with measurable declines in VO_2 max within 1 to 2 weeks
- C. Maximal strength, which is maintained for 6 to 8 weeks without training
- D. Flexibility, which remains unchanged regardless of activity level

10. During a 1RM back squat attempt, the athlete's nervous system must activate the highest-threshold motor units to produce maximal force. According to Henneman's Size Principle, these high-threshold motor units innervate which fiber type?

- A. Type I fibers with high oxidative capacity and low force production
- B. A random mixture of Type I and Type II fibers within the same motor unit
- C. Exclusively cardiac muscle fibers that are shared between the heart and skeletal muscle
- D. Type IIa and Type IIx fibers with high force production and fast contraction velocity

11. A strength and conditioning specialist measures an athlete's knee extension torque at 60 degrees/second and 240 degrees/second on an isokinetic dynamometer. According to the force-velocity relationship, which test speed will produce the higher peak torque?

- A. 60 degrees/second will produce higher peak torque because slower concentric velocities allow greater force production
- B. 240 degrees/second will produce higher peak torque because faster movement activates more motor units
- C. Both speeds will produce identical peak torque because isokinetic testing eliminates the force-velocity relationship
- D. Neither speed produces measurable torque because isokinetic testing measures only power output

12. Eccentric muscle actions can produce approximately 20% to 60% more force than maximal concentric actions at the same velocity. This characteristic of eccentric force production has which practical implication for resistance training?

- A. Athletes should never perform eccentric training because the excessive forces always cause injury
- B. Eccentric training is only appropriate for rehabilitation and has no application in performance training
- C. Athletes can lower heavier loads than they can lift, which is the basis for supramaximal eccentric training methods
- D. Eccentric and concentric force production are always equal, making the distinction clinically irrelevant

13. During a barbell back squat, the gluteus maximus functions as the primary hip extensor during the ascent. The quadriceps simultaneously extend the knee. In this movement, the quadriceps function in which muscle role relative to the gluteus maximus?

- A. Antagonist opposing the action of the gluteus maximus at the hip joint
- B. Synergist assisting in completing the overall squat movement by extending the knee while the gluteus maximus extends the hip
- C. Stabilizer holding the femur in a fixed position while the gluteus maximus contracts
- D. The quadriceps are inactive during the squat ascent and contribute no force

14. Cardiac output at rest is approximately 5 liters per minute. If resting heart rate is 70 beats per minute, what is the approximate resting stroke volume?

- A. 350 milliliters per beat calculated by multiplying heart rate by cardiac output
- B. 5 milliliters per beat calculated by dividing cardiac output by a factor of 1,000
- C. 140 milliliters per beat calculated by dividing cardiac output by half the resting heart rate
- D. Approximately 71 milliliters per beat calculated by dividing cardiac output (5,000 mL) by heart rate (70 bpm)

15. A strength and conditioning specialist is monitoring an athlete's heart rate during a graded exercise test. At which approximate percentage of VO_2max does stroke volume typically plateau, after which further cardiac output increases depend primarily on heart rate?

- A. 40% to 60% of VO_2max
- B. 10% to 20% of VO_2max
- C. 80% to 90% of VO_2max
- D. 95% to 100% of VO_2max at the absolute maximum of the test

16. During maximal aerobic exercise, the percentage of cardiac output directed to working skeletal muscle increases from approximately 15% to 20% at rest to approximately 80% to 85%. This redistribution is achieved primarily through which mechanism?

- A. Increased total blood volume produced by erythropoietin release during the exercise bout
- B. Structural closure of blood vessels to non-essential organs through permanent vascular remodeling
- C. Vasodilation in working muscles mediated by local metabolic signals and vasoconstriction in non-essential organs mediated by the sympathetic nervous system
- D. Decreased cardiac output that redirects the reduced blood flow exclusively to the muscles

17. A marathon runner has been training consistently for 5 years and has a resting heart rate of 45 beats per minute. This bradycardia is a beneficial adaptation because it indicates which cardiovascular change?

- A. Decreased stroke volume requiring fewer beats to circulate the same volume of blood
- B. Increased stroke volume from eccentric cardiac hypertrophy, allowing the same cardiac output with fewer beats per minute
- C. Pathological cardiac dysfunction requiring immediate medical evaluation and withdrawal from training
- D. Reduced blood volume that decreases the workload on the heart during rest

18. During heavy resistance exercise, blood pressure responses differ from aerobic exercise. Which statement correctly describes the blood pressure response to heavy resistance exercise with the Valsalva maneuver?

- A. Systolic blood pressure increases while diastolic blood pressure decreases significantly
- B. Both systolic and diastolic blood pressure decrease below resting values during the lift
- C. Blood pressure remains unchanged from resting values regardless of the load lifted
- D. Both systolic and diastolic blood pressure increase dramatically, with recorded values potentially exceeding 400/300 mmHg

19. Growth hormone (GH) is released from the anterior pituitary gland in response to exercise. Which resistance training protocol characteristics produce the greatest acute GH elevation?

- A. High volume, moderate intensity (70–85% 1RM), and short rest periods (60–90 seconds) that maximize metabolic stress
- B. Low volume, maximal intensity (95–100% 1RM), and long rest periods (5–7 minutes) that minimize fatigue
- C. Exclusive use of isolation exercises targeting small muscle groups with very light loads
- D. Complete rest without any exercise stimulus to allow baseline GH pulsatility

20. Testosterone is the primary androgenic-anabolic hormone that promotes muscle growth. Circulating testosterone levels in males are approximately how many times higher than in females?

- A. 2 to 3 times higher in males compared to females
- B. Equal between males and females when both are resistance trained
- C. 10 to 15 times higher in males compared to females
- D. 50 to 100 times higher in males compared to females

21. An athlete's blood work reveals chronically elevated cortisol with suppressed testosterone over the past 6 weeks despite consistent training. The testosterone-to-cortisol ratio has declined steadily. These findings most strongly suggest which condition?

- A. Optimal adaptation indicating the athlete is peaking for competition
- B. Normal hormonal fluctuation that requires no intervention or program modification
- C. Excessive protein intake causing hormonal imbalance through renal stress
- D. Overtraining syndrome with chronic imbalance between training stress and recovery capacity

22. Insulin-like growth factor-1 (IGF-1) is produced both systemically by the liver and locally within muscle tissue. The locally produced muscle-derived IGF-1 variant known as mechano-growth factor (MGF) is particularly important for which process?

- A. Inhibiting all protein synthesis to prevent excessive hypertrophy during recovery
- B. Activating satellite cells and stimulating local muscle protein synthesis through the mTOR pathway
- C. Directly increasing circulating testosterone levels through a positive feedback loop
- D. Suppressing cortisol release from the adrenal cortex during intense training

23. The specific adaptation to imposed demands (SAID) principle states that the body adapts specifically to the type of stress placed upon it. Which scenario best violates this principle in program design?

- A. Prescribing only long-distance jogging at low intensity for a shot putter who needs maximal explosive power
- B. Including heavy squats in the program of a football lineman who needs lower body strength
- C. Programming plyometric depth jumps for a basketball player who needs vertical jumping power
- D. Including sprint intervals in the conditioning plan for a soccer midfielder who performs repeated sprints

24. A muscle biopsy from an elite sprinter reveals a fiber type composition of 75% Type II fibers (predominantly IIa) and 25% Type I fibers. If this athlete transitions to exclusive endurance training for 12 months, which fiber type shift is most likely to occur?

- A. Type I fibers will convert to Type IIx fibers to meet the new anaerobic demands
- B. Type IIa fibers will convert to Type IIx fibers because detraining reverses training adaptations
- C. Some Type IIa fibers may shift toward more oxidative characteristics, but wholesale conversion of Type II to Type I remains limited and debated
- D. No fiber type changes will occur because fiber type distribution is permanently fixed at birth

25. The ventilatory threshold during a graded exercise test closely corresponds to which metabolic event?

- A. The point of maximal fat oxidation rate during progressive exercise
- B. The depletion of intramuscular phosphocreatine stores during the test
- C. The point at which the athlete reaches their genetic maximum for oxygen consumption
- D. The lactate threshold, where blood lactate accumulation begins to increase exponentially and ventilation rises disproportionately to buffer the resulting acidosis

26. During a progressive exercise test, the athlete's oxygen consumption increases linearly with intensity until a plateau is reached despite further increases in workload. This plateau defines which physiological measure?

- A. The lactate threshold marking the onset of blood lactate accumulation
- B. Maximal oxygen consumption (VO_2max), the maximum rate at which the body can consume and utilize oxygen
- C. The anaerobic threshold marking the transition from aerobic to anaerobic metabolism
- D. The ventilatory equivalent for carbon dioxide at peak exercise intensity

27. The Krebs cycle produces NADH and FADH₂ as its primary energy-carrying outputs. These molecules then deliver their electrons to which subsequent metabolic pathway for the production of the majority of aerobic ATP?

- A. Glycolysis in the sarcoplasm for additional anaerobic ATP production
- B. Beta-oxidation of fatty acids in the mitochondrial matrix for lipid metabolism
- C. The electron transport chain on the inner mitochondrial membrane
- D. The phosphagen system for phosphocreatine resynthesis in the sarcoplasm

28. Fat oxidation through beta-oxidation produces substantially more ATP per molecule than glucose oxidation, yet fat cannot serve as the dominant fuel during high-intensity exercise. Which physiological limitation explains this?

- A. Fat oxidation occurs at a slower rate than carbohydrate metabolism and cannot match the rapid ATP demand of high-intensity exercise
- B. Fat stores are insufficient to provide meaningful energy during any type of exercise
- C. Fat can only be oxidized during complete rest and is unavailable during any form of physical activity
- D. Fat oxidation produces toxic byproducts that impair muscle function at high exercise intensities

29. A strength and conditioning specialist is prescribing rest intervals for a training program targeting phosphagen system development. The work intervals consist of 6-second maximal sprints. To allow near-complete phosphocreatine recovery between efforts, the work-to-rest ratio should be approximately which of the following?

- A. 1:1 with equal work and rest durations for aerobic development
- B. 1:3 to 1:5 for glycolytic system training with partial recovery
- C. No rest is needed because the phosphagen system recovers instantaneously
- D. 1:12 to 1:20 to allow 3 to 5 minutes of rest for near-complete PCr resynthesis

30. An exercise physiologist monitors blood lactate levels in an untrained individual and a trained endurance athlete during the same graded exercise protocol. At what percentage of VO_2max would the lactate threshold typically occur in each individual?

- A. At identical percentages of VO_2max because the lactate threshold is independent of training status
- B. At approximately 50–60% of VO_2max in the untrained individual and 70–80% or higher in the trained athlete
- C. At 90% of VO_2max in both individuals regardless of their training history
- D. The lactate threshold cannot be measured in untrained individuals

31. Newton's First Law of Motion (Law of Inertia) states that a body at rest remains at rest unless acted upon by an external force. In the context of sprinting, this principle explains why which phase of the sprint requires the greatest force production?

- A. The acceleration phase, where the sprinter must overcome their body's inertia from a stationary or near-stationary start
- B. The maximum velocity phase, where the sprinter is already moving and needs only to maintain speed
- C. The deceleration phase after crossing the finish line, which requires no muscular force
- D. All phases require identical force production because inertia is constant at all velocities

32. During a standing long jump, the athlete applies force to the ground at an angle. According to Newton's Third Law, the ground pushes back with an equal and opposite force. The horizontal component of this ground reaction force is primarily responsible for which aspect of jump performance?

- A. The vertical height achieved during the flight phase of the standing long jump
- B. The rotational torque on the ankle joint during the takeoff phase
- C. The horizontal distance traveled during the flight phase of the standing long jump
- D. The landing impact forces experienced at the moment of ground contact

33. A strength and conditioning specialist calculates that a barbell weighing 150 kg requires a net upward force greater than 1,471.5 N ($150 \times 9.81 \text{ m/s}^2$) to accelerate off the floor during a deadlift. The athlete produces 2,000 N of vertical force. What is the net force and resulting acceleration of the barbell?

- A. Net force is 0 N because the athlete's force exactly equals the gravitational force
- B. Net force is 2,000 N upward with an acceleration of 13.3 m/s^2
- C. Net force is 1,471.5 N upward with an acceleration of 9.81 m/s^2
- D. Net force is 528.5 N upward ($2,000 - 1,471.5$), and the barbell accelerates at approximately 3.52 m/s^2 ($528.5 \div 150$)

34. The stretch-shortening cycle (SSC) enhances concentric force production through three mechanisms. Which of the following is NOT one of the three recognized mechanisms of SSC enhancement?

- A. Storage and return of elastic energy in the musculotendinous unit during the eccentric phase
- B. Increased oxidative enzyme activity within the mitochondria during the amortization phase
- C. The stretch reflex activated by muscle spindle detection of the rapid eccentric stretch
- D. Increased time for force development because tension begins building during the eccentric phase

35. During a fast stretch-shortening cycle movement such as sprinting (ground contact time less than 250 milliseconds), which neuromuscular quality is most critical for maximizing performance?

- A. Musculotendinous stiffness that enables rapid storage and return of elastic energy with minimal ground contact time
- B. Maximum voluntary contraction force measured during a slow isokinetic test at 30 degrees per second
- C. Aerobic capacity measured as VO_2max during a progressive treadmill test
- D. Hamstring flexibility measured during a sit-and-reach test

36. A biomechanical analysis reveals that an athlete's bar path during the overhead press curves forward approximately 4 inches from the ideal vertical trajectory. This forward deviation increases the moment arm of the load relative to the shoulder joint. What is the consequence?

- A. Decreased torque demand on the shoulder muscles allowing them to generate less force
- B. Improved mechanical efficiency because the curved path reduces friction
- C. Increased torque demand on the shoulder muscles and increased compressive loading on the lumbar spine
- D. No biomechanical consequence because bar path does not affect joint loading or muscular demand

37. In the human body, the vast majority of joints involved in athletic movement operate as third-class levers. This arrangement favors which mechanical outcome?

- A. Force production because the effort arm is always longer than the resistance arm
- B. Neither force nor speed because third-class levers provide a mechanical advantage of exactly one
- C. Equal emphasis on force and speed because the effort and resistance arms are always identical
- D. Speed and range of motion at the expense of force, because the effort arm is shorter than the resistance arm

38. A physical therapist measures a patient's shoulder flexion at 170 degrees using a goniometer while applying external force, but the patient can only actively raise their arm to 155 degrees through their own muscular effort. The 15-degree difference between these two measurements represents which concept?

- A. The patient's shoulder is hypermobile and at risk for dislocation during active movement
- B. The difference between passive range of motion and active range of motion at the shoulder
- C. A measurement error that should be corrected by retesting with a different goniometer
- D. Evidence of a complete rotator cuff tear preventing any active shoulder motion

39. The muscle spindle is a proprioceptor located within the muscle belly that detects changes in muscle length. Its reflexive response — the stretch reflex — is classified as monosynaptic. What does the term "monosynaptic" mean in this context?

- A. The reflex arc involves only one synapse between the afferent sensory neuron and the efferent motor neuron, making it the fastest reflex in the body
- B. The reflex requires processing through multiple brain regions before producing a motor response
- C. The reflex can only be activated by a single stimulus and cannot respond to repeated stretching
- D. The reflex involves multiple synapses across several interneurons in the spinal cord

40. PNF stretching techniques exploit the Golgi tendon organ's autogenic inhibition response to achieve greater range of motion. In the contract-relax method, the athlete first isometrically contracts the target muscle against resistance. What happens neurologically after the contraction ceases?

- A. The muscle spindle resets to a shorter resting length preventing any further stretch
- B. The stretch reflex is amplified causing the muscle to contract more forcefully
- C. Reciprocal inhibition activates the antagonist muscle to resist the subsequent stretch
- D. The GTO's inhibitory signal reduces alpha motor neuron activity to the target muscle, temporarily decreasing its tone and allowing a greater stretch

41. During a depth jump, if the amortization phase (the transition between the eccentric landing and the concentric takeoff) is too long, which consequence occurs?

- A. The stretch reflex contribution is enhanced because the muscle spindle has more time to fire
- B. The stored elastic energy is maximally preserved because longer transitions improve energy return
- C. The stored elastic energy dissipates as heat and the stretch reflex contribution diminishes, reducing the SSC benefit
- D. The eccentric loading phase is eliminated and the exercise becomes a purely concentric movement

42. Ground reaction force during sprinting has three components: vertical, anteroposterior (horizontal), and mediolateral. Research on elite sprinters has consistently shown that the most important GRF component for achieving higher top-end running velocities is which of the following?

- A. The mediolateral component that provides lateral stability during single-leg support
- B. The vertical component applied during the brief ground contact phase at maximum velocity
- C. The anteroposterior component that pushes the sprinter backward to increase stride length
- D. All three components contribute equally with no single component more important than the others

43. An athlete who weighs 80 kg can produce a peak vertical ground reaction force of 2,400 N during a vertical jump. A second athlete who weighs 100 kg produces a peak vertical GRF of 2,400 N. Assuming similar ground contact times, which athlete will achieve the higher vertical jump?

- A. The 80 kg athlete because their higher force relative to body weight produces greater net upward acceleration
- B. The 100 kg athlete because their greater mass provides more momentum for the jump
- C. Both athletes will achieve identical jump heights because they produce the same absolute force
- D. Neither athlete can jump because 2,400 N is insufficient to overcome gravity for any body weight

44. Chronic endurance training produces eccentric cardiac hypertrophy characterized by increased left ventricular chamber size. This adaptation directly increases which cardiovascular variable?

- A. Resting diastolic blood pressure through increased peripheral vascular resistance
- B. Resting heart rate through enhanced sympathetic nervous system dominance
- C. Blood viscosity through increased red blood cell production beyond normal limits
- D. Maximal stroke volume through greater ventricular filling capacity

45. Which of the following correctly describes the chronic cardiovascular adaptation specific to heavy resistance training that differs from the adaptation produced by endurance training?

- A. Eccentric cardiac hypertrophy with increased chamber size and increased maximal stroke volume
- B. Significant reduction in resting heart rate to below 40 beats per minute in all resistance-trained athletes
- C. Concentric cardiac hypertrophy with thickening of the left ventricular wall and minimal change in chamber size
- D. Complete reversal of any pre-existing cardiovascular adaptations from prior endurance training

46. Cortisol is a glucocorticoid hormone released by the adrenal cortex in response to physical and psychological stress. Which acute metabolic action of cortisol is classified as catabolic?

- A. Stimulating protein degradation and gluconeogenesis from amino acid substrates
- B. Directly activating satellite cells to initiate muscle fiber repair and regeneration
- C. Enhancing muscle glycogen synthesis through increased glycogen synthase activity
- D. Suppressing all lipolysis in adipose tissue to preserve energy reserves during stress

47. An athlete completes a resistance training session consisting of 5 exercises, 4 sets of 8 repetitions each, at 75% 1RM with 90-second rest periods. Immediately post-exercise, blood samples reveal elevated testosterone, elevated growth hormone, and elevated cortisol. Which interpretation of this combined hormonal response is most accurate?

- A. The elevated cortisol indicates the program was poorly designed and should be discontinued
- B. This combined elevation of anabolic and catabolic hormones is a normal acute response to high-volume resistance training and supports the adaptive signaling cascade
- C. Only the testosterone elevation is relevant because growth hormone and cortisol have no role in adaptation
- D. The athlete should immediately consume 100 grams of protein to suppress the cortisol response

48. A female sprinter has been training with the same program for 24 weeks without a deload week. She reports persistent insomnia, elevated resting heart rate, loss of appetite, and declining sprint times over the past month. Blood work reveals suppressed estrogen and elevated cortisol. Based on these findings, which intervention is most appropriate?

- A. Increasing training intensity to overcome the performance plateau through greater stimulus
- B. Adding a second daily training session to increase the weekly training frequency
- C. Maintaining the current program and adding caffeine supplementation to combat the fatigue
- D. Significantly reducing training volume and intensity, implementing a recovery phase, and referring to a sports medicine physician for evaluation

49. The rate of force development (RFD) is a critical performance variable for explosive athletes. RFD measures which specific neuromuscular capacity?

- A. The maximum amount of force an athlete can produce during a 5-second isometric hold
- B. The total work performed during a set of 10 repetitions at 80% of 1RM
- C. How quickly an athlete can produce force — the speed at which force rises from baseline to peak during a rapid contraction
- D. The duration for which an athlete can maintain 50% of their maximal voluntary contraction

50. Muscle spindles are arranged in parallel with extrafusal fibers and detect changes in muscle length. Golgi tendon organs are arranged in series with muscle fibers at the musculotendinous junction and detect changes in muscle tension. If both proprioceptors are simultaneously activated during a heavy isometric contraction, which reflexive outcome dominates?

- A. At high tension levels, the GTO's inhibitory signal can override the muscle spindle's facilitatory signal, producing autogenic inhibition that limits maximal voluntary force production
- B. The muscle spindle always dominates, producing maximal contraction regardless of tension levels
- C. Neither proprioceptor produces any reflexive response during isometric contractions
- D. Both proprioceptors produce identical facilitatory responses that summate to increase force

51. A strength and conditioning specialist is evaluating two athletes who have identical 1RM back squat values of 180 kg. Athlete A completes the lift in 2.5 seconds while Athlete B completes the lift in 1.8 seconds. Which athlete demonstrates superior power output on this lift?

- A. Both athletes have identical power output because they lifted the same load through the same range of motion
- B. Athlete B demonstrates superior power output because they completed the same work in less time (Power = Work ÷ Time)
- C. Athlete A demonstrates superior power output because the slower lift indicates greater muscular control
- D. Power cannot be calculated from the information provided because barbell displacement is unknown

52. Detraining studies have shown that when athletes cease all training, different physiological qualities decline at different rates. Which quality is typically most resistant to detraining and maintained longest?

- A. VO₂max, which shows no decline for at least 12 weeks without any cardiovascular training
- B. Speed, which actually improves during periods of complete rest due to neural recovery
- C. Flexibility, which remains permanently elevated after a single stretching session
- D. Maximal strength, which can be maintained for approximately 2 to 4 weeks or longer after the cessation of training

SPORT PSYCHOLOGY (Questions 53–75)

53. A collegiate track and field coach asks the strength and conditioning specialist to recommend a goal-setting strategy for a long jumper who wants to qualify for nationals. The most effective approach would combine which three types of goals?

- A. Three outcome goals targeting successively higher rankings at each competition
- B. Only process goals because outcome and performance goals create excessive pressure
- C. Outcome goals (qualify for nationals), performance goals (specific jump distances at benchmarks), and process goals (daily technique and training behaviors)

D. No goals at all because goal-setting has been shown to decrease athletic performance

54. Self-efficacy, as defined by Bandura, is distinct from general self-confidence because it possesses which specific characteristic?

A. Self-efficacy is task-specific and situation-specific rather than a global personality trait

B. Self-efficacy is a stable personality characteristic that cannot change with experience

C. Self-efficacy is determined exclusively by genetics and is unaffected by training or experience

D. Self-efficacy applies equally to all tasks and situations without variation

55. An athlete preparing for a powerlifting competition reports that they perform best in training when their coach plays loud, aggressive music and delivers intense verbal encouragement. According to the inverted-U hypothesis, this preference suggests that the athlete's optimal arousal level for heavy lifting is which of the following?

A. Very low because all resistance training tasks require minimal physiological activation

B. Relatively high because heavy, gross motor power tasks benefit from elevated arousal

C. Moderate because the inverted-U predicts identical optimal arousal for all tasks regardless of type

D. Irrelevant because arousal has no effect on strength performance in any circumstance

56. A high school swimmer was the top performer in their conference last season but has recently begun performing poorly in meets while still performing well in practice. The swimmer reports worrying constantly about losing their top ranking and experiencing racing thoughts before competition. These symptoms suggest which primary psychological issue?

A. Facilitative arousal that enhances competitive performance through heightened readiness

B. Low trait anxiety that produces beneficial excitement before all competitive events

C. Lack of physical talent that has only recently become apparent through increased competition

D. Elevated cognitive anxiety characterized by worry and fear of failure that impairs competitive performance

57. A sport psychologist recommends that a golfer experiencing pre-putt anxiety practice diaphragmatic breathing and progressive muscle relaxation. These techniques are specifically designed to address which component of anxiety?

- A. Cognitive anxiety involving negative thoughts and worry about the outcome
- B. Trait anxiety that is a permanent personality disposition unresponsive to relaxation techniques
- C. Somatic anxiety involving physical symptoms such as muscle tension and elevated heart rate
- D. Social anxiety involving fear of judgment from spectators and competitors

58. An athlete reports that during competitions, they find themselves repeatedly thinking "Don't miss this shot" and "What if I fail?" A sport psychology consultant teaches the athlete to recognize these thoughts, interrupt them with a cue word, and replace them with instructional self-talk such as "Follow through" and "Smooth release." This technique is called which of the following?

- A. Thought stopping followed by replacement with positive or instructional self-talk
- B. Progressive muscle relaxation targeting the muscles involved in the shooting motion
- C. Systematic desensitization through gradual exposure to competitive pressure situations
- D. Biofeedback training using physiological monitoring equipment

59. Motor learning is defined as a relatively permanent change in the ability to perform a motor skill as a result of practice or experience. It is distinguished from motor performance because of which characteristic?

- A. Motor learning is always visible as an immediate improvement during the practice session
- B. Motor learning refers to the underlying capability that persists over time, while motor performance is the observable execution at any given moment that can fluctuate due to fatigue, anxiety, or other transient factors
- C. Motor learning and motor performance are identical concepts with no meaningful distinction
- D. Motor performance is permanent while motor learning is temporary

60. In Fitts and Posner's three-stage model, the associative stage of motor learning is characterized by which performance features?

- A. Completely automatic execution requiring no conscious attention to the movement
- B. Large, frequent errors with heavy dependence on verbal instructions from the coach
- C. Inability to perform the skill under any circumstances even with coaching support
- D. Smaller, less frequent errors with the developing ability to self-detect and self-correct some mistakes

61. A strength and conditioning specialist is teaching a group of 15 athletes five different resistance exercises during a single training session. Based on the contextual interference effect, random practice — intermixing all five exercises throughout the session — would produce which learning outcome compared to blocked practice?

- A. Slower initial acquisition but superior long-term retention and transfer of all five exercises
- B. Faster initial acquisition and superior long-term retention of all five exercises
- C. Identical outcomes to blocked practice because the contextual interference effect applies only to sport skills
- D. Inferior long-term retention because random practice prevents the formation of stable motor programs

62. A coach provides feedback to a basketball player after a free throw: "Your elbow was angled outward instead of directly under the ball." This feedback is classified as which type?

- A. Knowledge of results (KR) providing information about the outcome of the shot
- B. Intrinsic feedback based on the athlete's own sensory perception during the shot
- C. Knowledge of performance (KP) providing information about the quality of the movement pattern
- D. Motivational feedback designed exclusively to increase the athlete's effort level

63. Research on feedback frequency has demonstrated the guidance hypothesis, which states that providing feedback after every single trial produces which long-term effect on motor learning?

- A. Optimal long-term retention because maximum information produces maximum learning
- B. No effect on learning because feedback frequency is irrelevant to skill acquisition
- C. Accelerated learning that persists permanently without any negative consequences
- D. Impaired long-term learning because the athlete develops dependency on external feedback rather than developing independent error-detection capabilities

64. Distributed practice — shorter practice sessions separated by rest intervals — has been shown to produce better long-term motor learning compared to massed practice. Which underlying mechanism best explains this advantage?

- A. Distributed practice eliminates all fatigue and therefore eliminates all performance errors
- B. The rest intervals between practice bouts allow for memory consolidation and deeper encoding of the motor program
- C. Massed practice produces no learning at all under any circumstances regardless of the skill being practiced
- D. Distributed practice works by preventing the athlete from ever making errors during acquisition

65. A tennis coach asks whether training with a heavier ball would improve a player's forehand speed when returning to the standard ball. This question relates to which motor learning concept?

- A. Transfer of training, where practice with one condition potentially affects performance in another related condition
- B. The guidance hypothesis regarding optimal feedback frequency during skill acquisition
- C. Fitts and Posner's autonomous stage of motor learning where skills become automatic
- D. The inverted-U hypothesis regarding optimal arousal for fine motor tasks

66. A strength and conditioning specialist notices that a previously enthusiastic athlete has become increasingly withdrawn, reports difficulty sleeping, has lost interest in training and competition, and expresses feelings of being "trapped" in their sport with no enjoyment. These symptoms are most consistent with which condition?

- A. Acute pre-competition anxiety that will resolve within hours of the next event
- B. Normal emotional fluctuation requiring no intervention or professional consultation
- C. Athletic burnout characterized by emotional exhaustion, depersonalization, and reduced sense of accomplishment
- D. Optimal psychological readiness for peak competitive performance

67. A collegiate wrestler has been displaying signs consistent with an eating disorder — dramatic weight fluctuations before weigh-ins, avoidance of team meals, excessive exercise beyond prescribed training, and preoccupation with body weight. According to the strength and conditioning specialist's scope of practice, the appropriate action is which of the following?

- A. Prescribing a detailed meal plan to correct the wrestler's nutritional deficiencies
- B. Conducting frequent body composition testing to monitor the wrestler's weight more closely
- C. Ignoring the signs because weight management is a normal part of wrestling culture
- D. Referring the athlete to a qualified healthcare professional for evaluation and treatment

68. The concept of Relative Energy Deficiency in Sport (RED-S) expands beyond the original female athlete triad to recognize that male athletes with chronic energy deficiency can also experience which consequences?

- A. No consequences because RED-S affects only female athletes exclusively
- B. Hormonal disruption, decreased bone mineral density, impaired immune function, and declining performance
- C. Enhanced athletic performance from the metabolic efficiency gained during energy restriction
- D. Increased testosterone production from the stress of caloric deficit

69. An athlete returning from a torn ACL expresses significant fear of re-injury during cutting and pivoting drills, despite being physically cleared by the medical team. The strength and conditioning specialist's most appropriate response includes which of the following?

- A. Gradually reintroducing sport-specific movements at progressive intensities while facilitating referral to a sport psychologist for the fear of re-injury
- B. Immediately returning the athlete to full-contact competition to "force" them past the fear
- C. Eliminating all cutting and pivoting movements permanently from the athlete's program
- D. Telling the athlete that psychological concerns are irrelevant and to focus only on physical readiness

70. A generalized motor program (GMP) allows an athlete to adapt a learned movement pattern to different situations by adjusting variable parameters while the invariant features remain constant. Which of the following is a variable parameter that changes across different executions of the same GMP?

- A. The relative timing and sequencing of muscle activations within the movement
- B. The relative force proportions between muscle groups during the movement
- C. The overall speed and absolute force of the movement execution
- D. The fundamental spatial pattern of the movement trajectory

71. A sport psychologist recommends that an athlete use multisensory imagery to prepare for competition. For this imagery to be most effective, the athlete should imagine the performance using which combination of sensory modalities?

- A. Only the visual modality while suppressing all other sensory input
- B. Only the auditory modality while focusing exclusively on environmental sounds
- C. Only the kinesthetic modality while avoiding any visual or emotional components
- D. Visual, kinesthetic, auditory, and emotional components simultaneously for the richest mental rehearsal

72. An athlete who has successfully performed a 150 kg squat in training for the first time reports feeling significantly more confident about attempting 155 kg next week. According to Bandura's self-efficacy theory, which source of self-efficacy is primarily responsible for this increased confidence?

- A. Vicarious experience from watching a training partner perform the same lift
- B. Past performance accomplishment — the direct experience of successfully completing the 150 kg squat
- C. Verbal persuasion from the coach encouraging the athlete to attempt the heavier load
- D. Physiological state interpretation based on reduced pre-lift anxiety symptoms

73. A strength and conditioning specialist is working with an athlete who consistently underperforms during high-pressure competitions despite demonstrating excellent physical readiness in practice settings. Which psychological factor most likely explains this performance discrepancy?

- A. Inadequate competitive anxiety management causing choking under pressure
- B. Overtraining syndrome that manifests only during competitive environments
- C. Insufficient physical talent that becomes apparent only against higher-caliber opponents
- D. Random performance variation that cannot be addressed through any intervention

74. In Nideffer's model of attentional focus, a point guard surveying the defensive formation to find an open teammate is using which type of attentional focus?

- A. Narrow-internal focus directed at specific body sensations during dribbling
- B. Narrow-external focus locked on a single defender's positioning
- C. Broad-external focus scanning the entire court to perceive multiple stimuli simultaneously
- D. Broad-internal focus analyzing personal strategy without environmental awareness

75. Research on the psychological impact of injury in athletes has consistently demonstrated which finding?

- A. Athletes who experience psychological distress during rehabilitation have longer recovery times and higher re-injury rates compared to psychologically well-adjusted athletes
- B. Psychological responses to injury have no effect on rehabilitation outcomes or return-to-play timelines
- C. All athletes respond identically to injury with no variation in psychological response
- D. Injury always improves mental toughness and psychological resilience in athletes

NUTRITION (Questions 76–95)

76. A 75 kg endurance athlete competing in a stage race requires carbohydrate intake at the upper end of recommendations to support daily high-volume training. What is the total daily carbohydrate target for this athlete at 10 g/kg/day?

- A. 375 grams per day based on the moderate training load recommendation
- B. 750 grams per day calculated as 75 kg multiplied by 10 g/kg/day
- C. 75 grams per day based on a very low carbohydrate approach
- D. 1,500 grams per day calculated by doubling the recommendation for competition days

77. The branched-chain amino acids (BCAAs) — leucine, isoleucine, and valine — have received significant attention in sports nutrition. However, current evidence suggests that BCAA supplementation is which of the following when adequate total protein intake is already achieved?

- A. Unnecessary and provides no additional benefit beyond what is achieved with sufficient complete protein intake containing all essential amino acids
- B. Essential for all athletes regardless of total protein intake because BCAAs have unique anabolic properties
- C. Required in doses exceeding 50 grams per day for any measurable muscle protein synthesis
- D. The only proven ergogenic supplement with stronger evidence than creatine monohydrate

78. An athlete's diet consists almost entirely of chicken breast, white rice, and broccoli. While protein and carbohydrate intake are adequate, the diet is extremely low in dietary fat (approximately 8% of total calories). Which physiological consequence is most likely if this diet continues for several months?

- A. Enhanced testosterone production from the low-fat, high-protein dietary composition
- B. Improved absorption of all vitamins regardless of their fat-soluble or water-soluble classification
- C. Increased mitochondrial density from the carbohydrate-dominant macronutrient profile
- D. Impaired production of steroid hormones and reduced absorption of fat-soluble vitamins (A, D, E, K)

79. A collegiate soccer player weighing 70 kg consumes a post-exercise meal containing 25 grams of whey protein and 80 grams of carbohydrate within 30 minutes of completing a 90-minute practice session. What are the primary physiological benefits of this post-exercise nutrition strategy?

- A. The protein suppresses all cortisol production for 24 hours while the carbohydrate eliminates fatigue permanently
- B. The whey protein provides excessive calories that will be stored exclusively as body fat
- C. The protein stimulates muscle protein synthesis and repair while the carbohydrate replenishes muscle glycogen stores, with insulin from the carbohydrate enhancing amino acid uptake
- D. This meal is excessive and should be replaced with water only to prevent weight gain

80. A strength and conditioning specialist advises athletes to hydrate before, during, and after exercise. Which pre-exercise hydration guideline is supported by current sports nutrition recommendations?

- A. Consume no fluids for 6 hours before exercise to prevent gastrointestinal discomfort
- B. Consume 5 to 7 milliliters per kilogram of body weight at least 4 hours before exercise
- C. Consume a minimum of 3 liters of water within 30 minutes of the start of exercise
- D. Pre-exercise hydration is unnecessary because thirst alone is a sufficient guide for all athletes

81. Sodium is the electrolyte lost in the greatest quantity through sweat during exercise. During prolonged endurance events lasting longer than 60 to 90 minutes in hot conditions, the failure to replace sodium losses while consuming excessive plain water can lead to which life-threatening condition?

- A. Hyponatremia — dangerously low blood sodium concentration from dilution by excessive water intake
- B. Hyperkalemia — dangerously elevated potassium levels from excessive sports drink consumption
- C. Metabolic alkalosis — dangerous elevation of blood pH from sodium loss in sweat
- D. Rhabdomyolysis — muscle fiber breakdown from electrolyte-free fluid consumption

82. Creatine monohydrate is the most extensively researched ergogenic supplement. The standard loading protocol involves consuming 20 grams per day divided into four 5-gram doses for 5 to 7 days. What is the purpose of the loading phase?

- A. To permanently increase the number of creatine receptors on the sarcolemma
- B. To convert creatine into testosterone through enzymatic reactions in the liver
- C. To increase intramuscular free creatine and phosphocreatine levels to storage capacity
- D. To rapidly saturate intramuscular phosphocreatine stores to their maximum capacity in the shortest possible time

83. An athlete asks which form of creatine supplementation has the strongest scientific evidence base. The strength and conditioning specialist should recommend which form?

- A. Creatine ethyl ester, which has been shown to be superior to monohydrate in all studies
- B. Buffered creatine (Kre-Alkalyn), which completely eliminates the loading phase requirement
- C. Creatine monohydrate, which remains the most extensively researched and consistently effective form
- D. Liquid creatine serum, which provides 100% absorption compared to 50% for monohydrate

84. Caffeine enhances exercise performance across multiple domains including endurance, strength, and power. Which population should exercise particular caution with caffeine supplementation due to potential side effects at ergogenic doses?

- A. All athletes under the age of 40 regardless of health status or caffeine tolerance
- B. Athletes who are sensitive to caffeine's stimulatory effects and may experience anxiety, GI distress, or insomnia at ergogenic doses of 3 to 6 mg/kg
- C. Only athletes competing in water-based sports because caffeine causes dangerous dehydration
- D. Only male athletes because caffeine has no effect on female athletic performance

85. Beta-alanine supplementation increases intramuscular carnosine, which buffers hydrogen ions during high-intensity exercise. The recommended daily dosing protocol to minimize the common side effect of paresthesia is which of the following?

- A. 3.2 to 6.4 grams per day divided into smaller doses of 0.8 to 1.6 grams taken throughout the day
- B. A single 20-gram dose taken immediately before competition for acute buffering effect
- C. 0.1 grams per day because higher doses provide no additional benefit
- D. 50 grams per day for a loading phase lasting 2 weeks followed by complete cessation

86. Sodium bicarbonate is an extracellular buffer that can enhance performance during high-intensity glycolytic exercise. The typical effective dose is 0.2 to 0.3 g/kg of body weight consumed 60 to 90 minutes before exercise. Which side effect commonly limits its use?

- A. Permanent liver damage from acute sodium bicarbonate toxicity at any dose
- B. Complete suppression of all anaerobic energy pathways during the exercise session
- C. Dangerous elevation of heart rate above 250 beats per minute during exercise
- D. Gastrointestinal distress including nausea, bloating, cramping, and diarrhea

87. An athlete following a plant-based diet asks about the concept of "protein complementation." The strength and conditioning specialist should explain that plant proteins are often classified as incomplete because they typically lack adequate amounts of one or more essential amino acids. How can a plant-based athlete ensure adequate amino acid intake?

- A. Consuming only soy protein at every meal because it is the only plant protein that exists
- B. Animal protein sources must be consumed at every meal because plant combinations cannot provide complete amino acid profiles
- C. Consuming a variety of complementary plant protein sources throughout the day provides all essential amino acids in adequate quantities
- D. Plant-based athletes cannot achieve adequate protein intake under any dietary strategy

88. An athlete is preparing for an ultra-endurance event lasting 6 or more hours. During the event, protein contribution to total energy expenditure increases above the normal 5% to 10% baseline. This increased protein utilization during prolonged exercise occurs primarily because of which condition?

- A. Protein is always the dominant fuel source regardless of exercise duration or intensity
- B. Glycogen depletion increases the reliance on amino acid oxidation through deamination to maintain energy production
- C. Protein is the preferred fuel for the phosphagen system during all exercise types
- D. Fat stores are completely depleted within the first 60 minutes of any endurance event

89. Vitamin D deficiency has been linked to impaired muscle function, compromised immune competence, and decreased bone mineral density in athletes. Which population of athletes is at greatest risk for vitamin D deficiency?

- A. Athletes who train exclusively indoors, live at northern latitudes, or have darker skin pigmentation
- B. Athletes who train outdoors in tropical climates with extensive sun exposure year-round
- C. Only athletes over the age of 65 because younger individuals cannot develop vitamin D deficiency
- D. Athletes who consume excessive dairy products because calcium blocks vitamin D synthesis

90. An athlete asks the strength and conditioning specialist about the optimal timing for carbohydrate intake to maximize glycogen replenishment when two training sessions are scheduled within 8 hours. What guidance is most evidence-based?

- A. Delaying all carbohydrate intake for 12 hours after the first session to promote fat adaptation
- B. Consuming carbohydrate only before the second session with no intake after the first session
- C. No specific timing strategy is necessary because glycogen replenishes at the same rate regardless of when carbohydrate is consumed
- D. Consuming 1.0 to 1.5 g/kg of carbohydrate within 30 minutes of the first session when rapid glycogen recovery is essential

91. For an athlete in a caloric deficit seeking to lose body fat while maintaining lean mass, the recommended rate of weight loss to minimize muscle catabolism is which of the following?

- A. 3 to 5 kilograms per week using severe caloric restriction and dehydration protocols
- B. No weight loss should ever be attempted by any athlete under any circumstances
- C. Approximately 0.5 to 1.0 kilogram per week through a moderate caloric deficit of 300 to 500 kcal/day
- D. 10 or more kilograms per month to reach the target weight as quickly as possible

92. A strength athlete asks whether protein consumed before sleep can support overnight muscle recovery. The current evidence suggests which recommendation?

- A. Protein consumed before sleep has no effect on overnight protein synthesis under any conditions
- B. Consuming 30 to 40 grams of casein protein before sleep can sustain overnight amino acid delivery and support muscle protein synthesis during the overnight fasting period
- C. Only carbohydrate should be consumed before sleep because protein intake disrupts sleep quality
- D. A minimum of 100 grams of protein must be consumed within 10 minutes of falling asleep

93. Iron absorption from dietary sources is influenced by several factors. Which dietary strategy enhances the absorption of non-heme iron from plant-based foods?

- A. Consuming vitamin C-rich foods alongside non-heme iron sources to convert ferric iron to the more absorbable ferrous form
- B. Consuming calcium-rich dairy products at the same meal to enhance non-heme iron absorption
- C. Consuming coffee or tea with meals to maximize polyphenol-mediated iron uptake
- D. Avoiding all vegetables because fiber completely prevents iron absorption

94. A strength and conditioning specialist is asked about the evidence base for glutamine supplementation to promote muscle growth in healthy, well-nourished athletes. The most accurate response based on current research is which of the following?

- A. Glutamine is the single most effective supplement for muscle growth, surpassing creatine monohydrate
- B. Glutamine at doses of 50 grams per day permanently increases testosterone levels in all athletes
- C. Glutamine supplementation has strong evidence for muscle growth that rivals the evidence for creatine
- D. Glutamine supplementation has limited evidence for promoting muscle growth in healthy, well-nourished athletes and is not currently classified among the supplements with strong ergogenic evidence

95. High-glycemic index carbohydrate foods are most appropriately consumed at which time relative to exercise for performance and recovery purposes?

- A. Only at breakfast because high-GI foods consumed at any other time cause metabolic dysfunction
- B. Exclusively during caloric restriction to suppress appetite and reduce total food intake
- C. During and immediately after exercise when rapid glucose delivery and glycogen replenishment are priorities
- D. Only before sleep to promote overnight insulin release and growth hormone suppression

SECTION 2 — PRACTICAL/APPLIED

125 Questions | 2.5 Hours Recommended

EXERCISE TECHNIQUE (Questions 96–140)

96. A strength and conditioning specialist is evaluating an athlete's barbell back squat technique and observes that the athlete consistently shifts their weight to one side during the ascent, creating an asymmetric movement pattern. This lateral weight shift most likely indicates which underlying issue?

- A. A bilateral strength or mobility asymmetry between the left and right lower extremities that should be assessed and addressed with unilateral corrective exercises
- B. Optimal squat technique because slight lateral shifting is normal and requires no correction
- C. The barbell is positioned correctly and the athlete should increase the load to correct the shift
- D. A cardiovascular condition that requires immediate medical evaluation

97. During the eccentric phase of a barbell Romanian deadlift, an athlete's lumbar spine transitions from a neutral lordotic curve to noticeable flexion as they lower the bar past knee height. The strength and conditioning specialist should respond by doing which of the following?

- A. Allowing the athlete to continue because lumbar flexion during the RDL is acceptable technique
- B. Increasing the load to strengthen the erector spinae through the rounded position
- C. Switching to a seated hamstring curl machine to eliminate all spinal loading from the program
- D. Stopping the set, reducing the range of motion or load, and cueing the athlete to maintain a flat back by hinging at the hips rather than rounding the spine

98. An athlete performing the barbell bench press reports chronic anterior shoulder pain. The strength and conditioning specialist observes that the athlete's elbows flare to 90 degrees from the torso during every repetition. Which technique modification is most likely to reduce the shoulder stress?

- A. Flaring the elbows further to 120 degrees to increase the stretch on the pectoralis major

- B. Cueing the athlete to tuck the elbows to approximately 45 to 75 degrees from the torso, reducing stress on the anterior shoulder structures
- C. Eliminating the bench press permanently and replacing it with no alternative pressing exercise
- D. Adding heavy behind-the-neck presses to strengthen the posterior shoulder before returning to bench press

99. When performing a front squat, the athlete must maintain a high elbow position to keep the bar securely on the anterior deltoids. If the elbows drop during the descent, the most immediate consequence is which of the following?

- A. Increased activation of the biceps brachii to support the bar in the rack position
- B. Improved thoracic extension and reduced demand on the upper back musculature
- C. The bar rolls forward off the shoulders, creating a dangerous loss of control and excessive wrist and elbow stress
- D. Enhanced quadriceps activation from the altered torso position

100. A strength and conditioning specialist observes an athlete performing a conventional deadlift with a rounded thoracic spine (kyphosis) but a neutral lumbar spine throughout the lift. How should this technique be evaluated?

- A. Some degree of thoracic kyphosis is generally tolerable during heavy deadlifts because the thoracic spine is structurally more resistant to flexion-related injury than the lumbar spine, though excessive rounding should still be monitored
- B. Any spinal flexion during the deadlift is equally dangerous regardless of the region
- C. Thoracic kyphosis is the preferred technique and should be exaggerated during all deadlift variations
- D. The athlete should immediately cease all deadlifting permanently due to this technique fault

101. An athlete performing dumbbell lunges consistently demonstrates the front knee collapsing medially (valgus) during the descent of each repetition. Which corrective strategy addresses the root cause of this error?

- A. Increasing the dumbbell weight to force the knee into a better tracking position
- B. Strengthening the hip abductors and external rotators (gluteus medius, piriformis) and cueing the athlete to drive the knee outward over the toes
- C. Switching to a barbell back squat because bilateral exercises eliminate valgus patterns
- D. Applying ice to the knee before each set to reduce inflammation causing the valgus

102. A collegiate strength and conditioning specialist wants to introduce the power clean to a group of freshman athletes who have never performed Olympic lifts. Which exercise should be taught first in the recommended top-down progression?

- A. Full squat clean from the floor at a challenging load to test the athletes' natural ability
- B. Snatch grip deadlift to develop pulling strength before any catching is introduced
- C. Hang power clean from mid-thigh at near-maximal loads to develop explosive pulling power
- D. Front squat to establish the front rack position and receiving posture before any pulling phases are introduced

103. During the power clean, an athlete is observed catching the bar with the feet landing in a stance significantly wider than shoulder width — approximately 50% wider than the pulling stance. This error reduces stability and power in the receiving position. Which coaching cue best corrects this foot placement?

- A. "Jump and land with your feet in the same position they started in — no wider than shoulder width"
- B. "Spread your feet as wide as possible to create maximum stability during the catch"
- C. "Land on your toes with your heels elevated to receive the bar in a more upright position"
- D. "Kick your feet backward during the pull to increase hip extension range of motion"

104. The snatch requires receiving the bar overhead with fully locked arms. Which mobility prerequisite must be assessed before an athlete attempts the full snatch?

- A. Overhead squat mobility — the ability to maintain a stable, locked-arm overhead position with the bar while squatting to full depth with an upright torso
- B. Only ankle dorsiflexion range of motion because the snatch is primarily a lower body exercise
- C. Only wrist flexion range of motion because the snatch grip places minimal demand on the shoulders
- D. No mobility prerequisites exist because the snatch can be performed safely by all athletes regardless of mobility

105. A strength and conditioning specialist observes an athlete during the power snatch who consistently allows the bar to drift forward and away from the body during the second pull, creating a horizontal arc rather than a vertical bar path. Which cue best addresses this error?

- A. "Push the bar forward with your arms to create a wider arc for more momentum"
- B. "Keep the bar close to your body throughout the pull by driving your hips forward into the bar and keeping your elbows high and outside"
- C. "Look down at the floor during the second pull to keep the bar path vertical"
- D. "Lean your torso backward as far as possible to counterbalance the forward bar path"

106. An athlete performing depth jumps from a 75 cm box demonstrates ground contact times that have increased from 190 milliseconds on the first repetition to 380 milliseconds by the sixth repetition. The rebound jump height has simultaneously decreased. What action should the strength and conditioning specialist take?

- A. Increase the box height to 100 cm to provide greater eccentric overload and force faster adaptation
- B. Add ankle weights to increase the training stimulus during each depth jump repetition
- C. Continue the set to 12 repetitions because plyometric training benefits from accumulated fatigue
- D. Terminate the exercise immediately because the athlete is fatiguing, ground contact time has doubled, and the stretch-shortening cycle benefit is being lost

107. A strength and conditioning specialist is programming plyometric exercises for a team of 20 novice athletes who have completed 8 weeks of general resistance training but have no plyometric training experience. Which exercise intensity and volume combination is most appropriate?

- A. High-intensity depth jumps from 42-inch boxes at 200 foot contacts per session
- B. Maximum-effort single-leg bounding for 100 meters repeated 10 times
- C. Low-to-moderate intensity exercises such as squat jumps, box jumps stepping down, and countermovement jumps at 80 to 100 foot contacts per session
- D. Weighted plyometric exercises with 50% of 1RM squat at 150 foot contacts per session

108. When performing a barbell bent-over row, the athlete should initiate the pulling motion by retracting the scapulae before bending the elbows. This cueing sequence ensures which biomechanical outcome?

- A. The upper back musculature (rhomboids, middle trapezius) is engaged as the primary mover before the biceps dominate the pull
- B. The biceps brachii performs all the work while the upper back muscles remain inactive
- C. The barbell follows a horizontal path away from the body rather than toward the torso
- D. The athlete's spine rounds to increase the stretch on the latissimus dorsi

109. A medicine ball rotational throw is classified as a plyometric exercise only when it is performed with which specific characteristic?

- A. A 5-second pause between catching and throwing to maximize isometric force development
- B. Extremely slow, controlled tempo during both the catching and throwing phases
- C. Maximum weight possible to develop maximal strength rather than explosive power
- D. Maximal speed with minimal transition time between the eccentric catch and the concentric throw to exploit the stretch-shortening cycle

110. During the acceleration phase of a sprint, a strength and conditioning specialist observes that an athlete is running fully upright from the first step rather than maintaining the expected forward body lean. This positional error results in which performance consequence?

- A. Enhanced acceleration because the upright position maximizes stride frequency
- B. Reduced horizontal ground reaction force production, impairing acceleration because the force vector is directed too vertically
- C. No performance consequence because body position is irrelevant during acceleration
- D. Improved top-end speed that compensates for any reduction in initial acceleration

111. A change-of-direction test such as the pro agility shuttle (5-10-5) differs from true agility because it lacks which component?

- A. A physical change of direction requiring deceleration and reacceleration
- B. Any timing mechanism to measure the speed of the movement
- C. A reactive perceptual-cognitive decision-making component in response to unpredictable stimuli
- D. Multiple directional changes within a single test attempt

112. Dynamic stretching before training has largely replaced static stretching as the preferred pre-exercise flexibility method. The primary reason for this shift is which finding from the research literature?

- A. Dynamic stretching increases range of motion while simultaneously activating the neuromuscular system, whereas static stretching before explosive exercise acutely reduces force production and power
- B. Static stretching permanently damages muscle fibers and should never be performed by any athlete
- C. Dynamic stretching requires no warmup and can be performed at maximum intensity from the very first repetition
- D. Dynamic stretching and static stretching produce identical effects and the shift is based solely on coaching preference

113. A complete warmup protocol before a sprint training session should include a general warmup, dynamic stretching, movement preparation, and a specific warmup. The specific warmup for sprint training should consist of which activity?

- A. Prolonged static stretching holds of 90 seconds per muscle group
- B. Heavy resistance training sets at 90% of 1RM for the lower body
- C. A lecture on sprint mechanics with no physical activity
- D. Sprint buildups at progressively increasing velocities — 50%, 70%, 85%, and 95% of maximum — before full-speed sprints

114. An athlete asks about the evidence for cryotherapy chambers (whole-body cryotherapy at minus 110°C) for post-training recovery. Based on the current research, the strength and conditioning specialist should advise which of the following?

- A. Whole-body cryotherapy is the single most effective recovery modality with overwhelming scientific support
- B. The evidence for whole-body cryotherapy is mixed, with some studies showing subjective recovery benefits but limited evidence of meaningful effects on objective performance markers, making it an optional rather than essential modality
- C. Cryotherapy chambers should replace sleep as the primary recovery strategy for all athletes
- D. Cryotherapy is dangerous and has been banned by all major sports organizations worldwide

115. Foam rolling performed before training has been shown to acutely increase range of motion. What advantage does foam rolling offer compared to static stretching as a pre-training flexibility tool?

- A. Foam rolling permanently restructures fascial tissue to produce lasting structural changes
- B. Foam rolling reduces range of motion rather than increasing it
- C. Foam rolling provides range of motion improvements without the acute decrements in force production and power associated with static stretching
- D. Foam rolling is identical to static stretching in every physiological effect

116. A strength and conditioning specialist is designing conditioning for a lacrosse midfielder who performs repeated sprints of 20 to 40 yards with 15 to 30 seconds of rest during game play. Which conditioning protocol best replicates these sport-specific demands?

- A. Repeated 20- to 40-yard sprints with 15- to 30-second rest periods, targeting the phosphagen system at the sport's actual work-to-rest ratio
- B. Continuous 5-kilometer runs at 70% of maximum heart rate three times per week
- C. Single 400-meter time trials with 10-minute rest periods between each attempt
- D. 60-minute cycling sessions at moderate intensity on a stationary bicycle

117. Aerobic conditioning provides which specific recovery benefit for team sport athletes who perform repeated high-intensity efforts during competition?

- A. Aerobic fitness eliminates the need for the glycolytic system during all team sport activities
- B. Aerobic conditioning increases the maximum duration of each individual sprint by 200%
- C. Aerobic fitness has no relevance to team sport performance because team sports are exclusively anaerobic
- D. The aerobic system replenishes phosphocreatine, clears metabolic byproducts, and restores homeostasis between high-intensity bouts, enabling faster recovery and sustained performance

118. A conditioning protocol for a tennis player includes 6-second all-out shuttle sprints with 90 seconds of passive rest between efforts. This work-to-rest ratio of approximately 1:15 targets which energy system?

- A. The glycolytic system through prolonged moderate-intensity work intervals
- B. The phosphagen system with near-complete phosphocreatine recovery between efforts
- C. The oxidative system through sustained low-intensity continuous activity
- D. All three energy systems equally regardless of the work-to-rest ratio

119. Tempo running at lactate threshold intensity (approximately 75% to 85% of maximum heart rate) for 20 to 30 minutes develops which specific aerobic adaptation?

- A. Maximum sprint speed by training the phosphagen system at high intensity
- B. Explosive power through rapid force development during each stride
- C. The body's capacity to sustain higher absolute intensities before lactate accumulation exceeds clearance, effectively raising the lactate threshold
- D. Flexibility through the prolonged eccentric loading of the lower extremity during each stride

120. The strength and conditioning specialist's most important general recommendation for athlete recovery should always begin with which foundational practices before considering any external modalities?

- A. Adequate sleep of 7 to 10 hours nightly and appropriate post-exercise nutrition (protein and carbohydrate) as the non-negotiable foundation
- B. Pneumatic compression boots for 45 minutes after every session
- C. Cryotherapy chamber sessions twice daily regardless of training content
- D. Electrical muscle stimulation applied to all major muscle groups for 90 minutes nightly

121. An athlete weighing 80 kg is performing multiple sets of heavy back squats at 85% of 1RM with 3-minute rest periods. During rest, the phosphagen system replenishes PCr to support the next heavy set. If the athlete shortened rest periods to 60 seconds, what would be the primary consequence?

- A. Faster strength gains because shorter rest produces more metabolic stress
- B. No change in performance because rest period length does not affect recovery between sets
- C. Enhanced phosphocreatine recovery because the cardiovascular system works harder with shorter rest
- D. Incomplete phosphocreatine recovery leading to reduced force production on subsequent sets and a shift from strength toward a hypertrophy/endurance stimulus

122. When spotting a barbell back squat with two spotters, each spotter should be positioned at which location?

- A. Both spotters directly behind the athlete assisting at the torso simultaneously
- B. One spotter at each end of the barbell, ready to assist by curling or rowing the bar upward if the athlete fails
- C. Both spotters in front of the athlete providing verbal encouragement only
- D. One spotter seated on the floor beneath the barbell to catch it if it drops

123. A strength and conditioning specialist observes that a novice athlete performing the barbell overhead press is holding the bar with an excessively wide grip that places the elbows outside the line of the wrists at the starting position. What is the appropriate grip width correction?

- A. The grip should be widened further to increase the contribution of the lateral deltoids
- B. No correction is needed because any grip width is equally effective for the overhead press
- C. The grip should be adjusted so that the forearms are approximately vertical when the bar is at shoulder height, placing the wrists directly above the elbows
- D. The grip should be narrowed to shoulder width or less to convert the press into a close-grip variation

124. An athlete performing a single-leg Romanian deadlift (RDL) consistently loses balance and cannot maintain a stable single-leg stance throughout the range of motion. Which regression is most appropriate?

- A. A bilateral barbell RDL to develop the hip hinge pattern and hamstring strength before progressing back to the single-leg variation
- B. A single-leg depth jump from a 36-inch box to develop balance through explosive training
- C. A heavy barbell back squat to develop overall leg strength that will transfer to single-leg balance
- D. The same single-leg RDL with heavier weight because greater load forces the athlete to stabilize more effectively

125. A strength and conditioning specialist is training a group of 30 athletes in a facility with 10 squat racks. To maximize training efficiency while maintaining safety, which approach is most appropriate?

- A. Having all 30 athletes perform squats simultaneously using bodyweight only and waiting for racks
- B. Organizing athletes into groups of 3 per rack, with athletes rotating between squatting, spotting, and resting to maintain continuous workflow and appropriate supervision
- C. Having all 30 athletes crowd around a single squat rack to observe one demonstration for the entire session
- D. Eliminating all squat rack exercises because the facility cannot accommodate 30 athletes

126. A collegiate strength and conditioning specialist discovers that an athlete has been training unsupervised in the weight room at 5:00 AM before the facility is officially open and before any staff arrives. This situation creates which primary concern?

- A. No concern because early morning training is beneficial for hormonal optimization
- B. No concern because all collegiate athletes are experienced enough to train without supervision
- C. Only a scheduling concern that can be addressed by asking the athlete to arrive 15 minutes later
- D. A significant safety and liability concern because unsupervised training violates facility policies and increases injury risk without qualified staff present to respond to emergencies

127. The general guideline for exercise order in a training session places power exercises first, followed by core multi-joint exercises, then assistance exercises, and finally trunk/core stability exercises. If an athlete needs to perform both the power clean and the back squat in the same session, which exercise should be performed first?

- A. Back squat first because it is a heavier exercise and develops the foundation for the power clean
- B. Either exercise can be performed first because exercise order has no effect on performance quality
- C. The power clean first because it is a power/explosive exercise requiring the highest neuromuscular coordination and technique precision, which degrade rapidly with fatigue
- D. Core stability exercises first to pre-fatigue the stabilizers before any compound movement

128. A training program for a basketball player includes power cleans, countermovement jumps, back squats, dumbbell shoulder press, lat pulldown, and front plank. Arranged in proper exercise order, which sequence is correct?

- A. Power cleans → countermovement jumps → back squats → dumbbell shoulder press → lat pulldown → front plank
- B. Front plank → lat pulldown → dumbbell shoulder press → back squats → countermovement jumps → power cleans
- C. Lat pulldown → front plank → power cleans → countermovement jumps → back squats → dumbbell shoulder press
- D. Dumbbell shoulder press → lat pulldown → front plank → back squats → power cleans → countermovement jumps

129. An athlete who has been performing exclusively machine-based lower body exercises for 12 months transitions to free weight squats. Despite having a strong leg press, the athlete struggles with the barbell squat at much lower loads. Which factor best explains this performance discrepancy?

- A. The athlete's leg muscles have atrophied during the 12 months of machine training
- B. The free weight squat requires greater stabilizer activation, balance, and intermuscular coordination that the machine-based training did not develop
- C. Machines are always superior to free weights and the athlete should return to machine training
- D. The barbell squat uses completely different prime movers than the leg press with no overlap

130. Resistance bands used in combination with barbell exercises create accommodating resistance. During a banded back squat, the resistance profile changes through the range of motion in which way?

- A. Resistance decreases at the top of the squat and increases at the bottom
- B. Resistance remains constant throughout the entire range of motion identical to free weights
- C. The bands eliminate all resistance at every point in the range of motion
- D. Resistance is lowest at the bottom (where the band is least stretched) and highest at the top (where the band is fully stretched), challenging the athlete most in the mechanically strongest position

131. An anti-extension exercise such as the ab wheel rollout trains the core musculature to resist which spinal movement?

- A. Trunk rotation in the transverse plane during throwing and striking activities
- B. Lateral flexion of the trunk in the frontal plane during side-bending movements
- C. Lumbar hyperextension as gravity attempts to pull the lumbar spine into an extended position
- D. Trunk flexion in the sagittal plane during crunch and sit-up movements

132. For an athlete with a history of lumbar disc herniation, which core exercise category is most appropriate for developing trunk stability while minimizing repeated spinal flexion?

- A. Anti-movement exercises (planks, Pallof press, loaded carries) that develop stability without requiring trunk flexion
- B. High-repetition weighted sit-ups on a decline bench to strengthen the rectus abdominis
- C. Rapid rotational medicine ball throws that maximally load the lumbar spine in all three planes
- D. Hyperextension exercises performed explosively with heavy external loading

133. When performing a lateral lunge, the athlete's weight should shift primarily over which leg, and the knee of the stepping leg should track in which direction?

- A. Weight shifts over the non-stepping leg while the stepping leg remains completely unloaded
- B. Weight shifts evenly over both legs with both knees locked in full extension throughout
- C. Weight shifts primarily over the stepping leg with the knee tracking over the toes in the direction the foot is pointing
- D. Weight shifts behind the body with the torso leaning backward away from the stepping leg

134. During a Bulgarian split squat (rear foot elevated), the rear foot should be positioned on the bench with which part of the foot making contact?

- A. The heel only, with the toes hanging off the edge of the bench
- B. The ball of the foot or the tops of the toes (laces down), allowing the ankle to remain in a neutral or slightly plantarflexed position
- C. The entire sole of the foot flat on the bench surface as if standing on it
- D. The lateral (outside) edge of the foot only to increase ankle stability demands

135. A strength and conditioning specialist is teaching an athlete the Turkish get-up. This exercise primarily develops which physical quality?

- A. Maximum lower body power for vertical jumping and sprinting performance
- B. Cardiovascular endurance for sustained moderate-intensity aerobic activity
- C. Total-body stability, shoulder integrity, and the ability to move through multiple positions while maintaining load overhead
- D. Grip strength exclusively with no contribution to stability or movement control

136. During a standing calf raise, the strength and conditioning specialist instructs the athlete to pause at the top position with the heels fully elevated before lowering under control. This pause is used to accomplish which training objective?

- A. Eliminating the stretch-shortening cycle contribution to isolate the concentric strength of the gastrocnemius and soleus
- B. Increasing the contribution of the quadriceps to the calf raise movement
- C. Reducing the training stimulus to the plantar flexors by shortening the range of motion
- D. Transitioning the exercise from a resistance training movement to a cardiovascular exercise

137. An athlete asks whether resistance training with slow, controlled tempo (4 seconds eccentric, 4 seconds concentric) or explosive tempo is more effective for developing muscular power. Based on the principle of training specificity, the strength and conditioning specialist should recommend which approach for power development?

- A. Slow tempo exclusively because greater time under tension produces greater power adaptation
- B. Explosive tempo for power exercises because power development requires high-velocity force production, which is specific to the quality being trained
- C. Identical tempos for all exercises regardless of the training goal
- D. No tempo prescription is necessary because contraction velocity has no effect on adaptation

138. A strength and conditioning specialist is designing a training program for a wrestler who needs both upper body pressing strength and pulling strength. Which exercise pair provides the most comprehensive development of these opposing movement patterns?

- A. Biceps curl and wrist curl targeting the forearm flexors
- B. Seated calf raise and leg extension targeting the lower body
- C. Front plank and side plank targeting the core stabilizers
- D. Bench press for horizontal pressing and bent-over row for horizontal pulling

139. During a hex bar (trap bar) deadlift, the athlete stands inside the bar and grips handles positioned at the sides of the body. Compared to a conventional barbell deadlift, this bar position has which biomechanical effect?

- A. Greater forward torso lean and increased moment arm on the lumbar spine
- B. Identical biomechanics with no meaningful difference from the conventional deadlift position
- C. Reduced moment arm on the lumbar spine because the load is centered closer to the body's center of mass
- D. Increased grip demand because the hex bar handles are thicker than a standard barbell

140. An athlete performing cable face pulls to strengthen the posterior deltoids and external rotators of the shoulder should position the cable at which height and pull toward which target?

- A. Cable at floor level, pulling upward toward the hips while internally rotating the shoulders
- B. Cable at face height, pulling toward the face while externally rotating the shoulders and retracting the scapulae
- C. Cable above head height, pulling downward toward the waist in a lat pulldown motion
- D. Cable at knee height, pulling laterally across the body in a woodchop pattern

PROGRAM DESIGN (Questions 141–184)

141. A needs analysis for a competitive 100-meter sprinter identifies maximal sprint speed, explosive starting power, and the ability to maintain velocity through the finish as the critical performance qualities. Based on this analysis, which energy system is dominant during competition?

- A. The phosphagen system, because the 100-meter sprint is completed in approximately 10 to 12 seconds of maximal effort
- B. The glycolytic system, because the sprint lasts longer than 2 minutes at moderate intensity
- C. The oxidative system, because aerobic metabolism supports all activities lasting longer than 5 seconds
- D. All three energy systems contribute equally regardless of the sprint duration

142. A strength and conditioning specialist is classifying exercises for a training program. Which of the following correctly identifies a structural exercise?

- A. Seated biceps curl performed on an incline bench
- B. Lying hamstring curl performed on a prone leg curl machine
- C. Seated cable row performed with chest support against a pad
- D. Barbell front squat, which loads the spine directly and requires the trunk musculature to maintain an erect posture

143. For a training session containing the hang clean, back squat, incline bench press, seated row, triceps pushdown, and Russian twist, the correct exercise order based on NSCA guidelines is which of the following?

- A. Triceps pushdown → Russian twist → seated row → incline bench press → back squat → hang clean
- B. Russian twist → triceps pushdown → seated row → incline bench press → hang clean → back squat
- C. Hang clean → back squat → incline bench press → seated row → triceps pushdown → Russian twist
- D. Back squat → hang clean → incline bench press → triceps pushdown → seated row → Russian twist

144. An athlete training 3 days per week who performs total-body sessions each day would benefit from which exercise ordering strategy within each session to maintain performance quality?

- A. Performing all exercises for one body region before moving to the next body region
- B. Alternating between upper body and lower body exercises throughout the session to allow each region to recover while the other works
- C. Performing only isolation exercises in each session with no compound movements
- D. Performing exercises in random order determined by a coin flip before each set

145. According to the repetition maximum continuum, which combination of load and repetitions is most appropriate for developing maximal strength?

- A. Greater than 85% of 1RM for 6 or fewer repetitions per set
- B. Less than 50% of 1RM for 25 or more repetitions per set
- C. 60% to 67% of 1RM for 15 to 20 repetitions per set
- D. Body weight only for as many repetitions as possible to failure

146. An athlete's 1RM on the bench press is 120 kg. A hypertrophy-focused protocol prescribes 4 sets of 10 at 72% of 1RM. What is the prescribed load and total volume load?

- A. Load = 100 kg; Volume load = 4,000 kg
- B. Load = 120 kg; Volume load = 4,800 kg
- C. Load = approximately 86 kg; Volume load = $86 \text{ kg} \times 10 \text{ reps} \times 4 \text{ sets} = 3,440 \text{ kg}$ (using 72% of 120 = 86.4 kg, rounded to 86 kg)
- D. Load = 60 kg; Volume load = 2,400 kg

147. Rest periods of 30 to 90 seconds between sets are specifically prescribed for which training goal?

- A. Maximal strength development requiring complete phosphocreatine and neural recovery
- B. Explosive power development requiring full recovery between ballistic sets
- C. Aerobic endurance development requiring sustained elevated heart rate during resistance training
- D. Muscle hypertrophy, where maintaining elevated metabolic stress and the associated hormonal response supports the growth stimulus

148. A strength and conditioning specialist prescribes a training protocol of 3 sets of 15 repetitions at 60% of 1RM with 20-second rest periods. This protocol is designed to develop which physical quality?

- A. Maximal strength through heavy loading and complete neural recovery
- B. Muscular endurance through high repetitions, low load, and minimal rest that maximizes metabolic demand
- C. Explosive power through ballistic movement at high velocity
- D. Muscle hypertrophy through moderate loading and moderate rest

149. Linear periodization progresses through sequential phases with which characteristic pattern of volume and intensity change?

- A. Volume gradually increases while intensity gradually decreases across mesocycles
- B. Both volume and intensity increase simultaneously throughout the training year
- C. Volume and intensity remain constant and unchanging across all phases
- D. Intensity is randomly selected for each session with no systematic progression

150. A strength and conditioning specialist designs a 12-week program using block periodization for an advanced shot putter. The three blocks should be sequenced in which order?

- A. Realization (peaking) → transmutation (sport-specific) → accumulation (high volume)
- B. Competition → transition → general preparation only
- C. Muscular endurance → flexibility → cardiovascular conditioning only
- D. Accumulation (high volume, moderate intensity) → transmutation (higher intensity, sport-specific) → realization (low volume, peaking for competition)

151. Daily undulating periodization (DUP) provides which primary advantage over linear periodization for intermediate and advanced athletes?

- A. DUP eliminates the need for any structured programming because daily variation is random
- B. DUP never uses heavy loads, so it reduces injury risk compared to linear periodization
- C. More frequent exposure to different training stimuli within each week, which may prevent accommodation and allow simultaneous development of multiple physical qualities
- D. DUP produces identical outcomes to linear periodization with no difference in adaptation

152. During the in-season competitive period, a collegiate basketball team reduces training from 4 sessions per week to 2 sessions per week, cuts volume from 4 sets to 2 sets per exercise, but maintains intensity at 85% of 1RM. What outcome is expected?

- A. Dramatic strength loss because volume and frequency were reduced
- B. Strength and power maintenance because intensity — the most critical variable — has been preserved
- C. Significant additional strength gains from the reduced training load
- D. Complete detraining within the first week of the reduced schedule

153. The transition (off-season) period following a competitive season should last approximately how long and focus on which objectives?

- A. 2 to 4 weeks of unstructured, low-intensity active recovery focused on physical and psychological restoration, addressing minor injuries, and restoring motivation
- B. 12 weeks of maximal-intensity training to immediately begin preparing for next season
- C. 6 months of complete bed rest with no physical activity of any kind
- D. The transition period should be eliminated entirely because continuous training produces the best results

154. For developing explosive power in the jump squat, research indicates peak power output occurs at which approximate loading range?

- A. 90% to 100% of back squat 1RM for maximum force contribution
- B. 50% to 70% of back squat 1RM for balanced force and velocity
- C. Equal peak power at all loads because loading does not affect power output
- D. 0% to 30% of back squat 1RM where lighter loading allows high velocity

155. Plyometric training frequency should be limited to 2 to 3 sessions per week with a minimum of 48 to 72 hours between sessions. What is the primary rationale for this recovery requirement?

- A. Plyometric exercises produce no fatigue and the recovery time is only for scheduling convenience
- B. The 48-to-72-hour interval allows only for cognitive processing of the movement patterns
- C. Adequate recovery of musculotendinous structures that experience significant eccentric loading during plyometric exercises
- D. The recovery period is needed for the cardiovascular system only

156. A strength and conditioning specialist wants to incorporate both heavy resistance training and plyometric training into the same training week for a track and field jumper. How should these two modalities be scheduled?

- A. Plyometrics should be performed immediately after a high-volume lower body resistance session for maximal fatigue
- B. Plyometric sessions should be performed on separate days from heavy lower body resistance training, or before resistance training on the same day when the athlete is fresh
- C. Plyometrics and resistance training should never be combined in the same training program
- D. Heavy lower body resistance training should always precede plyometrics in the same session

157. A high school football coach asks the strength and conditioning specialist to design a conditioning program for offensive linemen. The position demands 4- to 7-second maximum-effort plays with 25 to 40 seconds between plays. Which conditioning protocol is most sport-specific?

- A. Sprint intervals of 5 to 10 yards with rest periods of 25 to 40 seconds, replicating the position's phosphagen-dominant demands and actual work-to-rest ratio
- B. Continuous 3-mile runs at moderate pace performed three times per week
- C. 400-meter repeats with 60-second rest periods targeting the glycolytic system
- D. 60-minute cycling sessions at 50% of maximum heart rate

158. A needs analysis for a competitive swimmer identifies upper body pulling strength, rotator cuff injury prevention, aerobic endurance, and core stability as priority training areas. Which program design best addresses these identified needs?

- A. Exclusively lower body resistance training because kicking is the primary propulsive force in swimming
- B. Only flexibility training because range of motion is the only physical quality relevant to swimming
- C. Only aerobic pool training with no dry-land resistance exercise component
- D. Pull-up and row variations for upper body pulling, internal/external rotation exercises for rotator cuff health, core anti-rotation and anti-extension exercises, and sport-specific aerobic conditioning

159. A strength and conditioning specialist is working with a 30-year-old athlete who has 8 years of consistent resistance training experience. Which periodization model is most appropriate for this advanced athlete who is preparing for a single major competition?

- A. A fixed program with no variation performed identically for 52 weeks
- B. A beginner program with 2 sessions per week at 60% of 1RM with no progression
- C. Block periodization with accumulation, transmutation, and realization phases targeted to peak at the competition date
- D. Random exercise selection with no planned structure or progressive overload

160. An athlete performing the back squat has a tested 1RM of 200 kg. Their training program prescribes the following workout: warm-up sets at 50%, 70%, and 80% of 1RM, followed by 5 working sets of 3 at 88% of 1RM with 4-minute rest periods. What is the prescribed working load?

- A. 150 kg per working set based on 75% of 1RM
- B. 176 kg per working set based on 88% of 200 kg
- C. 200 kg per working set based on 100% of 1RM
- D. 100 kg per working set based on 50% of 1RM

161. During the specific preparation phase of the annual training plan, the emphasis shifts from general fitness development to sport-specific qualities. For a volleyball team, this phase should prioritize which training focus?

- A. Explosive vertical jumping power, lateral agility, overhead shoulder strength, and sport-specific conditioning
- B. Maximum aerobic endurance through long-distance running as the exclusive training modality
- C. Complete rest with no training to save energy for the upcoming competitive season
- D. Exclusively heavy strength training with no power or conditioning components

162. A reconditioning program for an athlete returning from shoulder surgery should progress through which general sequence before unrestricted return to competition?

- A. Immediate return to full competitive play on the day of medical clearance
- B. Exclusive lower body training for the remainder of the athlete's career
- C. Maximal-effort bench pressing on the first day of clearance to test the repaired shoulder
- D. Pain-free range of motion restoration → progressive resistance training → sport-specific movement integration → return to competition upon meeting objective criteria

163. A commonly cited return-to-play criterion following unilateral lower extremity injury is that the injured limb should achieve at least what percentage of the uninjured limb's strength and functional capacity?

- A. 50% to indicate minimal recovery has begun
- B. 70% to demonstrate moderate progress in rehabilitation
- C. At least 90% to minimize the risk of re-injury associated with persistent bilateral asymmetry
- D. 110% to provide a protective buffer against future injury

164. An athlete's test results reveal a back squat 1RM at the 90th percentile for their sport but a vertical jump at only the 35th percentile. This discrepancy between high maximal strength and low explosive power indicates which specific training deficiency?

- A. Insufficient maximal strength requiring heavier squat loading
- B. A rate of force development deficit requiring increased explosive training (plyometrics, Olympic lifts, jump squats) to develop the ability to express strength rapidly
- C. Excessive vertical jump training that has impaired their squat performance
- D. No deficiency because strength and power are completely unrelated qualities

165. A novice athlete beginning a resistance training program should start with which approach during the first 4 to 6 weeks?

- A. Moderate loads (60-70% estimated 1RM) with higher repetitions (10-15) emphasizing technique mastery, building work capacity, and allowing connective tissue adaptation
- B. Maximal loads at 95% of estimated 1RM with single repetitions from the first session
- C. Exclusive plyometric training with depth jumps from maximum-height boxes
- D. No resistance training for the first 6 months while focusing exclusively on flexibility

166. A strength and conditioning specialist designs a training protocol of 5 sets of 2 repetitions at 92% of 1RM with 5-minute rest periods. This protocol is designed to develop which physical quality?

- A. Muscular endurance through high-repetition sustained work
- B. Muscle hypertrophy through moderate-load metabolic stress
- C. Aerobic capacity through elevated heart rate during resistance training
- D. Maximal strength and neural adaptation through near-maximal loading with complete recovery between sets

167. Which periodization model is most appropriate for a recreational athlete who trains 3 days per week, has no specific competition date, and wants to simultaneously develop strength, hypertrophy, and power?

- A. Block periodization with each quality trained exclusively for 4 weeks before switching
- B. Linear periodization with a strict progression from endurance to strength to power across 16 weeks
- C. Daily undulating periodization varying training emphasis across sessions within each week to develop multiple qualities simultaneously
- D. No periodization with the same program performed identically every session indefinitely

168. A strength and conditioning specialist calculates that a training program produces the following weekly volume loads: Week 1 = 40,000 kg, Week 2 = 44,000 kg, Week 3 = 48,000 kg, Week 4 = 30,000 kg. Week 4 represents which training strategy?

- A. A training error that accidentally reduced the volume below the planned target
- B. A deload or unloading week designed to manage accumulated fatigue and allow recovery before the next loading cycle
- C. A peaking week where the athlete attempts new 1RM records at maximal intensity
- D. A complete cessation of all training activity for the entire week

169. A needs analysis for a competitive rower identifies aerobic endurance, upper body pulling strength, core stability, and lower body drive power as the critical physical qualities. Which exercise selection best addresses these identified needs?

- A. Exclusively distance running and cycling with no resistance training or rowing-specific exercises
- B. Only biceps curls and wrist curls because rowing is exclusively an arm exercise
- C. Exclusively plyometric depth jumps because explosive power is the only quality relevant to rowing
- D. Rowing-specific aerobic conditioning, barbell rows and pull-up variations for pulling strength, anti-extension and anti-rotation core exercises, and front squats and Romanian deadlifts for lower body drive power

170. For an athlete preparing for two major competitions separated by 8 weeks, which periodization approach allows for dual peaking?

- A. A single linear periodization model that peaks only at the first competition
- B. A constant training program with no variation that produces a single peak at an unpredictable time
- C. Complete cessation of all training between the two competitions
- D. Two sequential mesocycles each ending with a brief taper and peaking phase timed to the respective competition dates

171. An athlete who has reached a training plateau after 20 weeks of the same program needs which intervention to resume progress?

- A. The exact same program continued indefinitely because plateaus eventually resolve without intervention
- B. Complete cessation of all training for 6 months to allow full recovery before restarting
- C. Variation in training variables — exercises, loads, volumes, periodization model, or exercise order — to provide novel stimuli that overcome accommodation
- D. Reduction of all training to body weight exercises only with no external loading

172. A strength and conditioning specialist programs conditioning for a field hockey team. Matches involve sustained running with repeated high-intensity sprints interspersed throughout 70 minutes of play. Which conditioning combination best prepares athletes for these demands?

- A. Only heavy resistance training with no cardiovascular component
- B. Aerobic base development (tempo runs, fartlek) combined with repeated sprint training (short sprints with sport-specific rest periods) to develop both sustained endurance and sprint recovery capacity
- C. Exclusively long-distance running at low intensity with no sprint component
- D. Only 100-meter maximal sprints with 10-minute rest periods

173. A strength and conditioning specialist is programming for a decathlete who must compete in 10 events over 2 days. The training program must develop a uniquely broad range of physical qualities including sprint speed, endurance, jumping power, throwing power, and technical skills. Which periodization approach is most suitable?

- A. Concurrent training with undulating periodization that addresses multiple physical qualities simultaneously throughout the training year
- B. Block periodization focusing exclusively on one event for 4 weeks before moving to the next
- C. Linear periodization focusing only on sprinting for 6 months then only on throwing for 6 months
- D. No structured training because the variety of events makes periodization impossible

174. An athlete's training log shows the following back squat progression over 8 weeks: Week 1 = 4×8 at 70%, Week 3 = 4×6 at 77%, Week 5 = 4×5 at 82%, Week 7 = 4×3 at 88%. This loading pattern is characteristic of which periodization model?

- A. Daily undulating periodization with within-week variation of intensity and volume
- B. Block periodization with concentrated focus on a single quality per multi-week block
- C. Random programming with no planned progression or structure
- D. Linear periodization with progressive increases in intensity and decreases in volume across sequential phases

175. A strength and conditioning specialist designs a hypertrophy-focused training block. Which combination of training variables is most appropriate for maximizing muscle growth?

- A. 1 to 2 sets of 1 to 3 repetitions at 95% 1RM with 5-minute rest periods
- B. 10 to 15 sets of 1 repetition at 100% 1RM with 10-minute rest periods
- C. 3 to 6 sets of 6 to 12 repetitions at 67% to 85% of 1RM with 30 to 90 seconds of rest
- D. 1 set of 50 repetitions at 20% of 1RM with no rest for the entire program

176. A training program for a sprinter includes both heavy back squats (5×3 at 90% 1RM) and jump squats (5×3 at 30% 1RM). The heavy squats develop which end of the force-velocity continuum and the jump squats develop which end?

- A. Heavy squats develop speed; jump squats develop maximal strength
- B. Heavy squats develop the high-force/low-velocity end (maximal strength); jump squats develop the low-force/high-velocity end (speed-strength)
- C. Both exercises develop identical qualities with no difference in training effect
- D. Heavy squats develop aerobic endurance; jump squats develop flexibility

177. A strength and conditioning specialist is designing a return-to-training protocol for an athlete who has been completely detrained for 6 weeks following surgery. The initial training phase should begin at what approximate intensity and volume relative to the athlete's pre-surgery training?

- A. 100% of pre-surgery intensity and volume to rapidly restore previous fitness levels
- B. 120% of pre-surgery levels to compensate for the detraining period
- C. The same advanced program the athlete was following before surgery
- D. Significantly reduced intensity and volume compared to pre-surgery levels, with gradual progressive increases based on tolerance and performance response

178. A strength and conditioning specialist needs to develop a conditioning protocol for a basketball team. Games involve 48 minutes of play with repeated sprints, jumps, and direction changes interspersed with brief recovery periods during free throws, timeouts, and substitutions. Which comprehensive conditioning approach best prepares the team?

- A. Only long-distance running at moderate intensity 5 days per week
- B. Only heavy resistance training with no cardiovascular conditioning component
- C. Exclusively static stretching sessions for 60 minutes each
- D. A combination of aerobic base training (tempo runs, fartlek), anaerobic interval training (repeated court-length sprints with sport-specific rest), and sport-specific agility conditioning

179. An athlete training for a triathlon needs to develop swimming, cycling, and running endurance while also maintaining lean mass and preventing overuse injuries. The training program should include which components?

- A. Exclusively heavy powerlifting with no endurance training components
- B. Only flexibility training because triathletes need range of motion more than any other quality
- C. Sport-specific endurance training in all three disciplines, moderate-load resistance training for injury prevention and lean mass maintenance, and periodized recovery weeks
- D. Only sprint interval training because endurance events do not require aerobic conditioning

180. An in-season strength maintenance program for a football team prescribes 2 sessions per week at 80–85% 1RM with reduced volume (2 to 3 sets instead of 4 to 5). This program maintains strength while managing in-season fatigue. If the coach demands that one maintenance session be removed to accommodate an additional practice, what consequence is most likely?

- A. No consequence because one session per week is sufficient for strength maintenance in-season
- B. Reducing to one session per week increases the risk of detraining if the remaining session does not maintain adequate intensity and total stimulus
- C. The team will gain significant additional strength from the extra practice session
- D. The extra practice session provides identical neuromuscular stimulus to the eliminated strength session

181. A strength and conditioning specialist is working with a martial artist who competes in 3-minute rounds with 1-minute rest periods. The conditioning program should target which energy system as the primary focus?

- A. The glycolytic system, because 3-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant duration range
- B. Only the phosphagen system because individual strikes last less than 1 second
- C. Only the oxidative system because the total fight duration exceeds 5 minutes
- D. No energy system training is needed because martial arts technique alone determines competitive success

182. A strength and conditioning specialist is designing an annual training plan for a track and field sprinter whose outdoor season runs from April through June with the championship in late June. The general preparation phase should begin at which approximate time?

- A. June, immediately before the championship competition
- B. April, at the start of the outdoor competitive season
- C. January, during the off-season or early indoor season
- D. October of the following year

183. A strength and conditioning specialist must modify a training program for an athlete with a wrist injury that prevents gripping a barbell. Which approach maintains lower body training while accommodating the injury?

- A. Eliminating all training until the wrist is fully healed
- B. Belt squats, leg press, goblet squats with modified grip, and other lower body exercises that do not require a conventional barbell grip
- C. Only upper body machine exercises to maintain strength in the uninjured area
- D. Heavy barbell back squats with standard grip because the wrist will not be affected

184. For a novice athlete, which training frequency, exercise selection, and loading strategy is most evidence-based during the initial 8 weeks of a resistance training program?

- A. 6 sessions per week using a 6-day body-part split with 90%+ 1RM loads
- B. 2 to 3 total-body sessions per week using fundamental multi-joint exercises at moderate loads (60-70% 1RM) with higher repetitions (10-15) and emphasis on technique mastery
- C. One session per month using maximal loads to absolute failure on every exercise
- D. Daily sessions using exclusively isolation exercises at maximal intensity

TESTING AND EVALUATION (Questions 185–206)

185. A strength and conditioning specialist is selecting a test battery for a group of 50 high school football players. The testing must be completed within a single 3-hour session. Which criteria should guide the test selection process?

- A. Only laboratory-based tests requiring individual administration should be selected regardless of time constraints
- B. Tests should be selected based solely on their cost with the cheapest options always preferred
- C. Random test selection because all tests are equally valid for all sports and populations
- D. Tests should be valid, reliable, specific to football's demands, practical for large-group administration within the time available, and safe for the population being tested

186. A test that produces consistent, reproducible scores when administered under identical conditions on repeated occasions demonstrates which psychometric property?

- A. Face validity based on the test's visual appearance of relevance
- B. Content validity demonstrating comprehensive coverage of the performance domain
- C. Reliability — the consistency and reproducibility of test results across repeated administrations
- D. Criterion validity demonstrated by comparison with a gold standard measurement

187. During a 1RM back squat test, an athlete completes a successful lift at 140 kg with proper depth and technique, then fails at 150 kg when their knees collapse into valgus and the depth is insufficient. The 1RM should be recorded as which value?

- A. 140 kg — the last weight successfully lifted with acceptable technique through the full range of motion
- B. 150 kg because the weight was moved off the rack and the athlete attempted the descent
- C. 145 kg as the average of the successful and failed attempts
- D. Neither value because the test must be restarted from the beginning

188. An athlete performs a countermovement jump and a static (squat) jump. The CMJ height is 58 cm and the SJ height is 49 cm, producing a 9 cm difference. This 9 cm difference indicates which neuromuscular characteristic?

- A. The athlete has poor static strength in the quadriceps that should be addressed with heavy squats
- B. The athlete effectively utilizes the stretch-shortening cycle, with the 9 cm difference representing the contribution of stored elastic energy and the stretch reflex to jump performance
- C. The athlete has excessive flexibility that impairs their static jump performance
- D. The test was administered incorrectly because the two jump types should always produce identical heights

189. A strength and conditioning specialist is selecting a field test for aerobic capacity that can be administered to a large group of athletes outdoors with minimal equipment. Which test best fits these requirements?

- A. Direct VO_2max measurement on a laboratory treadmill with metabolic cart analysis
- B. Wingate anaerobic power test on a cycle ergometer with computerized data collection
- C. Single-leg isokinetic strength test at multiple velocities with EMG monitoring
- D. 20-meter multistage shuttle run (beep test) or 1.5-mile run test, both of which require only a measured course and timing device

190. The sit-and-reach test is the most commonly used field assessment of flexibility. Which specific limitation of this test should the strength and conditioning specialist consider when interpreting results?

- A. The test is too expensive for most facilities to afford and requires specialized equipment
- B. The test takes more than 30 minutes per athlete to administer properly
- C. The test primarily measures hamstring and lower back flexibility and is influenced by limb proportions, so it does not provide a comprehensive assessment of whole-body flexibility
- D. The test measures shoulder flexibility exclusively and has no relevance to the lower body

191. Skinfold measurements are used to estimate body composition through a two-step calculation process. Which sequence correctly describes this process?

- A. Skinfold thicknesses are entered into prediction equations to estimate body density, which is then converted to body fat percentage using equations such as the Siri equation
- B. Skinfold thicknesses directly produce body fat percentage without any intermediate calculation
- C. Skinfold thicknesses estimate muscle mass rather than fat mass
- D. Skinfold thicknesses are used only to calculate bone mineral density

192. The accuracy of body composition assessment using bioelectrical impedance analysis (BIA) is most significantly affected by which variable?

- A. The color of the athlete's clothing during the measurement
- B. The athlete's hydration status, which affects electrical conductivity and can alter body fat estimates by several percentage points
- C. The room temperature in the testing facility
- D. The brand of running shoes the athlete is wearing during the assessment

193. Sprint testing using electronic timing gates provides more accurate results than hand timing primarily because electronic timing eliminates which source of measurement error?

- A. Wind resistance that affects the athlete's running speed during the test
- B. Temperature effects on the athlete's muscle contraction velocity
- C. The brand of timing gates used affects the electromagnetic field around the athlete
- D. The reaction time variability of the human timer, which introduces approximately 0.1 to 0.3 seconds of error per measurement

194. A bilateral comparison of isokinetic knee extension strength reveals that an athlete's right quadriceps produces 200 N·m of peak torque while the left produces 165 N·m — a bilateral asymmetry of 17.5%. Based on commonly cited clinical thresholds, this finding suggests which of the following?

- A. Normal bilateral variation that requires no intervention
- B. The athlete's right leg is overtrained and should be detrained immediately
- C. A clinically significant asymmetry exceeding the 10–15% threshold that warrants targeted corrective programming and possible medical evaluation
- D. The isokinetic test was administered incorrectly and the results are invalid

195. An athlete's testing data reveals the following normative percentile rankings: back squat 1RM = 70th percentile, vertical jump = 72nd percentile, pro agility = 45th percentile, 1.5-mile run = 65th percentile. Based on this profile, which physical quality should receive the highest programming priority?

- A. Agility and change-of-direction speed, which is the athlete's most significant weakness at the 45th percentile
- B. Maximal strength, which is already at the 70th percentile and should be further increased
- C. Vertical jump, which is similar to maximal strength and is already well developed
- D. Aerobic endurance, which at the 65th percentile is the second-lowest ranking

196. Normative data tables used for interpreting test results must be matched to the athlete's population in terms of which variables to produce meaningful comparisons?

- A. Only the athlete's shoe size and dominant hand
- B. Sport, competitive level, age, and sex — using an inappropriate reference population produces misleading percentile rankings
- C. Only the athlete's hair color and eye color
- D. Only the time of year the test is administered

197. A strength and conditioning specialist administers performance tests at the beginning and end of a 12-week preparatory period. Which standardization practice is most important for ensuring that changes in test scores reflect true performance improvement rather than measurement error?

- A. Using different tests at each time point to prevent the athlete from becoming familiar with the testing procedures
- B. Allowing the athlete to choose their own warmup and testing conditions at each session
- C. Administering tests immediately after a heavy training session to evaluate performance under fatigued conditions
- D. Using identical testing conditions across both sessions — same warmup protocol, same equipment, same test order, same time of day, and same environmental conditions

198. Which body composition assessment method provides the highest accuracy (lowest measurement error) but requires expensive laboratory equipment and is impractical for large-group field testing?

- A. Skinfold measurement using calipers and prediction equations
- B. Bioelectrical impedance analysis using a handheld or scale-based device
- C. Dual-energy X-ray absorptiometry (DEXA), which provides the most accurate measurement with error of approximately 1–2%
- D. Visual estimation of body fat percentage by an experienced coach

199. An athlete's vertical jump test results over four testing sessions are: 66 cm, 59 cm, 71 cm, and 54 cm. This range of 17 cm across identical testing conditions suggests which problem with the testing process?

- A. Excellent reliability because the scores show a consistent upward trend
- B. No problem because high variability is expected and desired in performance testing
- C. The testing conditions were not adequately standardized, or the test itself has poor reliability for this athlete
- D. The athlete's true performance is exactly the average of all four scores with no measurement error

200. Goniometric assessment of joint range of motion provides what specific advantage over the sit-and-reach test for evaluating an athlete's flexibility?

- A. Goniometry is less expensive than the sit-and-reach test
- B. Goniometry requires less time to administer than the sit-and-reach test
- C. Goniometry is less accurate than the sit-and-reach test for all joints
- D. Goniometry provides joint-specific range of motion measurements at any individual joint, identifying specific restrictions that the sit-and-reach test cannot detect

201. A strength and conditioning specialist conducts a T-test for a group of basketball players and records the following times: Player A = 9.2s, Player B = 10.5s, Player C = 8.8s, Player D = 11.3s. Using sport-specific normative data for collegiate male basketball players, which interpretation is most appropriate?

- A. All four players performed identically because the differences are too small to be meaningful
- B. Individual scores should be compared against the normative data table to determine each player's percentile ranking relative to their sport-specific reference population
- C. The times should be added together to create a single team agility score
- D. The T-test cannot distinguish between athletes of different agility levels

202. A comprehensive pre-season testing battery for a collegiate soccer team should include assessments of which performance domains to align with the sport's physical demands?

- A. Only maximal bench press because upper body strength is the sole determinant of soccer performance
- B. Only body composition because lean athletes always outperform others regardless of other qualities
- C. Aerobic capacity, sprint speed, agility/change of direction, lower body power, and body composition
- D. Only flexibility because soccer requires no strength, speed, power, or endurance

203. An athlete returning from a meniscus repair completes return-to-play testing. The single-leg hop for distance on the surgical leg achieves 93% of the non-surgical leg. Based on commonly cited bilateral symmetry criteria, what recommendation is most appropriate?

- A. The athlete has met the 90% symmetry threshold and may be considered for return to sport pending additional clinical evaluation and medical clearance
- B. The athlete must achieve 100% symmetry before any sport participation
- C. Bilateral hop testing has no relevance to return-to-play decisions
- D. The athlete should be permanently restricted from competition

204. A force plate during vertical jump testing measures that Athlete A produces a peak GRF of 3,200 N in 180 milliseconds, while Athlete B produces a peak GRF of 3,200 N in 280 milliseconds. Both athletes weigh the same. Which athlete likely achieves the higher vertical jump, and why?

- A. Both athletes achieve identical jump heights because they produce the same peak force
- B. Athlete B because slower force development always produces higher jumps
- C. Neither athlete can be compared because force plate data does not relate to jump height
- D. Athlete A, because their faster rate of force development produces a greater impulse during the limited ground contact time, resulting in higher jump performance

205. Which testing method for assessing aerobic capacity provides the most accurate direct measurement but is impractical for most field settings?

- A. The 1.5-mile run test conducted on an outdoor track
- B. Direct VO_2max measurement using a metabolic cart with expired gas analysis during a graded exercise test
- C. The 20-meter multistage shuttle run (beep test) conducted outdoors
- D. The Cooper 12-minute run test conducted on a measured course

206. An athlete's pre-season and post-season test results show the following changes: back squat 1RM increased from 120 kg to 140 kg, vertical jump increased from 60 cm to 68 cm, and pro agility time improved from 4.8s to 4.5s. These improvements are most meaningfully interpreted by doing which of the following?

- A. Ignoring the results because test data has no practical application
- B. Reporting only the absolute values without any context or comparison
- C. Comparing the magnitude of change to the test's known measurement error to determine if the changes represent true performance improvement, and evaluating percentile ranking changes against normative data
- D. Assuming all changes are due to measurement error with no real improvement

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. A university plans to build a new strength and conditioning facility that must accommodate up to 60 athletes training simultaneously. Using the NSCA's minimum guideline of 40 square feet per athlete, the minimum usable training floor space required is which of the following?

- A. 1,200 square feet based on a reduced allocation of 20 square feet per athlete
- B. 600 square feet based on 10 square feet per athlete
- C. 6,000 square feet based on 100 square feet per athlete
- D. 2,400 square feet calculated as 60 athletes multiplied by 40 square feet per athlete

208. Ceiling height in areas where overhead lifting exercises are performed (overhead press, snatch, jerk) should be a minimum of which height to ensure adequate clearance?

- A. At least 12 feet, with 14 feet or higher being ideal to accommodate overhead barbell positions for the tallest athletes
- B. 7 feet is sufficient because no exercise requires clearance above head height
- C. 20 feet minimum because all strength training exercises require extreme vertical clearance

D. Ceiling height is irrelevant because overhead lifting exercises should never be performed indoors

209. An emergency action plan (EAP) for a strength and conditioning facility must identify the exact location of which specific emergency equipment?

A. Only the facility's thermostat and climate control panel

B. AED units, first aid kits, emergency phones, and fire extinguishers, along with the fastest route for EMS to access the facility

C. Only the facility's music system and speaker locations

D. Only the head coach's office location and parking spot

210. The NSCA requires all CSCS-certified professionals to maintain current CPR/AED certification. The primary reason for this requirement is which of the following?

A. To satisfy a bureaucratic requirement with no practical safety application

B. To ensure marketing compliance for the NSCA's brand image

C. To ensure that every certified professional can provide immediate life-saving intervention for cardiac emergencies occurring in the training environment

D. To qualify the professional to perform surgical procedures during emergencies

211. In negligence law, "breach of duty" occurs when the strength and conditioning professional fails to meet which standard?

A. The standard of perfection requiring zero injuries under all circumstances

B. The personal standard of the injured athlete's expectations regardless of industry norms

C. The financial standard of the facility's insurance policy deductible

D. The standard of care — the degree of care, skill, and diligence that a reasonably competent professional with similar training would exercise under similar circumstances

212. A signed waiver documents that the participant has been informed of inherent risks and voluntarily agrees to participate. A waiver generally does NOT protect the facility against which type of legal claim?

- A. Claims of gross negligence or reckless conduct that demonstrate willful disregard for safety
- B. Claims based on normal inherent risks that were clearly disclosed in the waiver document
- C. Claims from participants who voluntarily assumed all documented risks of the activity
- D. Claims for minor muscle soreness that is a normal outcome of resistance training

213. An athlete asks the strength and conditioning specialist to recommend specific prescription medications for chronic knee pain. According to scope of practice guidelines, the correct response is which of the following?

- A. Prescribing the most commonly used over-the-counter anti-inflammatory medication
- B. Referring the athlete to a physician or other qualified healthcare provider for evaluation and any medication decisions
- C. Prescribing a specific dosage of prescription-strength medication based on the athlete's body weight
- D. Diagnosing the cause of the knee pain and selecting the appropriate pharmaceutical treatment

214. Which of the following activities falls within the strength and conditioning specialist's scope of practice?

- A. Diagnosing a suspected torn meniscus based on physical examination
- B. Prescribing rehabilitation exercises for a post-surgical ACL reconstruction
- C. Designing a periodized annual training program based on a needs analysis, teaching exercise technique, and administering performance assessments
- D. Creating individualized meal plans with specific caloric and macronutrient prescriptions

215. Equipment that shows visible signs of wear, damage, or malfunction should be handled according to which protocol?

- A. Continued use until the equipment breaks completely because replacing it is expensive
- B. Only the manufacturer can evaluate equipment damage, so nothing should be done until they visit
- C. Equipment damage should be hidden from athletes to prevent unnecessary anxiety
- D. Immediately removed from service, tagged as out of order, documented in the maintenance log, and repaired or replaced before being returned to use

216. A sport coach pressures the strength and conditioning specialist to allow athletes to train unsupervised during early morning hours before staff arrives. The specialist should respond by doing which of the following?

- A. Declining the request, explaining that unsupervised training violates facility safety policies and creates unacceptable liability risk without qualified staff present to supervise and respond to emergencies
- B. Agreeing because the coach has ultimate authority over all training decisions
- C. Allowing unsupervised training but only for senior athletes who are experienced lifters
- D. Providing the athletes with keys to the facility and asking them to sign an additional waiver

217. The NSCA's professional standards establish that when a sport coach's training demands conflict with evidence-based safety practice, the CSCS-credentialed professional should do which of the following?

- A. Always comply with the sport coach because the coach has final authority over all program decisions
- B. Decline to implement unsafe practices, explain the evidence-based rationale, and advocate for the athletes' safety and wellbeing
- C. Resign immediately without discussion
- D. Implement the coach's demands but document personal objections in a private journal

218. Supervision ratios in a strength and conditioning facility should be adjusted based on the exercises being performed. When athletes are performing technically demanding Olympic lifts, the supervision ratio should be adjusted in which direction compared to machine-based exercises?

- A. The ratio should remain identical regardless of exercise type because all exercises require the same supervision
- B. The ratio should be wider (fewer staff per athlete) because Olympic lifts require less supervision than machines
- C. Closer supervision ratios (fewer athletes per qualified staff member) are required because Olympic lifts carry higher technique demands and injury risk
- D. No supervision is needed for Olympic lifts because the barbell can be safely dropped

219. A strength and conditioning facility maintains records of all athlete training programs, testing data, signed waivers, medical clearance forms, equipment maintenance logs, and incident reports. From a legal perspective, the primary purpose of maintaining these records is which of the following?

- A. To provide content for the facility's social media accounts and marketing campaigns
- B. To satisfy the athletes' curiosity about their training history
- C. Records serve no legal purpose and are maintained only for administrative convenience
- D. To demonstrate standard of care, document informed consent, and provide evidence of reasonable safety practices if a legal claim arises

220. A strength and conditioning specialist discovers that a colleague without appropriate credentials has been teaching heavy power cleans to inexperienced freshman athletes without proper progression or supervision. The most appropriate professional response is which of the following?

- A. Addressing the concern with the colleague and/or appropriate supervisor, as allowing unqualified instruction of technically demanding exercises to inexperienced athletes creates significant safety and liability risks
- B. Ignoring the situation because it does not involve the specialist's own athletes
- C. Encouraging the colleague to increase the load to build the athletes' confidence faster
- D. Posting about the situation on social media to alert the public

PRACTICE EXAM 3 — ANSWER KEY

WITH EXPLANATIONS

SECTION 1 — SCIENTIFIC FOUNDATIONS

EXERCISE SCIENCE (Questions 1–52)

1. B — A fiber type distribution of 60% Type II and 40% Type I is characteristic of sprinters and power athletes who rely on fast-twitch fibers for explosive, short-duration efforts. Elite endurance athletes typically show the opposite distribution with 70% or more Type I fibers. Fiber type composition is largely genetic but influences the athletic activities for which an individual is best suited.
2. D — The sarcoplasmic reticulum is a specialized organelle within muscle fibers whose primary function is storing calcium ions during rest and releasing them into the sarcoplasm upon receiving signals from the T-tubules during excitation-contraction coupling. When the action potential reaches the sarcoplasmic reticulum, calcium floods the sarcoplasm, binds to troponin C, and initiates cross-bridge formation. Calcium is then pumped back into the SR to terminate contraction.
3. A — A 45% strength increase with only 3% structural change after 10 weeks is the hallmark of neural adaptation — improved motor unit recruitment, enhanced rate coding, and better intermuscular coordination. In novice trainees, the nervous system's ability to activate existing muscle mass improves dramatically before measurable hypertrophy occurs. This explains why early strength gains far outpace visible changes in muscle size.
4. C — The epimysium, perimysium, and endomysium all converge at the ends of a muscle to form the tendon, which transmits the force generated by individual muscle fibers to the bone at the muscle's origin and insertion. This connective tissue framework is essential for converting microscopic cross-bridge forces into macroscopic joint movement.
5. B — The sticking point during a biceps curl occurs at a joint angle where actin-myosin filament overlap is suboptimal, reducing the number of cross-bridges that can form simultaneously. According to the length-tension relationship, force production is greatest at the muscle's optimal resting length and decreases at lengths shorter or longer than this optimum.
6. D — At the shortest sarcomere length, actin filaments from opposite sides of the sarcomere overlap each other and may compress against the Z-lines, physically interfering with cross-bridge formation. This explains why muscles produce less force in highly shortened positions — a phenomenon directly relevant to understanding sticking points in resistance exercises.

7. A — Tropomyosin is the rod-shaped regulatory protein that lies along the groove of the actin double helix, physically blocking the myosin binding sites when the muscle is at rest. When calcium binds to troponin C, the resulting conformational change shifts tropomyosin away from the binding sites, exposing them for cross-bridge formation.
8. C — With only 10 seconds of rest between maximal jumps, phosphocreatine stores cannot adequately replenish — full PCr recovery requires 3 to 5 minutes. Each successive jump draws from progressively more depleted PCr reserves, forcing greater reliance on glycolysis and reducing the peak power available for each effort. This demonstrates why rest period length is critical for phosphagen-dependent activities.
9. B — The cardiovascular system declines most rapidly during detraining, with measurable reductions in VO_{2max} occurring within 1 to 2 weeks of complete inactivity. Maximal strength is more resistant to detraining, typically maintaining for 2 to 4 weeks or longer. This hierarchy of detraining rates is important for prioritizing which qualities to maintain during injury recovery.
10. D — According to Henneman's Size Principle, the highest-threshold motor units — which are the largest and innervate Type IIa and Type IIx fibers — are recruited last, only when force demands approach maximal levels. A 1RM back squat requires near-maximal voluntary contraction, necessitating activation of these high-threshold fast-twitch motor units to produce sufficient force.
11. A — The force-velocity relationship for concentric muscle actions demonstrates that slower contraction velocities allow greater force production because more cross-bridges can form simultaneously and cycle through the power stroke at lower speeds. At 60 degrees/second, the muscle contracts more slowly than at 240 degrees/second, producing higher peak torque.
12. C — Because eccentric force capacity exceeds concentric capacity by 20% to 60%, athletes can control heavier loads during the lowering phase than they can lift concentrically. This is the physiological basis for supramaximal eccentric training methods — loading the eccentric phase beyond the concentric 1RM to provide a novel overload stimulus that drives strength and connective tissue adaptation.
13. B — During the squat ascent, the quadriceps extend the knee while the gluteus maximus extends the hip — both contribute to the overall movement of standing up. The quadriceps function as synergists to the gluteus maximus because they assist in completing the overall movement by contributing force at a different joint, not opposing or stabilizing the gluteus maximus.
14. D — Cardiac output equals heart rate multiplied by stroke volume ($Q = HR \times SV$). Rearranging: $SV = Q \div HR = 5,000 \text{ mL} \div 70 \text{ bpm} = \text{approximately } 71 \text{ mL per beat}$. This calculation demonstrates how the two components of cardiac output interact at rest and is a testable quantitative concept on the CSCS exam.
15. A — Stroke volume typically plateaus at approximately 40% to 60% of VO_{2max} during progressive exercise. Beyond this point, stroke volume remains relatively constant and further

increases in cardiac output are achieved primarily through continued increases in heart rate via sympathetic nervous system activation.

16. C — Blood flow redistribution during exercise is achieved through selective vasodilation in working muscles — mediated by local metabolic signals including increased CO₂, decreased O₂, elevated temperature, and metabolite accumulation — combined with vasoconstriction in non-essential organs mediated by the sympathetic nervous system. This dual mechanism ensures priority delivery to the most metabolically active tissues.
17. B — A resting heart rate of 45 bpm in a trained endurance athlete reflects increased stroke volume from eccentric cardiac hypertrophy (enlarged left ventricular chamber). Because cardiac output at rest remains relatively constant (~5 L/min), the increased stroke volume allows the heart to maintain output with fewer beats per minute — a highly efficient adaptation.
18. D — During heavy resistance exercise with the Valsalva maneuver, both systolic and diastolic blood pressure increase dramatically due to the elevated intra-thoracic and intra-abdominal pressure. Recorded values in research have exceeded 400/300 mmHg during maximal lifts. This acute response differs markedly from the aerobic exercise pattern where diastolic pressure remains stable.
19. A — The greatest acute growth hormone response is produced by protocols that maximize metabolic stress — high training volume, moderate intensity (70–85% 1RM), and short rest periods (60–90 seconds). The elevated blood lactate, hydrogen ion accumulation, and reduced pH created by these conditions are the primary triggers for GH release from the anterior pituitary.
20. C — Circulating testosterone levels in males are approximately 10 to 15 times higher than in females, making testosterone the primary hormonal factor explaining sex-based differences in muscle mass, strength, and power. This magnitude of difference has significant implications for expected training adaptations between male and female athletes.
21. D — Chronically elevated cortisol with suppressed testosterone and a declining T:C ratio over 6 weeks is a hallmark presentation of overtraining syndrome. This hormonal profile indicates that cumulative training stress has overwhelmed recovery capacity, shifting the body into a chronic catabolic state that impairs adaptation and performance.
22. B — Mechano-growth factor (MGF), a locally produced splice variant of IGF-1, activates satellite cells and stimulates muscle protein synthesis through the mTOR signaling pathway in response to mechanical loading. This local IGF-1 production within the muscle is believed to be a key mediator of the hypertrophic response, working independently of systemic IGF-1 levels.
23. A — Prescribing only long-distance jogging for a shot putter who needs maximal explosive power directly violates the SAID principle because the training stimulus (low-intensity, sustained aerobic activity) does not match the performance demand (brief, maximal-effort explosive power). The

adaptations produced by distance jogging — improved aerobic capacity and slow-twitch fiber enhancement — do not transfer to shot put performance.

24. C — When a sprinter transitions to exclusive endurance training, some Type IIa fibers may shift toward more oxidative characteristics within the Type II spectrum. However, wholesale conversion of Type II fibers to Type I fibers through training alone remains limited and debated in the research literature. The most well-established transition is within the Type II subtypes.
25. D — The ventilatory threshold closely corresponds to the lactate threshold — the intensity at which blood lactate accumulation begins to increase exponentially. At this point, ventilation increases disproportionately relative to oxygen consumption as the body's bicarbonate buffering system converts hydrogen ions and bicarbonate into water and CO₂, which must be expelled through increased breathing.
26. B — Maximal oxygen consumption (VO₂max) is defined as the plateau in oxygen consumption that occurs despite further increases in exercise intensity during a graded exercise test. This plateau represents the maximum rate at which the body can consume and utilize oxygen and is the gold standard measure of aerobic capacity.
27. C — NADH and FADH₂ produced by the Krebs cycle deliver their electrons to the electron transport chain (ETC) located on the inner mitochondrial membrane. As electrons pass along the chain, energy is released to pump hydrogen ions across the membrane, creating the electrochemical gradient that drives ATP synthase to produce the majority of aerobic ATP.
28. A — Fat oxidation through beta-oxidation occurs at a significantly slower rate than carbohydrate metabolism through glycolysis and oxidative phosphorylation. During high-intensity exercise, the rate of ATP demand exceeds what fat oxidation can provide, forcing the body to rely increasingly on the faster (but more limited) carbohydrate pathways to meet energy needs.
29. D — A work-to-rest ratio of 1:12 to 1:20 for 6-second maximal sprints provides 72 to 120 seconds (approximately 1 to 2 minutes) of rest between efforts. While full PCr recovery requires 3 to 5 minutes, ratios in this range allow near-complete (85–95%) recovery, supporting repeated high-quality phosphagen-dominant efforts.
30. B — The lactate threshold typically occurs at approximately 50–60% of VO₂max in untrained individuals and at 70–80% or higher in well-trained endurance athletes. This upward shift with training reflects increased mitochondrial density, improved oxidative enzyme activity, and greater fat oxidation capacity that reduce the muscle's dependence on anaerobic glycolysis at any given workload.
31. A — The acceleration phase requires the greatest force production because the sprinter must overcome their body's inertia from a stationary or near-stationary start. According to Newton's First Law, a body at rest remains at rest unless acted upon by an external force — the sprinter must generate substantial horizontal force to overcome this inertia and initiate forward movement.

32. C — The horizontal component of the ground reaction force during a standing long jump is primarily responsible for propelling the athlete forward through the air. While the vertical component determines flight height, the horizontal component determines the forward distance traveled. The angle of force application determines the relative contribution of each component.
33. D — Net force equals the athlete's applied force minus the gravitational force on the barbell: $2,000 \text{ N} - 1,471.5 \text{ N} = 528.5 \text{ N}$ upward. Acceleration equals net force divided by mass: $528.5 \div 150 = 3.52 \text{ m/s}^2$. This application of Newton's Second Law ($F = ma$) demonstrates how net force — not total force — determines acceleration.
34. B — The three recognized mechanisms of SSC enhancement are: storage and return of elastic energy, the stretch reflex contribution from muscle spindle activation, and increased time for force development during the eccentric phase. Increased oxidative enzyme activity is an adaptation to endurance training and is not a mechanism of the stretch-shortening cycle.
35. A — During fast SSC movements with ground contact times under 250 milliseconds, musculotendinous stiffness is the critical quality because it enables rapid storage and return of elastic energy with minimal energy loss. A stiffer muscle-tendon unit deforms less during ground contact, stores energy more efficiently, and returns it more rapidly during the concentric phase.
36. C — When the bar path deviates forward from the ideal vertical trajectory, the moment arm between the load and the shoulder joint increases. Greater torque demand requires the shoulder muscles to produce more force to control the load, and the forward displacement also increases compressive loading on the lumbar spine as the body compensates for the anterior weight shift.
37. D — Third-class levers have the effort (muscle insertion) positioned between the fulcrum (joint) and the resistance (external load), creating a resistance arm longer than the effort arm. This arrangement favors speed and range of motion because a small amount of muscle shortening produces a large movement at the distal end of the lever, but the muscle must produce forces many times greater than the external load.
38. B — A 15-degree difference between passive ROM (170°) and active ROM (155°) at the shoulder represents the normal distinction between passive and active range of motion. Passive ROM exceeds active ROM because external force can move the joint beyond the limit of voluntary muscular effort. This difference is clinically useful for identifying whether limitations are structural or neuromuscular.
39. A — The term "monosynaptic" means the reflex arc involves only a single synapse — between the afferent sensory neuron from the muscle spindle and the efferent alpha motor neuron innervating the same muscle. This single-synapse arrangement makes the stretch reflex the fastest reflex in the body, with a response time measured in milliseconds.
40. D — During the contract-relax PNF technique, the voluntary isometric contraction activates the Golgi tendon organ, which detects the elevated tension and sends inhibitory signals through an

inhibitory interneuron. After the contraction ceases, this autogenic inhibition reduces alpha motor neuron activity to the target muscle, temporarily decreasing its tone and allowing a greater passive stretch.

41. C — A prolonged amortization phase allows the elastic energy stored in the musculotendinous unit during the eccentric landing to dissipate as heat rather than being returned as mechanical energy during the concentric takeoff. Additionally, the stretch reflex contribution diminishes because the rapid eccentric-to-concentric transition that maximally stimulates the reflex has been interrupted.
42. B — Research on elite sprinters consistently demonstrates that the vertical ground reaction force applied during the brief ground contact phase at maximum velocity is the primary determinant of top-end running speed. Faster sprinters produce greater vertical force relative to body weight during ground contact times of less than 100 milliseconds.
43. A — Both athletes produce 2,400 N of absolute force, but the 80 kg athlete has a higher force-to-body-weight ratio. Net upward force for the 80 kg athlete = $2,400 - (80 \times 9.81) = 2,400 - 785 = 1,615$ N. Net force for the 100 kg athlete = $2,400 - 981 = 1,419$ N. The 80 kg athlete achieves greater net acceleration ($1,615/80 = 20.2$ m/s² vs. $1,419/100 = 14.2$ m/s²).
44. D — Eccentric cardiac hypertrophy increases the left ventricular chamber size, allowing greater filling volume during diastole. This increased filling capacity directly translates to a higher stroke volume at maximal exercise intensity, which is the primary mechanism by which endurance training increases maximal cardiac output and VO₂max.
45. C — Heavy resistance training produces concentric cardiac hypertrophy — thickening of the left ventricular wall with minimal change in chamber size. This adaptation allows the heart to generate greater pressure during the repeated acute blood pressure elevations that occur with heavy lifting, differing from the eccentric (chamber enlargement) hypertrophy produced by endurance training.
46. A — Cortisol's catabolic actions include stimulating protein degradation and gluconeogenesis — the synthesis of glucose from non-carbohydrate sources, particularly amino acids derived from muscle protein breakdown. This provides glucose for the brain and other glucose-dependent tissues during stress but comes at the cost of muscle protein loss.
47. B — A combined elevation of testosterone, growth hormone, and cortisol following high-volume resistance training is a normal, expected acute hormonal response. The anabolic hormones support protein synthesis and tissue repair, while cortisol mobilizes energy substrates and manages the inflammatory response. This combined response is part of the adaptive signaling cascade.
48. D — Persistent insomnia, elevated resting heart rate, appetite loss, declining performance, suppressed estrogen, and elevated cortisol over several weeks without adequate recovery are classic indicators of overtraining syndrome. The appropriate intervention is significant reduction in training stress, implementation of a recovery phase, and medical evaluation to rule out other conditions and address the hormonal disruptions.

49. C — Rate of force development (RFD) measures how quickly an athlete can produce force — specifically, the speed at which force rises from baseline to peak during a rapid contraction. RFD is critical for explosive performance because athletic movements occur within time constraints (e.g., 80–100ms ground contact during sprinting) that may not allow peak force to be reached.
50. A — At high tension levels during an isometric contraction, the GTO's inhibitory signal can override the muscle spindle's facilitatory signal, producing autogenic inhibition that limits maximal voluntary force production. This protective mechanism prevents the muscle from generating forces that could damage the tendon or bone. Chronic heavy training can reduce this inhibitory influence.
51. B — Power equals work divided by time ($\text{Power} = \text{Work} \div \text{Time}$). Both athletes performed the same work (same load through the same range of motion), but Athlete B completed it in less time (1.8s vs. 2.5s). Therefore, Athlete B demonstrated higher power output. This demonstrates why bar velocity and movement speed matter for power development.
52. D — Maximal strength is typically the most resistant to detraining, with measurable values maintained for approximately 2 to 4 weeks or longer after cessation of training. Aerobic capacity declines more rapidly (within 1–2 weeks). This hierarchy of detraining rates explains why strength can be maintained with reduced training frequency during competition seasons while aerobic conditioning requires more consistent attention.

SPORT PSYCHOLOGY (Questions 53–75)

53. C — The most effective goal-setting approach combines all three goal types in a hierarchical structure: an outcome goal (qualify for nationals) provides long-term direction, performance goals (specific jump distances at benchmark dates) break the outcome into measurable targets, and process goals (daily technique and training behaviors) direct attention to the controllable actions that drive improvement.
54. A — Self-efficacy is task-specific and situation-specific — an athlete can have high self-efficacy for one task and low self-efficacy for another. Unlike general self-confidence, which is a broad personality disposition, self-efficacy refers specifically to an individual's belief in their ability to perform a particular task in a particular situation, and it changes based on experience and context.
55. B — Heavy powerlifting is a gross motor, high-force task that benefits from relatively high arousal levels. The elevated physiological activation supports maximal muscle recruitment, aggressive effort, and the intense focus needed for near-maximal lifting. Fine motor precision tasks, by contrast, require lower optimal arousal because excessive activation interferes with fine coordination.
56. D — Performing well in practice but poorly in competition, combined with constant worry about losing ranking and racing thoughts, indicates elevated cognitive anxiety — the mental component of competitive anxiety characterized by negative thoughts, worry, and fear of failure. Cognitive

anxiety has a consistently negative relationship with performance and requires cognitive intervention strategies.

57. C — Diaphragmatic breathing and progressive muscle relaxation are physical relaxation techniques specifically designed to address somatic anxiety — the physiological symptoms including muscle tension, elevated heart rate, and rapid breathing. These techniques activate the parasympathetic nervous system to counteract the physical manifestations of anxiety.
58. A — The technique described — recognizing negative thoughts, interrupting them with a cue word, and replacing them with positive or instructional statements — is thought stopping. This cognitive strategy directly breaks the negative self-talk cycle and substitutes constructive content that supports focus and confidence during performance.
59. B — Motor learning refers to the relatively permanent underlying capability that persists over time, while motor performance is the observable execution at any given moment. Performance can fluctuate due to fatigue, anxiety, motivation, or distraction without reflecting a change in the athlete's actual learning. A poor performance on a given day does not mean learning has not occurred.
60. D — The associative stage is characterized by smaller, less frequent errors compared to the cognitive stage, with the athlete developing the ability to self-detect and self-correct some mistakes. The athlete has a general understanding of the movement pattern and is refining it through practice, but execution is not yet automatic and still requires conscious attention.
61. A — The contextual interference effect demonstrates that random practice produces slower initial acquisition compared to blocked practice but significantly better long-term retention and transfer. The constant task-switching forces deeper cognitive processing during each trial, building more robust and flexible motor program representations that persist over time and transfer to novel contexts.
62. C — "Your elbow was angled outward instead of directly under the ball" is knowledge of performance (KP) — information about the quality of the movement pattern itself. KP describes how the movement was executed rather than what the outcome was, making it more useful for skill learning because it tells the athlete what to change in their technique.
63. D — The guidance hypothesis states that constant feedback (after every trial) creates dependency on external correction. The athlete learns to rely on the coach's input rather than developing their own internal error-detection capabilities. Reducing feedback frequency forces the athlete to attend to their own sensory information, producing more self-sustaining skill that persists without the coach present.
64. B — The rest intervals between distributed practice bouts allow for memory consolidation — the neurological process by which short-term motor memories are stabilized and transferred to long-term storage. This deeper encoding produces more durable motor program representations

compared to massed practice, which does not allow sufficient time for consolidation between practice attempts.

65. A — Training with a heavier ball to potentially improve forehand speed relates to transfer of training — the concept that practice under one condition affects performance under a different condition. Whether the transfer is positive (heavier ball improves standard ball performance) or negative (heavier ball disrupts timing) depends on the similarity between training and competition conditions.
66. C — Withdrawal from social interaction, difficulty sleeping, loss of interest, and feeling "trapped" with no enjoyment are hallmark symptoms of athletic burnout — a psychological syndrome characterized by emotional exhaustion, depersonalization (cynicism toward the sport), and a reduced sense of accomplishment. Burnout requires professional evaluation and typically involves restructuring the athlete's relationship with their sport.
67. D — Dramatic weight fluctuations, meal avoidance, and excessive exercise beyond prescribed training are warning signs of an eating disorder. The strength and conditioning specialist's scope of practice requires referral to a qualified healthcare professional for evaluation and treatment. Prescribing meal plans, conducting additional body composition testing, or ignoring the signs are all inappropriate responses.
68. B — RED-S expands beyond the original female athlete triad to recognize that male athletes with chronic energy deficiency can also experience hormonal disruption (suppressed testosterone), decreased bone mineral density, impaired immune function, and declining athletic performance. The condition is driven by low energy availability regardless of sex.
69. A — Fear of re-injury after ACL reconstruction is a recognized psychological barrier to successful return to sport. Gradually reintroducing sport-specific movements at progressive intensities builds physical confidence while facilitating referral to a sport psychologist addresses the cognitive and emotional components of the fear. Both physical and psychological readiness are necessary for safe return.
70. C — The overall speed and absolute force of movement execution are variable parameters of a generalized motor program that change across different situations. The invariant features — relative timing, relative force proportions, and the fundamental spatial pattern — remain constant, allowing the same motor program to be adapted to different speeds, loads, and contexts.
71. D — Multisensory imagery that engages visual (seeing the performance), kinesthetic (feeling the muscular sensations), auditory (hearing environmental sounds), and emotional (experiencing the associated confidence and arousal) components simultaneously produces the richest and most effective mental rehearsal. Single-modality imagery is less effective than multi-modal engagement.

72. B — Past performance accomplishment — the direct experience of successfully completing the 150 kg squat — is the most powerful source of self-efficacy according to Bandura's theory. This personal mastery experience provides the strongest evidence that future success at a slightly higher load is achievable, directly building the task-specific confidence needed for the next attempt.
73. A — Consistently performing well in practice but underperforming in competition indicates a failure to manage competitive anxiety effectively. The high-pressure environment triggers cognitive anxiety (worry, negative self-talk, fear of failure) and/or somatic anxiety (muscle tension, elevated heart rate) that disrupts the automatic execution of well-learned skills — a phenomenon known as choking under pressure.
74. C — A point guard surveying the entire defensive formation to find an open teammate is using broad-external attentional focus — scanning a wide field of external stimuli simultaneously. This allows processing of multiple players' positions and movements before narrowing focus to a specific passing target. Effective athletes shift between attentional modes as situational demands change.
75. D — Research consistently demonstrates that athletes experiencing significant psychological distress during injury rehabilitation — including fear of re-injury, frustration, depression, and social isolation — have longer recovery times and higher re-injury rates compared to psychologically well-adjusted athletes. This underscores the importance of addressing psychological factors as part of comprehensive injury management.

NUTRITION (Questions 76–95)

76. B — A 75 kg athlete at 10 g/kg/day requires 750 grams of carbohydrate per day ($75 \times 10 = 750$). This upper-end recommendation supports the glycogen demands of high-volume training in endurance sports such as stage racing, where daily glycogen depletion and replenishment cycles are extreme.
77. A — When total protein intake already provides adequate essential amino acids from complete protein sources, isolated BCAA supplementation offers no additional benefit for muscle protein synthesis. The leucine trigger for mTOR activation is already supplied by the complete protein. BCAA supplements are most useful only when total protein intake is insufficient.
78. D — Chronically low dietary fat intake (below 15–20% of total calories) impairs production of steroid hormones — particularly testosterone, which requires cholesterol as a precursor — and reduces absorption of fat-soluble vitamins A, D, E, and K, which require dietary fat for transport across the intestinal wall. Both consequences can compromise health and training adaptation.
79. C — The 25 grams of whey protein stimulates muscle protein synthesis through leucine-triggered mTOR activation and provides amino acids for tissue repair. The 80 grams of carbohydrate replenishes depleted muscle glycogen through glycogen synthase activation. The insulin response from the carbohydrate enhances amino acid uptake into muscle cells, creating a synergistic recovery effect.

80. B — Pre-exercise hydration guidelines recommend consuming 5 to 7 milliliters per kilogram of body weight at least 4 hours before exercise. This allows adequate time for absorption and urinary excretion of excess fluid, ensuring the athlete begins exercise in a euhydrated state with stable plasma volume.
81. A — Hyponatremia — dangerously low blood sodium concentration below 135 mmol/L — occurs when excessive plain water intake during prolonged exercise dilutes the blood sodium that has been lost through sweating. Symptoms range from nausea and confusion to seizures, coma, and death. Sodium-containing fluids are essential during prolonged exercise in heat.
82. D — The loading phase (20 g/day for 5–7 days) rapidly saturates intramuscular phosphocreatine stores to their maximum capacity in the shortest possible time. This accelerated saturation allows the athlete to begin experiencing the ergogenic benefits of increased PCr stores within a week rather than waiting the approximately 28 days required with a maintenance-only approach.
83. C — Creatine monohydrate remains the most extensively researched and consistently effective form of creatine supplementation. Despite marketing claims for alternative forms (ethyl ester, Kre-Alkalyn, liquid serum), none have demonstrated superiority to monohydrate in peer-reviewed research. Monohydrate is also typically the most cost-effective option.
84. B — Athletes who are sensitive to caffeine's stimulatory effects may experience anxiety, gastrointestinal distress, heart palpitations, or insomnia at the ergogenic doses of 3 to 6 mg/kg body weight. Individual tolerance varies substantially, and sensitive individuals should start with lower doses and assess their response before using full ergogenic doses.
85. A — The recommended beta-alanine dosing protocol is 3.2 to 6.4 grams per day divided into smaller doses of 0.8 to 1.6 grams taken throughout the day. Dividing the daily dose minimizes the intensity of paresthesia — the harmless but uncomfortable tingling sensation — by keeping each individual dose below the threshold that triggers noticeable symptoms.
86. D — Gastrointestinal distress — including nausea, bloating, cramping, and diarrhea — is the most common side effect that limits sodium bicarbonate use as an ergogenic aid. The alkaline nature of sodium bicarbonate and the large dose required (0.2–0.3 g/kg) can significantly irritate the GI tract. Some athletes use enteric-coated capsules or serial loading protocols to improve tolerability.
87. C — Plant-based athletes can achieve adequate essential amino acid intake by consuming a variety of complementary protein sources throughout the day. Different plant proteins have different amino acid profiles — grains tend to be low in lysine while legumes tend to be low in methionine — so combining multiple sources provides all essential amino acids in sufficient quantities.
88. B — During ultra-endurance exercise lasting 6 or more hours, glycogen depletion forces the body to increase its reliance on amino acid oxidation through deamination to maintain energy production. The carbon skeletons of amino acids enter the Krebs cycle or gluconeogenic pathways to supplement declining carbohydrate availability.

89. A — Athletes who train exclusively indoors (no UV exposure), live at northern latitudes (insufficient UVB radiation for cutaneous vitamin D synthesis), or have darker skin pigmentation (increased melanin reduces UV-mediated vitamin D production) are at greatest risk for vitamin D deficiency. Screening and supplementation when levels are insufficient is increasingly standard practice.
90. D — When two training sessions occur within 8 hours, consuming 1.0 to 1.5 g/kg of carbohydrate within 30 minutes of the first session maximizes glycogen resynthesis by capitalizing on the period when glycogen synthase activity is highest. Delaying carbohydrate intake reduces the rate of glycogen restoration and may compromise performance in the second session.
91. C — A weight loss rate of approximately 0.5 to 1.0 kilogram per week through a moderate caloric deficit of 300 to 500 kcal/day minimizes lean mass loss while still producing meaningful fat loss. Faster rates of loss achieved through severe restriction lead to disproportionate muscle catabolism, hormonal disruption, and impaired training adaptation.
92. B — Consuming 30 to 40 grams of casein protein before sleep can sustain amino acid delivery throughout the overnight fasting period. Casein forms a gel in the stomach that slows digestion, providing a sustained release of amino acids that supports muscle protein synthesis during the 7 to 9 hours of sleep when no other protein is consumed.
93. A — Consuming vitamin C-rich foods alongside non-heme iron sources enhances absorption by converting ferric iron (Fe^{3+}) to the more bioavailable ferrous form (Fe^{2+}). This is particularly important for athletes with low ferritin who rely on plant-based iron sources, as non-heme iron has lower baseline bioavailability than heme iron from animal products.
94. D — Glutamine supplementation has limited evidence supporting its use for promoting muscle growth in healthy, well-nourished athletes. While glutamine plays roles in immune function and gut health, the existing research does not place it among the supplements with strong ergogenic evidence (creatine, caffeine, beta-alanine, sodium bicarbonate) for muscle growth or performance enhancement.
95. C — High-glycemic index foods produce rapid blood glucose spikes and are most appropriately consumed during and immediately after exercise when rapid glucose delivery to working muscles and rapid glycogen replenishment are the priorities. The fast absorption rate matches the acute metabolic needs of the peri-exercise window.

SECTION 2 — PRACTICAL/APPLIED

EXERCISE TECHNIQUE (Questions 96–140)

96. A — A consistent lateral weight shift during the squat ascent indicates a bilateral strength or mobility asymmetry between the lower extremities. The athlete compensates by shifting load to the stronger or more mobile side. Assessment of bilateral hip, ankle, and quadriceps function should identify the deficit, and unilateral corrective exercises should address it.

97. D — Lumbar flexion during the RDL indicates the athlete has exceeded their available hip flexion range, causing the pelvis to tilt posteriorly and the lumbar spine to round. The appropriate response is to stop the set, reduce the range of motion or load, and cue the athlete to maintain a flat back by hinging at the hips rather than continuing into spinal flexion.
98. B — Elbows flared to 90 degrees during the bench press places excessive stress on the anterior shoulder structures (anterior capsule, glenohumeral ligaments, long head of biceps tendon). Cueing the athlete to tuck the elbows to approximately 45 to 75 degrees reduces the horizontal abduction demand at the shoulder and decreases anterior joint stress while still effectively training the pressing muscles.
99. C — When the elbows drop during a front squat, the bar loses its stable shelf on the anterior deltoids and rolls forward, creating a dangerous loss of control. The forward bar shift also increases the flexion torque on the spine and places excessive stress on the wrists and elbows as they attempt to hold the bar. High elbows are essential for safe front squat execution.
100. A — Some degree of thoracic kyphosis is generally tolerable during heavy conventional deadlifts because the thoracic spine is structurally more resistant to flexion-related injury than the lumbar spine — the thoracic vertebrae are reinforced by the rib cage and have naturally less mobility. However, excessive rounding should still be monitored and corrected.
101. B — Medial knee collapse (valgus) during lunges is most commonly caused by weakness in the hip abductors and external rotators (gluteus medius, piriformis) that fail to control femoral adduction and internal rotation. Strengthening these muscles and cueing "drive the knee outward over the toes" addresses the root cause rather than just the symptom.
102. D — The NSCA's top-down teaching progression begins with the front squat to establish the front rack receiving position and develop comfort with the bar on the anterior deltoids. This ensures the athlete can safely catch the bar before any pulling phases are introduced, reducing the risk of catching errors during the learning process.
103. C — The hang clean progresses from the pulling stance to the catching stance. Cueing "jump and land with your feet in the same position" prevents the excessively wide landing that reduces stability. The catch stance should be approximately shoulder width — the same as the pulling stance — to maintain a stable, powerful receiving position.
104. A — The snatch requires receiving the bar overhead with locked arms in a deep squat. The overhead squat mobility test assesses whether the athlete can maintain a stable, locked-arm position with the bar directly overhead while squatting to full depth with an upright torso. Without this mobility, the full snatch cannot be performed safely.
105. B — "Keep the bar close" is the fundamental coaching cue for correcting a forward-drifting bar path. Driving the hips forward into the bar during the second pull and keeping the elbows high and

outside maintain a vertical bar path close to the body's center of mass. A bar that swings forward creates a longer moment arm and makes the overhead catch unstable.

106. D — Ground contact time doubling from 190ms to 380ms with declining rebound height indicates the athlete is fatiguing and the stretch-shortening cycle is no longer being effectively utilized. Plyometric training is quality-based — continuing to perform degraded repetitions trains poor movement patterns and provides no power development benefit. The exercise should be terminated.
107. C — Novice athletes with no plyometric experience should begin with low-to-moderate intensity exercises (squat jumps, box jumps stepping down, countermovement jumps) at volumes of 80 to 100 foot contacts per session. High-intensity depth jumps and weighted plyometrics are reserved for advanced athletes with established strength bases and plyometric training experience.
108. A — Initiating the row with scapular retraction before elbow flexion ensures that the upper back muscles (rhomboids, middle trapezius) are the primary movers driving the initial pulling motion. If the elbows bend first, the biceps dominate the pull and the upper back muscles receive a reduced training stimulus.
109. D — A medicine ball exercise qualifies as plyometric only when performed with maximal speed and minimal transition time between the eccentric catch and concentric throw. This rapid SSC execution stores and returns elastic energy and activates the stretch reflex. A paused or slow-tempo throw eliminates the SSC benefit and is no longer classified as plyometric.
110. B — Running fully upright during the acceleration phase (first 10 meters) directs ground reaction forces too vertically, reducing the horizontal force component needed to overcome inertia and generate forward momentum. A pronounced forward lean during acceleration allows the athlete to direct force more horizontally, producing the forward-directed ground reaction forces essential for rapid acceleration.
111. C — The pro agility shuttle is a preplanned test with a fixed movement pattern — the athlete knows exactly where to go before starting. True agility requires a reactive perceptual-cognitive component where the athlete must perceive, process, and respond to an unpredictable stimulus. This distinction is fundamental to understanding what the test actually measures.
112. A — Dynamic stretching increases range of motion while simultaneously activating the neuromuscular system through active muscle engagement. Static stretching before explosive exercise has been shown to acutely reduce force production and power output by decreasing musculotendinous stiffness and neural activation. This evidence-based distinction drives the preference for dynamic stretching pre-exercise.
113. D — The specific warmup for sprint training should consist of sprint buildups at progressively increasing velocities — 50%, 70%, 85%, and 95% of maximum speed — before performing full-

speed sprints. This progressive intensity increase allows the neuromuscular system to rehearse the exact movement pattern and loading conditions at incrementally higher demands.

114. B — The evidence for whole-body cryotherapy is mixed. Some studies report subjective benefits (perceived recovery, reduced soreness), but evidence of meaningful effects on objective performance markers is limited. It remains an optional supplementary modality rather than an essential recovery tool, and it should never replace foundational recovery practices (sleep, nutrition).
115. C — Foam rolling provides range of motion improvements comparable to static stretching but without the acute decrements in force production and power output associated with sustained static stretches. This makes foam rolling a preferred pre-training mobility tool because it enhances flexibility while preserving the neuromuscular readiness needed for explosive performance.
116. A — Conditioning that replicates the lacrosse midfielder's actual game demands — 20- to 40-yard sprint distances with 15- to 30-second rest periods — targets the phosphagen energy system at the sport-specific work-to-rest ratio. This specificity ensures that the physiological adaptations produced in training transfer directly to competitive performance.
117. D — The aerobic system replenishes phosphocreatine stores, clears metabolic byproducts (lactate, hydrogen ions), and restores homeostasis between high-intensity bouts. Athletes with well-developed aerobic fitness recover faster between sprints and plays, maintaining higher performance quality across repeated efforts throughout an entire game.
118. B — Six-second sprints with 90-second rest (approximately 1:15 ratio) target the phosphagen system with near-complete phosphocreatine recovery between efforts. The short work duration falls within the phosphagen-dominant range, and the generous rest period allows sufficient PCr resynthesis for maximal-quality repeated efforts.
119. C — Tempo running at lactate threshold intensity trains the body to sustain higher absolute workloads before lactate production exceeds clearance capacity. This adaptation raises the lactate threshold to a higher percentage of $VO_2\text{max}$, meaning the athlete can work at a greater absolute intensity aerobically before the onset of fatigue-inducing lactate accumulation.
120. A — Adequate sleep (7–10 hours nightly) and post-exercise nutrition (protein for muscle repair, carbohydrate for glycogen replenishment) are the foundational recovery practices with the strongest evidence base. No external modality — compression, cryotherapy, electrical stimulation — can compensate for deficits in these non-negotiable requirements.
121. D — Shortening rest from 3 minutes to 60 seconds during heavy sets prevents adequate phosphocreatine resynthesis between sets, reducing the available ATP-PC energy for each subsequent set. Force production declines, and the training stimulus shifts from a strength-focused protocol (heavy load, full recovery) to a more metabolic, hypertrophy/endurance-oriented stimulus.

122. B — When two spotters are used for the barbell back squat, one spotter stands at each end of the barbell, ready to assist by curling or rowing the bar upward if the athlete fails the lift. This positioning allows the spotters to apply force evenly on both sides of the barbell simultaneously.
123. C — The correct grip width for the overhead press positions the forearms approximately vertical when the bar is at shoulder height, placing the wrists directly above the elbows. This alignment ensures the force is directed vertically through the strongest mechanical position and reduces lateral stress on the wrists and elbows.
124. A — Regressing to a bilateral barbell RDL allows the athlete to develop the hip hinge pattern, hamstring strength, and general posterior chain control on a stable two-footed base before progressing back to the balance-demanding single-leg variation. Building the movement foundation bilaterally creates the stability and strength needed for successful unilateral execution.
125. B — Organizing athletes into groups of 3 per rack creates an efficient rotation where one athlete squats, one spots, and one rests between sets. This structure maximizes training density while maintaining appropriate supervision and ensures each athlete has a dedicated spotter during every working set.
126. D — Unsupervised training before staff arrives violates facility policies, eliminates emergency response capability (no one present to administer CPR/AED or call EMS), and creates significant legal liability. If an athlete were injured during an unsupervised session, the facility's failure to enforce supervision policies would strengthen a negligence claim substantially.
127. C — The power clean is a power/explosive exercise that requires the highest neuromuscular coordination and technical precision, both of which degrade rapidly with fatigue. It must be performed first in the session when the athlete is freshest. The back squat, while heavy, is a core multi-joint exercise that follows power exercises in the standard hierarchy.
128. A — The correct order follows NSCA guidelines: power cleans and countermovement jumps first (power/explosive exercises), then back squats (core multi-joint), then dumbbell shoulder press and lat pulldown (core or assistance exercises), and finally front plank (core stability last). This preserves neuromuscular quality for the most technically demanding exercises.
129. B — Despite developing quadriceps and hip extensor strength on the leg press, the athlete did not develop the stabilizer activation, balance, proprioception, and intermuscular coordination required for the free weight squat. Machine-guided movement patterns do not transfer to free weight performance because the stabilization and coordination demands are fundamentally different.
130. D — Resistance bands provide the least resistance at the bottom of the squat (where the band has minimal stretch) and maximum resistance at the top (where the band is fully stretched). This accommodating resistance curve challenges the athlete progressively through the range of motion, overloading the mechanically strongest position where free weights alone become relatively easy.

131. C — Anti-extension exercises train the core to resist lumbar hyperextension. During the ab wheel rollout, gravity pulls the lumbar spine into extension as the body elongates; the rectus abdominis and deep trunk stabilizers must contract to maintain a neutral spine against this extending force. This functional stabilization pattern is directly relevant to athletic movements under load.
132. A — Anti-movement exercises (planks, Pallof press, loaded carries) develop trunk stability without requiring repeated trunk flexion that loads the intervertebral discs. For athletes with lumbar disc pathology, these exercises provide the stabilization training needed for athletic performance while minimizing the repetitive flexion-compression cycles that can exacerbate disc conditions.
133. C — During a lateral lunge, the athlete's weight shifts primarily over the stepping leg as the hips push back and down into the lunge. The knee of the stepping leg should track over the toes in the direction the foot is pointing. This position loads the hip extensors and adductors of the stepping leg while protecting the knee from valgus stress.
134. B — The rear foot in a Bulgarian split squat should contact the bench with the ball of the foot or the tops of the toes (laces down), allowing the ankle to remain in a neutral or slightly plantarflexed position. This provides stable contact without restriction and allows the front leg to do the primary work while the rear foot serves as a balance point.
135. C — The Turkish get-up develops total-body stability, shoulder integrity, and the ability to transition through multiple positions (supine, half-kneeling, standing) while maintaining load overhead. It challenges shoulder stability, hip mobility, core control, and proprioception simultaneously, making it a comprehensive movement preparation and stability exercise.
136. A — Pausing at the top of the calf raise eliminates the stretch-shortening cycle contribution by removing the rapid eccentric-to-concentric transition. This isolates the concentric strength of the gastrocnemius and soleus, forcing them to produce force from a dead-stop position without the assistance of stored elastic energy or the stretch reflex.
137. B — The SAID principle dictates that power development requires explosive training tempo because power is the product of force and velocity. Slow-tempo training develops maximal strength and time under tension but does not train the high-velocity force production that defines power. Matching the training velocity to the desired performance quality is essential for specificity.
138. D — The bench press trains horizontal pressing (pectoralis major, anterior deltoids, triceps) while the bent-over row trains horizontal pulling (latissimus dorsi, rhomboids, posterior deltoids, biceps). This opposing movement pair provides comprehensive development of the pushing and pulling musculature around the shoulder and trunk.
139. C — The hex bar positions the load at the athlete's sides rather than in front of the body, centering it closer to the body's center of mass. This reduces the horizontal distance between the load and the lumbar spine, decreasing the moment arm and the flexion torque on the lumbar spine compared to a conventional barbell deadlift.

140. B — Cable face pulls should be performed with the cable set at face height, pulling toward the face while externally rotating the shoulders and retracting the scapulae. This targets the posterior deltoids, infraspinatus, teres minor, and middle trapezius — muscles critical for shoulder health and postural balance in athletes who perform heavy pressing movements.

PROGRAM DESIGN (Questions 141–184)

141. A — The 100-meter sprint is completed in approximately 10 to 12 seconds of all-out maximal effort, placing it squarely within the phosphagen system's dominant time domain (0–10 seconds). The phosphagen system provides the fastest rate of ATP regeneration through phosphocreatine hydrolysis, making it the primary energy contributor for this brief, maximal event.
142. D — A structural exercise loads the spine directly and requires the trunk musculature to maintain an erect posture. The barbell front squat meets this criterion because the bar rests on the anterior deltoids and creates compressive forces through the axial skeleton that the core must stabilize. Seated or supported exercises that do not load the spine are not classified as structural.
143. C — The correct order follows NSCA guidelines: hang clean (power/explosive) → back squat (core multi-joint) → incline bench press (core multi-joint) → seated row (core multi-joint) → triceps pushdown (assistance/isolation) → Russian twist (core/trunk). This sequence preserves neuromuscular quality for the most demanding exercises.
144. B — Alternating between upper body and lower body exercises allows each region to recover while the other works. This upper-lower alternation strategy maintains higher performance quality across the session by preventing regional fatigue accumulation, which is particularly beneficial in total-body sessions with multiple exercises.
145. A — Loads greater than 85% of 1RM for 6 or fewer repetitions per set target maximal strength development through neural adaptations — increased motor unit recruitment, improved rate coding, and enhanced intermuscular coordination. This high-intensity, low-repetition combination forces the nervous system to activate high-threshold motor units that drive maximal force production.
146. C — 72% of $120\text{ kg} = 86.4\text{ kg}$, rounded to 86 kg per working set. Volume load = $86\text{ kg} \times 10\text{ reps} \times 4\text{ sets} = 3,440\text{ kg}$. This moderate-load, higher-repetition protocol with short rest periods creates the mechanical tension and metabolic stress associated with hypertrophy training.
147. D — Rest periods of 30 to 90 seconds are specifically prescribed for hypertrophy training because they maintain elevated metabolic stress — including lactate accumulation, hydrogen ion concentration, and growth hormone release — while providing just enough recovery to perform subsequent sets at the prescribed load and repetition range.
148. B — Three sets of 15 repetitions at 60% 1RM with 20-second rest periods represent a muscular endurance protocol. The low load, high repetitions, and extremely short rest maximize metabolic

demand and train the muscle's ability to sustain repeated contractions under fatigue — the definition of muscular endurance.

149. A — Linear periodization progresses with volume gradually decreasing while intensity gradually increases across sequential mesocycles. The typical progression moves from high-volume/moderate-intensity (hypertrophy/endurance) through moderate-volume/high-intensity (strength) to low-volume/very-high-intensity (power/peaking).
150. D — Block periodization for an advanced shot putter progresses through: accumulation (high volume, moderate intensity for work capacity and general hypertrophy), transmutation (higher intensity for converting structural gains into sport-specific strength and power), and realization (low volume, very high intensity for peaking explosive performance at competition).
151. C — DUP's primary advantage is more frequent exposure to different training stimuli within each week — varying between hypertrophy, strength, and power sessions — which may prevent the accommodation that occurs with prolonged exposure to a single training zone. This frequent variation allows simultaneous development of multiple physical qualities within the same training week.
152. B — Maintaining intensity at 85% 1RM while reducing volume and frequency preserves the neural and muscular stimulus needed to maintain strength and power. Research consistently shows that intensity is the most critical variable for in-season maintenance — volume and frequency can be cut substantially without detraining as long as intensity is preserved.
153. A — The transition period should last approximately 2 to 4 weeks and focus on unstructured, low-intensity active recovery. This period provides physical restoration from accumulated competition fatigue, psychological renewal of motivation, opportunity to address minor nagging injuries, and mental preparation for the next training cycle.
154. D — For lower body exercises like the jump squat, peak power output occurs at approximately 0% to 30% of back squat 1RM. The lighter loading allows for high contraction velocities that maximize the velocity component of the power equation. Heavier loads produce more force but at velocities too slow to maximize power output.
155. C — The 48-to-72-hour recovery requirement between plyometric sessions allows adequate recovery of the musculotendinous structures that experience significant eccentric loading during plyometric exercises. Tendons and connective tissues require more recovery time than muscle tissue and are at risk for overuse injury if plyometric sessions are performed too frequently.
156. B — Plyometric sessions should be performed on separate days from heavy lower body resistance training, or before resistance training in the same session when the athlete is fresh. Performing plyometrics after heavy lifting (when fatigued) degrades explosive output, impairs landing mechanics, and reduces the quality-based stimulus that plyometric training is designed to provide.

157. A — Sprint intervals of 5 to 10 yards with 25 to 40 seconds rest exactly replicate the offensive lineman's position demands — short maximal efforts with brief recovery periods. This protocol targets the phosphagen system at the sport's actual work-to-rest ratio, producing the most transferable conditioning adaptation.
158. D — This combination directly addresses all identified needs: rowing and pull-up variations develop upper body pulling strength for the swim stroke, internal/external rotation exercises protect the rotator cuff from repetitive overuse injury, core anti-rotation and anti-extension exercises develop the trunk stability needed during swimming, and sport-specific aerobic conditioning develops the endurance base.
159. C — An advanced athlete with 8 years of training experience preparing for a single major competition requires the concentrated, targeted stimuli of block periodization. The accumulation-transmutation-realization sequence allows precise control of the training emphasis in each block, with the realization block timed to produce peak performance at the competition date.
160. B — 88% of 200 kg = 176 kg per working set. The warmup sets at 50% (100 kg), 70% (140 kg), and 80% (160 kg) progressively prepare the neuromuscular system for the heavy working load. The 5 sets of 3 at 176 kg with 4-minute rest is a classic maximal strength protocol.
161. A — During specific preparation for volleyball, the emphasis shifts to explosive vertical jumping power (plyometrics, Olympic lifts), lateral agility (change-of-direction drills), overhead shoulder strength (pressing and pulling exercises), and sport-specific conditioning (interval training matching volleyball's work-to-rest patterns). These sport-specific qualities build upon the general fitness developed earlier.
162. D — Reconditioning after shoulder surgery follows a progressive sequence: pain-free range of motion restoration → progressive resistance training at increasing loads → sport-specific movement integration (throwing, pressing, overhead activities) → return to competition upon meeting objective strength and functional criteria with medical clearance.
163. C — The commonly cited return-to-play criterion requires the injured limb to achieve at least 90% of the uninjured limb's strength and functional capacity before unrestricted competition. Persistent asymmetries exceeding 10% are associated with elevated re-injury risk and indicate that reconditioning is not yet complete.
164. B — A 90th percentile squat with a 35th percentile vertical jump indicates adequate maximal strength but poor ability to express that strength explosively. This rate of force development deficit requires increased explosive training — plyometrics, Olympic lifts, and jump squats — rather than additional heavy strength work.
165. A — Novice athletes benefit most from moderate loads (60–70% estimated 1RM) with higher repetitions (10–15) during the first 4 to 6 weeks. This approach develops movement proficiency

through multiple repetitions, builds initial work capacity, allows connective tissue time to adapt, and establishes the neural and structural foundation for heavier loading in subsequent phases.

166. D — Five sets of 2 at 92% 1RM with 5-minute rest periods is a maximal strength and neural adaptation protocol. The near-maximal loading recruits the highest-threshold motor units, and the complete rest between sets allows full phosphocreatine recovery and neural restoration for maximal force production on every set.
167. C — DUP is ideal for a recreational athlete with no specific competition date because it allows simultaneous development of multiple qualities — strength, hypertrophy, and power — through within-week variation. Each session targets a different training zone, providing diverse stimuli that address all three goals concurrently without requiring a specific peaking timeline.
168. B — The pattern of three progressively increasing volume weeks (40K, 44K, 48K) followed by a reduced week (30K) represents a deload or unloading week. This programmed reduction in training stress allows accumulated fatigue to dissipate while maintaining enough stimulus to preserve adaptation, setting up the athlete for the next loading cycle.
169. A — This combination addresses all identified needs: rowing-specific aerobic conditioning develops endurance, barbell rows and pull-ups develop upper body pulling strength, anti-extension and anti-rotation core exercises develop trunk stability, and front squats and RDLs develop the lower body drive power essential for the rowing stroke.
170. D — Two sequential mesocycles, each ending with a brief taper and peaking phase timed to the respective competition dates, allows the athlete to peak twice within the 8-week window. This dual-peaking approach maintains a training stimulus between competitions while providing the volume reduction and intensity maintenance needed for performance expression at each event.
171. C — The principle of accommodation states that the response to a constant stimulus diminishes over time. After 20 weeks of identical programming, variation in training variables — exercises, loads, volumes, periodization model, or exercise order — provides novel stimuli that the body must adapt to, overcoming the plateau and resuming progress.
172. B — Field hockey's demands — sustained running with interspersed sprints over 70 minutes — require both aerobic endurance and repeated sprint ability. Aerobic base development (tempo runs, fartlek) builds sustained endurance, while repeated sprint training (short sprints with sport-specific rest) develops sprint recovery capacity. The combination addresses both demands.
173. A — A decathlete competing in 10 diverse events needs to develop sprint speed, endurance, jumping power, throwing power, and technical skills simultaneously throughout the training year. Concurrent training with undulating periodization provides the framework for addressing multiple physical qualities in parallel without the periods of detraining that concentrated approaches would create.

174. D — Progressive increases in intensity (70% → 77% → 82% → 88%) with corresponding decreases in volume (4×8 → 4×6 → 4×5 → 4×3) across sequential 2-week phases is the defining characteristic of linear periodization. Each phase builds on the previous one, moving from higher-volume moderate-intensity work toward lower-volume high-intensity work.
175. C — Three to 6 sets of 6 to 12 repetitions at 67% to 85% of 1RM with 30 to 90 seconds of rest is the classic hypertrophy protocol. This combination provides sufficient mechanical tension for muscle growth, and the short rest periods maintain the metabolic stress and acute hormonal environment that support the hypertrophic stimulus.
176. B — Heavy squats at 90% 1RM develop the high-force/low-velocity end of the force-velocity continuum (maximal strength), while jump squats at 30% 1RM develop the low-force/high-velocity end (speed-strength). Training both ends of the continuum within the same program provides comprehensive power development.
177. A — An athlete returning from 6 weeks of complete detraining should begin at significantly reduced intensity and volume. Training status has declined, connective tissues have lost adaptation, and the risk of injury from immediate return to pre-surgery levels is substantial. Gradual progressive increases based on tolerance and performance response allow safe reconditioning.
178. D — Basketball's 48-minute games with mixed demands require a comprehensive approach: aerobic base training supports sustained play and between-effort recovery, anaerobic interval training develops repeated sprint capacity, and sport-specific agility conditioning develops the lateral movement and reactive direction changes that define basketball performance.
179. C — A triathlon program requires sport-specific endurance training in swimming, cycling, and running (the three competitive disciplines), moderate-load resistance training (for injury prevention through musculoskeletal strengthening and lean mass maintenance), and periodized recovery weeks (to prevent overtraining from the high cumulative training volume).
180. B — Reducing from two maintenance sessions to one per week increases the risk of detraining if the remaining single session does not provide adequate intensity and total stimulus. While some research suggests that one high-quality session can maintain strength for brief periods, the reduced training frequency narrows the margin for error in preserving competitive-season strength.
181. A — Three-minute rounds of sustained high-intensity fighting fall within the glycolytic-dominant duration range (approximately 1–4 minutes). The glycolytic system provides the primary ATP contribution during each round, while the phosphagen system powers individual explosive strikes and the aerobic system supports recovery during the 1-minute rest between rounds.
182. D — For an outdoor season running April through June with a late-June championship, the general preparation phase should begin approximately in January (or even late fall) to allow sufficient time for general fitness development, specific preparation, and peaking. Starting in January provides approximately 5 to 6 months of structured preparation before the championship.

183. C — Belt squats, leg press, goblet squats with a modified grip, and other exercises that do not require a conventional barbell grip allow continued lower body training while accommodating the wrist injury. Eliminating all lower body training leads to unnecessary detraining of the uninjured limbs.
184. B — The evidence-based approach for novice athletes during the initial 8 weeks is 2 to 3 total-body sessions per week using fundamental multi-joint exercises (squat, hinge, press, pull) at moderate loads (60–70% 1RM) with higher repetitions (10–15) and emphasis on technique mastery. This builds movement competency, work capacity, and connective tissue adaptation safely.

TESTING AND EVALUATION (Questions 185–206)

185. D — Tests for a high school football testing battery should be selected based on validity (measuring football-relevant qualities), reliability (producing consistent results), specificity (reflecting football's demands — power, speed, agility, strength), practicality (administrable to 50 athletes in 3 hours), and safety (appropriate for the high school population).
186. C — Reliability is the psychometric property defined by consistent, reproducible scores across repeated administrations under identical conditions. A reliable test produces similar results when the same athlete is tested multiple times without a true change in fitness, meaning observed score changes can be attributed to actual performance improvement rather than measurement error.
187. A — The 1RM is defined as the last weight successfully lifted with acceptable technique through the full range of motion. Since the athlete completed 140 kg with proper depth and technique but failed at 150 kg with collapsed knees and insufficient depth, 140 kg is the valid 1RM. A failed attempt with technique errors is never recorded regardless of the load.
188. B — A 9 cm difference between CMJ (58 cm) and SJ (49 cm) indicates effective stretch-shortening cycle utilization. The countermovement allows the storage of elastic energy and activation of the stretch reflex, both of which contribute additional force during the concentric takeoff that is unavailable during the static jump's concentric-only execution.
189. D — Both the beep test and 1.5-mile run are field tests of aerobic capacity that require only a measured course and timing device, can be administered to large groups, and can be conducted outdoors. The beep test adds the advantage of repeated direction changes and external pacing, while the 1.5-mile run requires self-pacing.
190. C — The sit-and-reach test primarily measures hamstring and lower back flexibility and is influenced by the athlete's limb proportions (arm-to-leg-to-trunk ratio). It does not assess flexibility at other joints and cannot distinguish between hamstring flexibility and lumbar mobility contributions. For joint-specific flexibility assessment, goniometry is preferred.
191. A — The two-step body composition calculation from skinfolds involves: (1) entering skinfold thicknesses into population-specific prediction equations to estimate body density, then (2)

converting body density to body fat percentage using conversion equations such as the Siri equation ($\% \text{ BF} = [495 \div \text{body density}] - 450$). Both steps are required for the final estimate.

192. B — BIA measures body composition by passing a low-level electrical current through the body and estimating composition based on electrical impedance. Hydration status significantly affects impedance — dehydration increases resistance and overestimates body fat, while hyperhydration decreases resistance and underestimates body fat. Consistent hydration status across tests is essential for reliable results.
193. D — Electronic timing eliminates the reaction time variability of the human timer, which introduces approximately 0.1 to 0.3 seconds of error per measurement. In short sprints (10–40 yards), this error can represent a substantial proportion of the total sprint time and may obscure real performance differences between athletes.
194. C — A 17.5% bilateral asymmetry in knee extension strength substantially exceeds the commonly cited 10–15% clinical threshold. This magnitude of difference warrants targeted corrective programming with unilateral exercises emphasizing the weaker side, and possible medical evaluation to identify underlying pathology or incomplete rehabilitation.
195. A — The pro agility time at the 45th percentile is the athlete's most significant weakness relative to their sport peers. All other qualities are at the 65th percentile or above. Programming should prioritize agility and change-of-direction training to address this relative deficit while maintaining the stronger qualities.
196. B — Normative data tables must match the athlete's sport, competitive level, age, and sex for percentile rankings to be meaningful. Using data from an inappropriate population — such as NFL norms for a high school soccer player — produces misleading rankings that do not reflect the athlete's standing relative to their actual peer group.
197. D — Using identical testing conditions across both sessions — same warmup protocol, same equipment, same test order, same time of day, same environmental conditions, and same instructions — is the most critical standardization practice. Any variation between sessions introduces confounding variables that may be incorrectly interpreted as performance changes.
198. C — Dual-energy X-ray absorptiometry (DEXA) provides the highest accuracy for body composition assessment with measurement error of approximately 1–2%. However, DEXA requires expensive laboratory equipment, trained operators, and individual administration, making it impractical for field settings or large-group testing despite its superior accuracy.
199. A — A 17 cm range across four testing sessions under supposedly identical conditions indicates poor reliability — either the testing conditions were not adequately standardized, or the test itself produces inconsistent results for this athlete. Reliable tests should produce scores within a much narrower range when true performance has not changed.

200. D — Goniometry provides joint-specific range of motion measurements at any individual joint in the body, allowing the identification of specific restrictions. The sit-and-reach test provides only a global assessment of hamstring and lower back flexibility and cannot pinpoint whether a limitation exists at the hip, knee, ankle, or any other specific joint.
201. B — Individual T-test times should be compared against sport-specific normative data tables for collegiate male basketball players to determine each player's percentile ranking. This contextual comparison reveals where each player stands relative to their peer group, identifying those who need targeted agility development and those who are already well-developed.
202. C — A comprehensive soccer testing battery should assess aerobic capacity (shuttle run or 1.5-mile run), sprint speed (10m and 40m sprints), agility/change of direction (pro agility or T-test), lower body power (vertical jump), and body composition (skinfolds or BIA). These assessments align with soccer's demands for endurance, speed, agility, and explosive power.
203. A — At 93%, the surgical leg exceeds the commonly cited 90% bilateral symmetry threshold. The athlete may be considered for return to sport, pending additional clinical evaluation (physician clearance, functional movement assessment, sport-specific testing) to ensure comprehensive readiness beyond the single hop test.
204. D — Athlete A achieves the same peak force (3,200 N) in less time (180ms vs. 280ms), demonstrating a faster rate of force development. The greater impulse (force \times time) produced during the same ground contact duration results in higher takeoff velocity and therefore higher jump performance. RFD is a critical discriminator when peak force is equal.
205. B — Direct VO_2max measurement using a metabolic cart with expired gas analysis during a graded exercise test is the gold standard for aerobic capacity assessment. It measures the actual rate of oxygen consumption rather than estimating it from performance data. However, it requires expensive laboratory equipment and individual administration, limiting field applicability.
206. C — Test result changes should be compared against each test's known measurement error (standard error of measurement or minimal detectable change) to determine whether the improvements represent true performance gains or fall within the range of normal measurement variability. Additionally, percentile ranking changes provide context for evaluating the magnitude and significance of improvement.

ORGANIZATION AND ADMINISTRATION (Questions 207–220)

207. D — Using the NSCA's minimum guideline of 40 square feet per athlete: $60 \text{ athletes} \times 40 \text{ sq ft} = 2,400$ square feet of minimum usable training floor space. Using the upper guideline of 60 square feet: $60 \times 60 = 3,600$ sq ft. The absolute minimum is 2,400 square feet, with 3,600 square feet providing more comfortable spacing.
208. A — A minimum ceiling height of 12 feet is generally recommended for areas where overhead lifting occurs, with 14 feet or higher being ideal. This clearance must accommodate the tallest

athletes performing overhead movements (snatch, jerk, overhead press) with the barbell at full arm extension above their head.

209. B — An EAP must identify the exact locations of AED units, first aid kits, emergency phones, and fire extinguishers, as well as the fastest route for emergency medical services to access the facility. Knowing where emergency equipment is located and how to direct EMS to the scene eliminates critical delays during life-threatening emergencies.
210. C — CPR/AED certification ensures that every CSCS-credentialed professional can provide immediate life-saving intervention for cardiac emergencies — the most time-critical medical events that can occur in a training environment. Cardiac arrest survival rates decline approximately 10% for every minute without CPR and defibrillation.
211. D — "Breach of duty" occurs when a professional fails to meet the standard of care — the degree of care, skill, and diligence that a reasonably competent professional with similar training and experience would exercise under similar circumstances. This standard is not perfection but rather the minimum level of competence expected in the profession.
212. A — Waivers generally do not protect against claims of gross negligence or reckless conduct — willful disregard for safety that goes beyond simple carelessness. A waiver acknowledges inherent risks of an activity, but it cannot absolve a professional who demonstrates reckless behavior, such as knowingly using defective equipment or prescribing clearly inappropriate exercises.
213. B — Recommending specific prescription medications falls entirely outside the strength and conditioning specialist's scope of practice. Medication decisions require medical training and prescriptive authority that only physicians and certain other licensed healthcare providers possess. The appropriate response is referral to a qualified healthcare provider.
214. C — Designing periodized training programs, teaching exercise technique, and administering performance assessments are core functions within the CSCS scope of practice. Diagnosing injuries, prescribing rehabilitation exercises, and creating individualized meal plans all require separate professional credentials and fall outside the strength and conditioning specialist's scope.
215. D — Damaged or malfunctioning equipment must be immediately removed from service, tagged as out of order to prevent inadvertent use, documented in the maintenance log, and repaired or replaced before being returned to use. Continuing to use damaged equipment violates the duty to maintain a safe training environment and increases liability.
216. A — The specialist should decline the request, explaining that unsupervised training creates unacceptable safety and liability risks. Without qualified staff present, there is no one to supervise technique, provide spotting, respond to injuries, or administer CPR/AED in the event of a cardiac emergency. This is a non-negotiable safety standard.
217. B — The NSCA's professional standards require the CSCS to decline implementing practices that conflict with evidence-based safety principles, explain the rationale to the sport coach, and

advocate for the athletes' safety and wellbeing. The certified professional has ultimate responsibility for the strength and conditioning program and cannot defer that responsibility to coaches who lack the specialized training.

218. C — Olympic lifts carry higher technique demands, faster barbell velocities, and greater injury potential than machine-based exercises. Closer supervision ratios — fewer athletes per qualified staff member — are required to provide adequate observation, cueing, and emergency response during these technically demanding movements.
219. D — Comprehensive records demonstrate standard of care (training was properly designed and supervised), document informed consent (athletes acknowledged risks), provide evidence of reasonable safety practices (equipment was maintained, incidents were reported), and create a contemporaneous record that can be critical evidence if a legal claim arises.
220. A — Addressing the concern with the colleague and/or supervisor is the appropriate professional response. Unqualified instruction of technically demanding exercises to inexperienced athletes creates significant safety risks. The issue should be resolved through professional channels to protect the athletes, the colleague, and the institution from potential harm and liability.